AREA IV - Undeformed sediments and late movement structures
Geographical setting: Weakly or non-deformed Cretaceous and Tertiary sediments cover the entire Danish sector outside the wrench zones (figs. 10, 13, 47).

Geological description: In Permian, Triassic and Jurassic times, the individual fault blocks of the Central Graben subsided differentially along normal faults. In Cretaceous and Tertiary times, however, this pattern changed into a more general non-fault controlled subsidence of the entire North Sea area. Therefore non- or weakly deformed Upper Cretaceous and Tertiary sediments cover large parts of the Danish North Sea. In these sediments, stratigraphic traps are expected to be present.

In some areas, however, late movements along old deep-seated faults resulted in uplift, which in some cases has created gentle structural arch traps. This mechanism is also termed 'drape' (Blair 1975).

Distribution of potential hydrocarbon traps: In non-deformed sediments, hydrocarbons may be trapped in primary stratigraphic traps. These are often expected to be located along structural highs, but e.g. Paleocene submarine fans cover most of the northern Viking Graben. Stratigraphic traps might be improved by differential compaction. This mechanism is based on the assumption that there is less lithostatic pressure on the crest of the reservoir body than on the flanks. As a result sediments on the flanks undergo greater compaction, and the vertical closure of the stratigaphical trap is improved.

Unlimited reservoirs and stratigraphic traps may in addition be weakly deformed by drape into gentle structural arch traps or late movement structures. Simple drape, as defined by Blair (1975), is caused by re-juvenation of deep-seated old faults, resulting in uplift and creating a gentle dome structure.

An example of this type of late movement structure is the Inge structure which is located over the crest of the Dogger High. This structure is characterized by a rather large areal closure and a relatively small vertical closure, which were probably induced by late movements along the Dogger High faults.

7.0 Reservoir rocks

By Finn Jacoben, Kirsten Lieberkind & Erik Nygaard

The present chapter contains a review of the potential reservoir rocks drilled in the Danish Central Graben. The source data for this descriptive summary originates primarily from wells drilled to explore chalk reservoirs. The main part of possible chalk reservoirs has been evaluated only by using wire line logs, since few cores have been cut and very few tests performed. Therefore, further investigations are necessary to evaluate and describe these possible reservoir rocks properly.

In this chapter, each zone in which shows have been recorded, and each porosity zone, is described. This is done with reference to the formations/log-units given earlier in the paper. The characteristics relevant to reservoir evaluation, such as the extension, thickness, depth, porosity, and permeability, are described. The characterizing terms (good, fair, etc.) used for reservoir parameters in sandstone reservoirs cannot be applied automatically to chalk reservoirs. The descriptions are accompanied by maps showing the known occurrences.

7.1 CA-1 Unit (Early Carboniferous)

Lithologic characteristics: Sandstone, siltstone, carbonaceous shales and sporadic coal seams.

Extension, thickness, and depth: According to Ziegler (1977), Carboniferous deposits are present in the major part of the Central Graben, but due to lack of data a delineation of the extension in the Danish sector is not possible. The thickness recorded in the P-1 well is 67 m, but the regional thickness may well be 100 to 200 m. Away from the highs, the deposits are mostly very deeply seated.

Reservoir parameters (fig. 49): Only the sandstones may be considered as potential reservoirs (net reservoir rock 13.5 m). The sandstones vary from fine to medium-grained, occassionally silty. The porosity varies from 5 to 15% (average 11%). Calcite cement has been found and may reduce the porosity.

Remarks: The section is stratigraphically below the known potential sources. Therefore the CA-1 Unit may represent a possible reservoir in faulted areas only.

7.2 Rotliegendes Group

Lithological characteristics: The lower section comprises volcanic tuff. The upper section consists of soft, and occasionally silty marl, interbedded with shale, and at the base sandstone.

Extension, thickness, and depth: The thickness of the Rotliegendes is, in the P-1 well, more than 200 m, but may be more than 1000 m in the central part of the basin. Away from the highs the series is very deeply seated.

Reservoir parameters (fig. 49): Only the sandstones may be considered to have reservoir properties. They are coarse to fine grained and occassionally silty or shaly. Calcite cement is found in the lower beds. The total known thickness of the group is 213 m, with a maximum net reservoir zone of 20.5 m. The porosity is rather low (2-10%, average 5%) due to cement and a varying content of clay and silt. The permeability is not known.

Remarks: No shows are found in the Rotliegendes in the Central Graben area, but gas finds are known from the southern North Sea, northern Holland, Germany, and Poland. The probable lack of source rocks below the Rotliegendes Group suggests that it may be a hydrocarbon-bearing reservoir rock in faulted areas, where it may be sourced from younger beds only.

7.3 Zechstein Group

Lithologic characteristics: This section is characterized by evaporites.

Extension, thickness, and depth: In the Central Graben, Zechstein deposits are mostly drilled on domal structures. Therefore the stratigraphy, lithology, thicknesses of the units, extension etc. cannot be clarified. In the basin between the structures the series is very deeply seated.

Reservoir parameters (fig. 50): Dolomitic intervals are the only possible primary reservoirs. From onshore wells the dolomite beds are known in some instances to have fairly high porosities and permeabilities. Often the pores in the dolomites are filled with anhydrite, which reduces the porosity to near zero.

Some cap rock anhydrites in Central Graben are fractured. Overlying oil may have migrated into these fractures, but permeability remains very low.

7.4 Bacton Group (Early Triassic)

Lithologic characteristics: Dominated by claystone which in some places can be silty, anhydritic, or calcareous. There are minor silt and sandstone beds.

Extension, thickness, and depth: The formation has been encountered in 3 wells only (B-1, Q-1, and U-1), but it is probably present in the entire area.

Seismic evaluation is possible only in the southern part, where the top Triassic varies in depth from 3000 to 4500 m. To the north, the group grades into the Smith Bank Formation (Q-1).

The thickness is fairly constant and greatest near topographic highs. The thicker parts seem to consist of relatively coarse-grained sediments derived from the highs. The net sand thickness therefore seems to be a result of local geological processes.

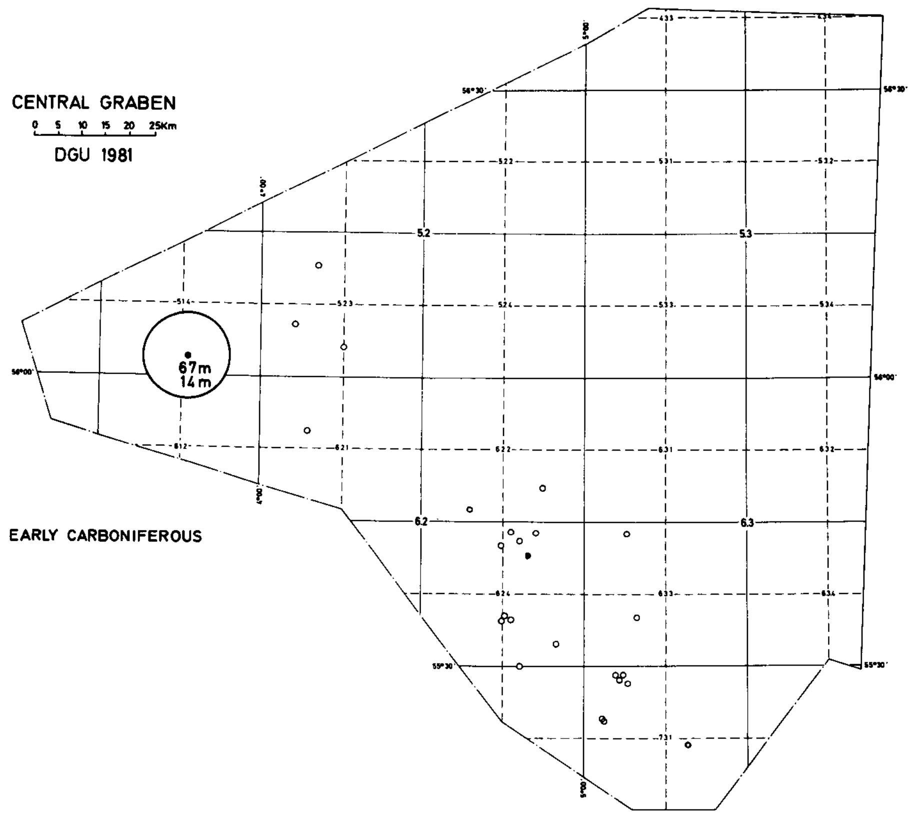
Reservoir parameters (fig. 50): Gas shows are recorded in the Q-1 well, but the available data allow no statements regarding the reservoir conditions.

In the study area there is fair data only from the U-1 well. Here the porosities of the sand beds are 10 and 17%, for the Bunter Sandstone and Bunter Shale respectively. The higher porosity in the intercalated Bunter Shale Formation sand beds may be due to a higher clay content, which would reduce the permeability. No data to clarify this question are available.

7.5 J-2 Unit (Middle Jurassic)

Lithologic characteristics: Interbedded pure sandstones, claystones and heterolithic sand-siltstones with coal seams.

Extension, thickness, and depth: The Unit may cover most of the Central Graben area, but it is until now known only in the A-2, M-8, O-1, and U-1 wells. Most of these wells are situated on domal structures. The influence of halokinesis on the thickness of the formation has not yet been clarified. In large parts of the



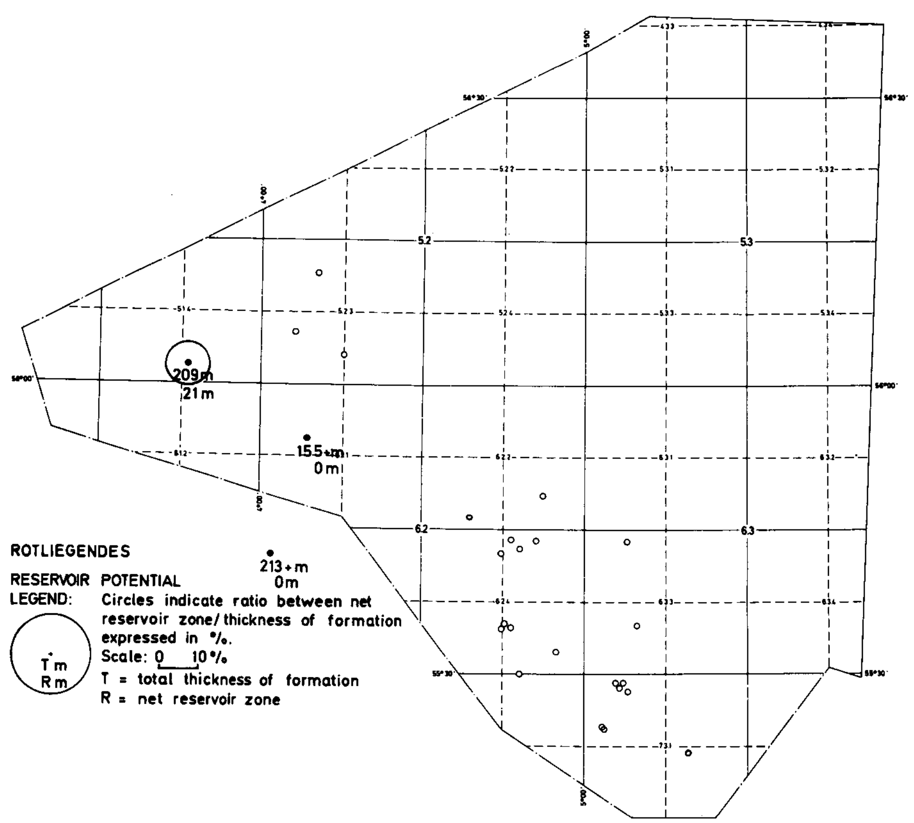
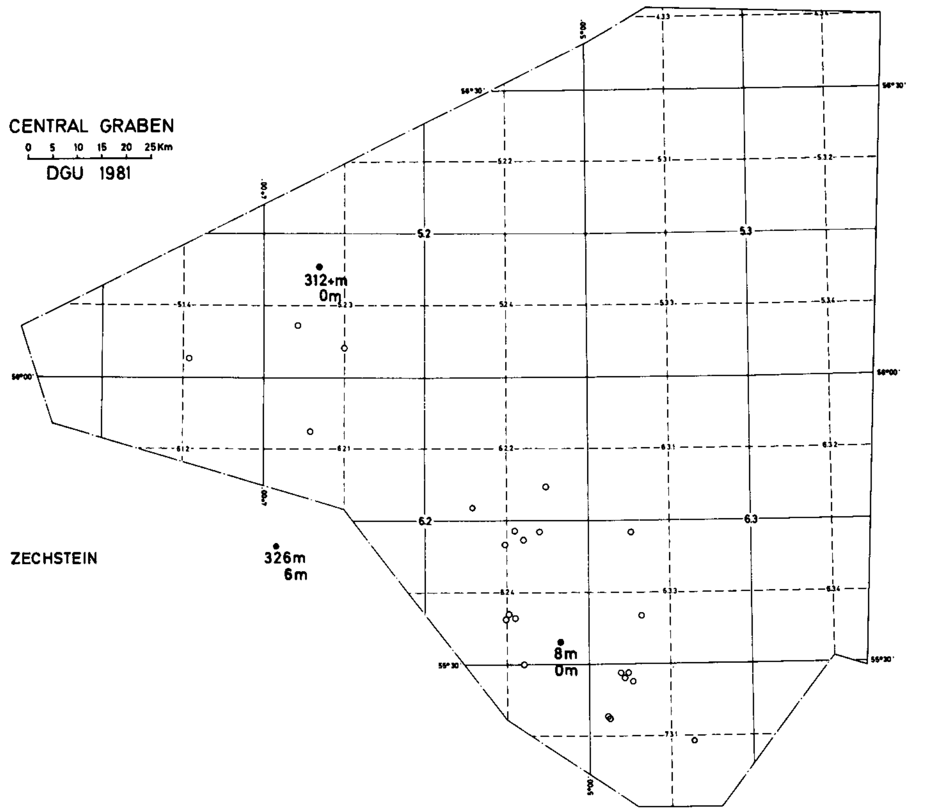


Fig. 49: The reservoir potential of a) Early Carboniferous and b) Rotliegendes section in the Central Graben area.



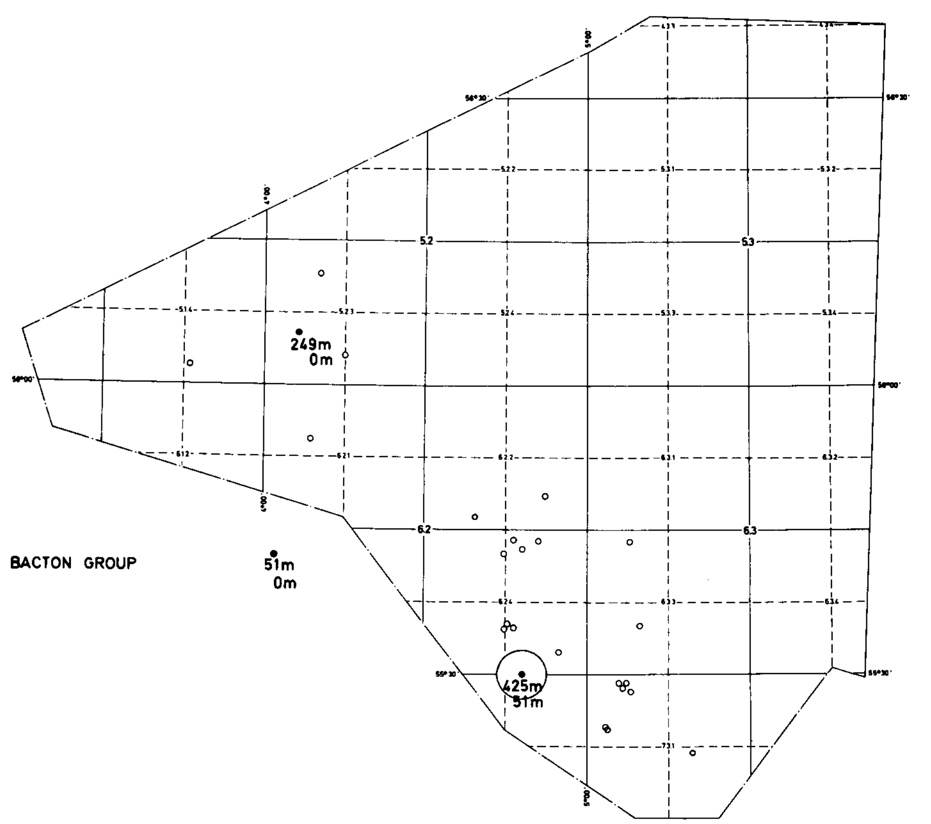
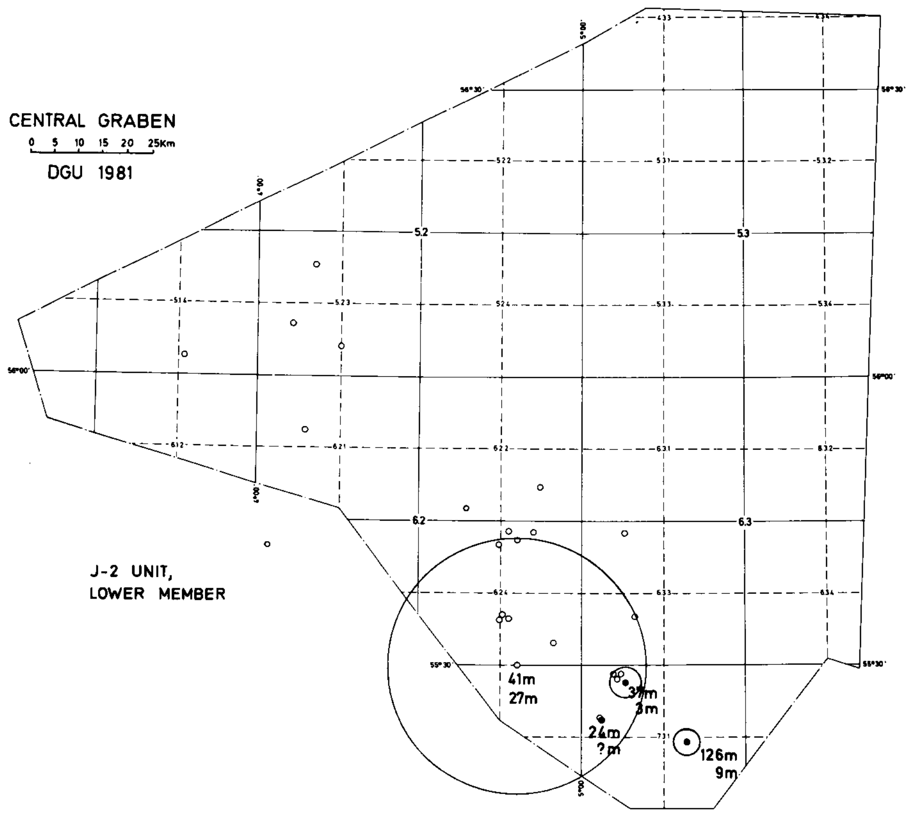


Fig. 50: The reservoir potential of a)Zechstein and b) the Bacton Group. – For legend, see fig. 49.



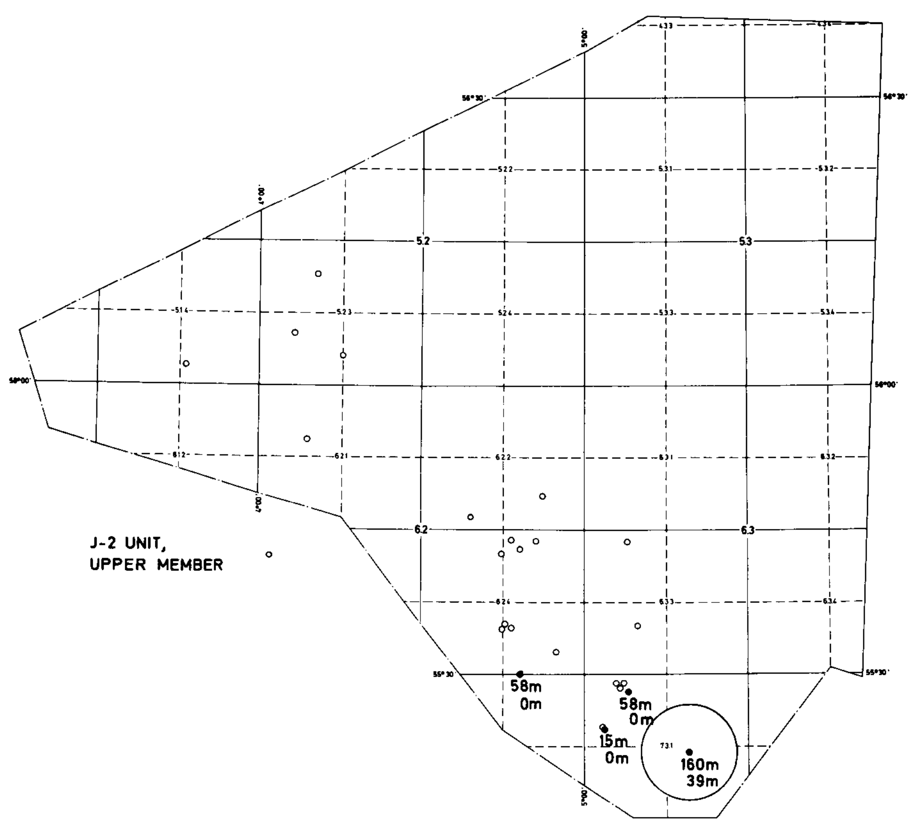
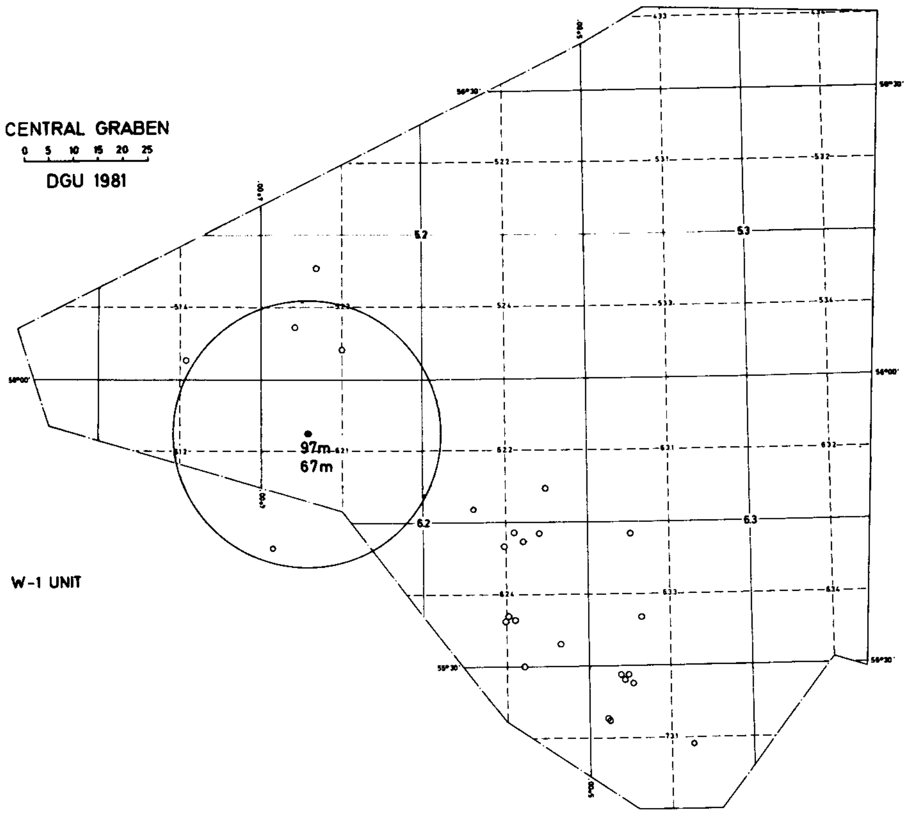


Fig. 51: The reservoir potential of a) the J-2 Unit, Lower Member and b) the J-2 Unit, Upper Member. For legend, see fig. 49.



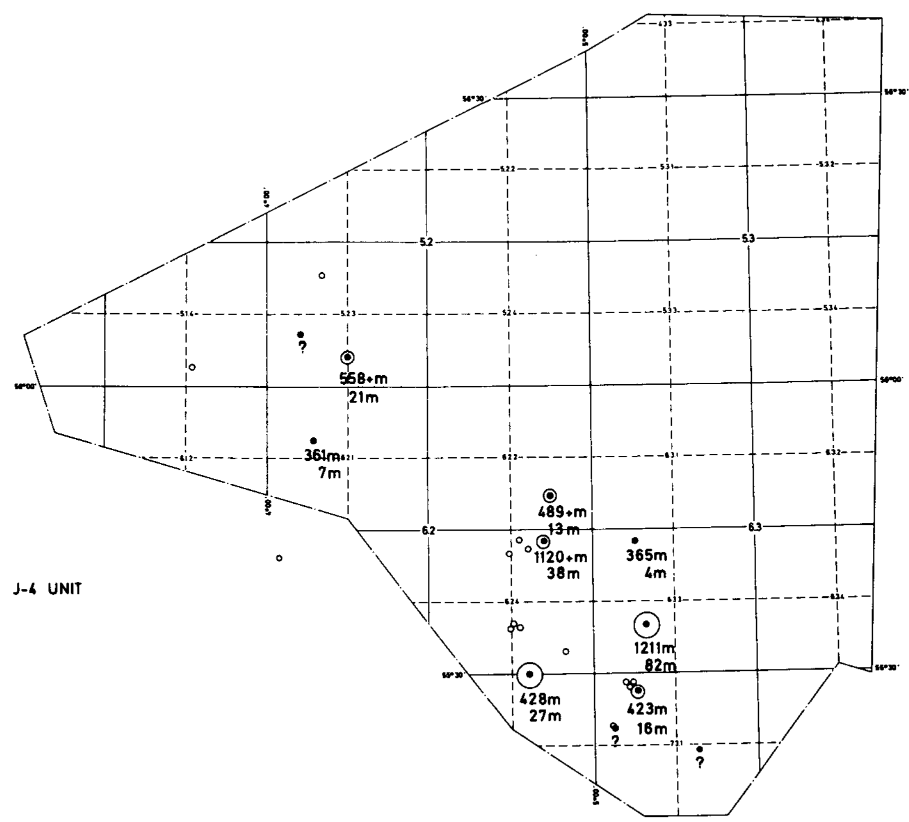


Fig. 52: The reservoir potential of a) W-1 Unit and b) the J-4 Unit. – For legend, see fig. 49.

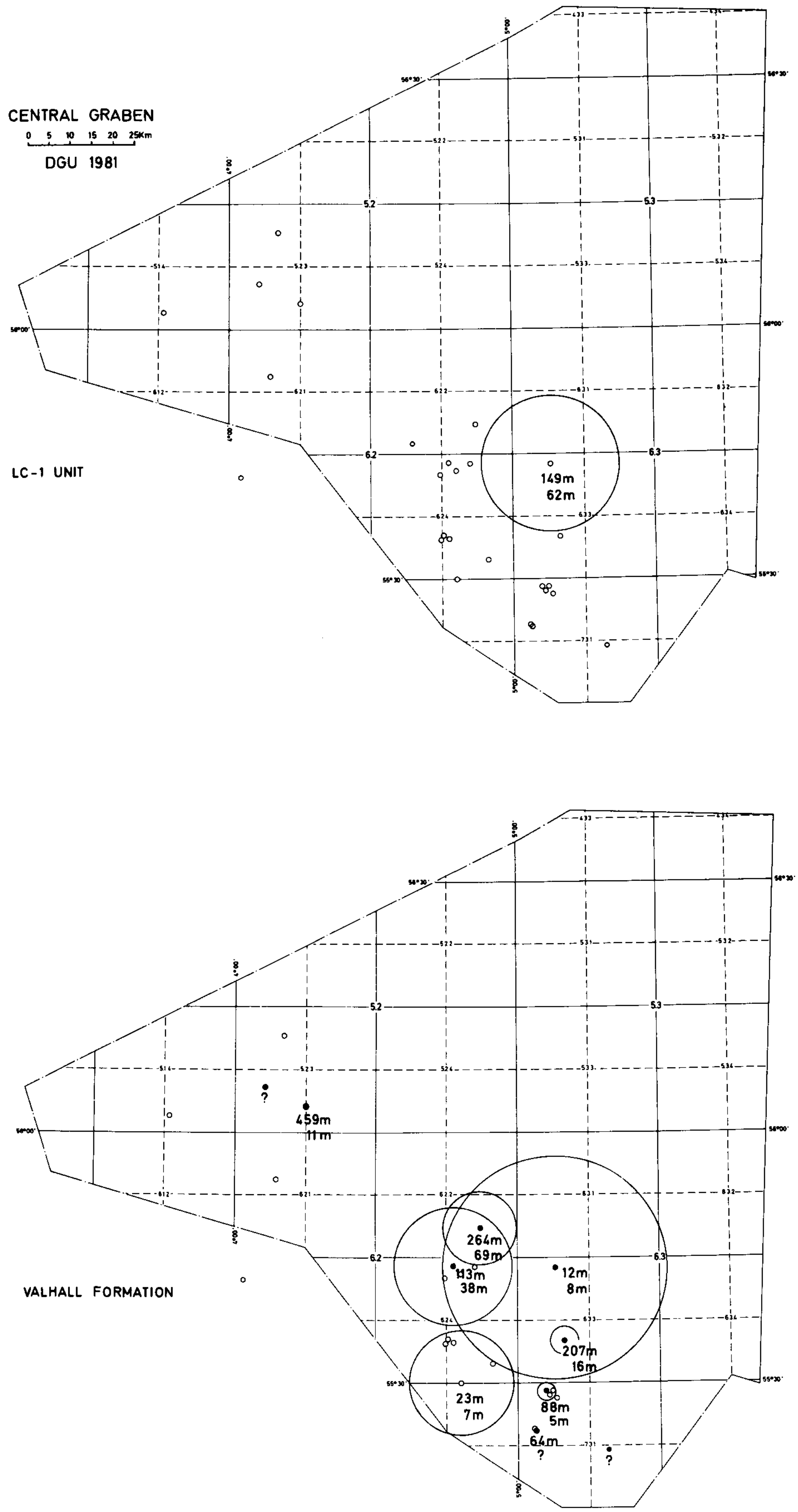


Fig. 53: The reservoir potential of a) the LC-1 Unit and b) the Valhall Formation. – For legend, see fig. 49.

Central Graben (between the structures) the depth may be 4000-5000 m.

Reservoir parameters (fig. 51): The Unit is divided into a lower member consisting of interbedded thick sandstones, claystones, and heteroliths and a less sandy upper member with coal seams.

In most wells there is a quantitatively upward decreasing occurrence of sandstone beds. This corresponds to the distribution of gas shows, which dominate in the lower member.

The following two facies may have reservoir properties: 1) the pure sandstone, which is hard to friable, fine to medium-grained, slightly calcareous with fair visible porosity, and 2) the heterolithic sand- and siltstones.

Only the sandstone beds are evaluated here. The average porosity is 20%, varying from 15-30%. Some sandy intervals are calcite cemented, which has reduced both porosity and permeability.

7.6 W-1 Unit (Late Jurassic)

Lithologic characteristics: The Unit consists of sandstones, minor siltstones, and conglomerates with interbedded, dark grey claystone and heterolithic silt- and claystones.

Reservoir parameters (fig. 52): All sections except the interbedded claystone seem to be potential reservoirs, with the conglomerates being the best reservoir rock. The conglomerates comprise rounded granular clasts of chalcedony and quartz, some dolomitic and granitic clasts and minor ammounts of siltstone clasts, all set in a medium-grained sand matrix.

The sandstones are fine-grained and firm, in part friable, depending on the degree of calcite-cementation. Loose medium-grained sand beds of vitreous and milky quartz have been found.

Three major sandstone intervals occur in the W-1 Unit, giving a net sand thickness of 67 m with a porosity varying from 6 to 14%. The average value of porosity is 11% based on bulk density log. The neutron porosity seems to be higher due to the clay content.

Two Formation Interval Tests (FIT) were performed in the W-1 Unit but no conclusive calculations of the permeability can be made. The moderate sorting and the presence of clay in the sandstone will lower the permeability.

7.7 J-3 Unit (Late Jurassic)

Lithologic characteristics: Claystone, often slightly silty, slightly calcareous; and subordinate occurrences of siltstone, medium to coarse-grained; and marlstone.

Reservoir parameters: Oil traces are reported from silty and calcareous layers in the A-2 and G-1 wells. Therefore silty layers may have reservoir properties, whereas the dominating clayey intervals have none. The irregular occurrence of the silty and calcareous beds may indicate restricted possibilities for commercial finds. These beds may be found along domal structures, on the top of which the J-3 Unit is absent or exists only as rims around the highs.

No cores have been cut and no tests performed in this Unit.

7.8 J-4 Unit (Late Jurassic)

Lithologic characteristics: Claystone, shaly, laminated, slightly silty and calcareous, with mica. Interbeds of thin lime- and dolostones are numerous.

Reservoir parameters (fig. 52): Several hydrocarbon shows have been reported from the lime- and dolostone stringers and the more silty intervals. The stringers may be of diagenetic origin and contain secondary porosity, contributing to the creation of reservoir conditions. The thickness of the stringers is approximately 2'. The log porosity in the stringers varies from 3-36%, averaging 10-12%. The total number of stringers varies from well to well.

The Unit is tested only in one well (E-1). The test indicated no significant amount of oil or gas. The permeability cannot be evaluated due to poor quality of test data.

The porous stringers may be sourced by the Unit itself.

7.9 LC-1 Unit (Late Jurassic - Early Cretaceous)

Lithologic characteristics: Sand and siltstone, silty sandstone, and sandy siltstones, with thin subordinate beds of calcareous shale and clay.

Extension, thickness, and depth: The Unit has been found in the V-1 well only, which is situated close to the margin of the Ringkøbing-Fyn High. Here the thickness is 61.5 m and depth 2702-2851 m. The Unit may be found as a fringe around other, similar structures.

Reservoir potential (fig. 53): The entire Unit seems to be a potential reservoir rock. This is confirmed by traces of oil and gas in the uppermost silty and sandy interval.

The porosity varies between 3 and 36% (log) with an average of 22%. No cores have been cut and no tests have been performed in the Unit.

7.10 Valhall Formation (Early Cretaceous)

Lithologic characteristics: Soft, grey to dark grey calcareous mudstone and shale with abundant limestone, marl, and siltstone beds.

In the lower part, the Formation has a relatively high terrigeneous content and may in parts be submarine fans. Dolomitic stringers (diagenetic) similar to those of the J-4 Unit are found in this lower part. The upper part of the Formation consists of lime and marlstone.

Extension, thickness, and depth: The Formation is the most prominent part of the Lower Cretaceous in the Danish Central Graben. The thickness of the Formation appears to show local maxima to more than 600 m, depending on the setting in relation to halokinetic structures. The Formation is generally thin or absent on structural highs.

Reservoir parameters (fig. 53): Due to the location of the Danish wells on salt domes, very little data are available on deep seated parts in the study area. However, in the V-1 well the sand- and siltstones interbedded with claystones might indicate good reservoir conditions. The porosity varies from 19 to 24% (log), averaging 22%.

The lime- and marlstones in the upper part of the formation may also have good reservoir properties, and shows are found in more wells.

The few tests from this Formation (the Adda-1 and E-1 wells) indicate relatively poor reservoir conditions.

7.11 Rødby Formation (Early Cretaceous)

Lithologic characteristics: The lithology varies considerably from well to well, but the main characteristic features of the Formation are marls, limestones or calcareous mudstones interbedded with clays and shales. Sandy intervals also occur.

Extension, thickness, and depth: The Formation is widely distributed in the Central Graben outside structural highs. The Formation is generally thin, typically 10-20 m, although local thicknesses up to 50 m may occur (the E-1 and I-1 wells). This greater thickness may be a result of sand deposition as indicated in the E-1 well.

Reservoir parameters: Apparently this Formation has limited reservoir potential. However, shows in sandy intervals in E-1 may indicate a small reservoir potential.

The porosity varies from 1% to 40%(log).

A drill stem test in the E-1 well gave no flow, indicating a very low permeability.

7.12 Chalk Group (Late Cretaceous - Early Cenozoic)

Exploration for oil and gas in chalk reservoirs, has been accelerated within the last ten years by discoveries of successful hydrocarbon reservoirs in the chalk in both the USA and the North Sea. Although chalk is a fairly poor reservoir rock, high production rates can be achieved if fracturing and a high oil column are present. The production can be enlarged by mechanical fracturing and/or acidizing of the rock, and the Chalk Group in general can be considered a reservoir rock (Scholle 1977b). More than 90% of the chalk is normally composed of calcareous nannoplankton (coccoliths) and foraminifera. Other biogenic- or terrestrial constituents such as bryozoans, clay-minerals, and clastic sand-grains are present in minor amounts.

The sediment is very fine-grained, as the sizes of the coccolith platelets range from 5-30 microns, and disintegrated platelets are even smaller. The foraminifera are found in the silt and sand fractions. The chalk provides a good primary porosity, but the narrow pore throats result in a low matrix permeability.

The coccolith- and foraminiferal skeletal calciumcarbonate has a low magnesium content, which makes the chalk somewhat resistant to the diagenetic alterations that cause loss or gain of porosity. Nevertheless, several factors affect the porosity.

Compaction and diagenesis: Chalk, upon initial deposition, has approximately 70% porosity. The initial porosity decreases with depth of burial resulting in a porosity value of 5% at a depth of 2500 m, following a 'normal compaction' trend (fig. 54). Several other factors affect the magnitude of porosity loss during the burial: Primary composition, tectonic stress, pore fluid pressure, the presence of hydrocarbons, pore water chemistry, and redeposition.

Primary composition: Variations in grain size, faunal composition, and clay content, result in differentiated diagenetic alterations, which cause variations in porosity and permeability.

The lower member of the Chalk-6 Unit, often has a clay content of 10-15%, which seems to prevent stylolitization and micro-fracturing. The clay occupies part of the pore space and blocks the pore throats. This causes a low porosity and permeability. The primary content of silicious skeletons, which during diagenesis is dissolved and reprecipitated as chert, also reduces porosity and permeability. In some places chert layers may even be permeability barriers, as seen at the Dan field.

A high content of calcispheres, as often found in the Chalk-4 Unit seems to cause a slight reduction in porosity and permeability.

The coccolith-foraminiferal chalk of the Chalk-5 Unit and the upper member of the Chalk-6 Unit, which seem to be the diagenetically most stable, has resisted porosity reduction at shallower depth. At greater depths of burial these units show abundant pressure solution (stylolites) as well as some reduction in porosity and permeability.

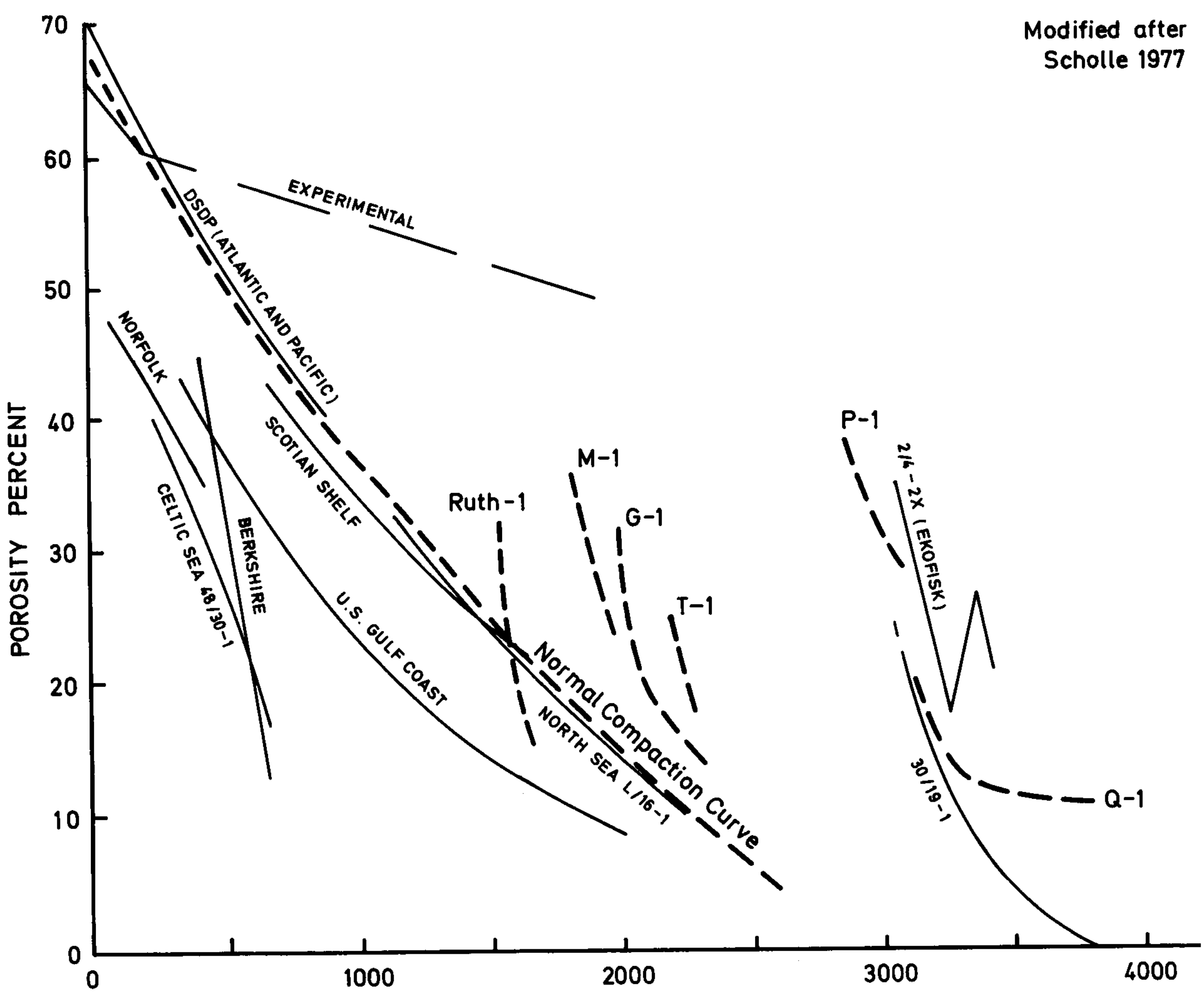


Fig. 54: Porosity v.s. depth of the Chalk Group in the G-1, M-1, P-1, Q-1, and Ruth-1 wells and a normal compaction curve plotted for comparison on a diagram from Scholle (1977b).

Tectonic stress: In heavily faulted or folded areas, stresses may be introduced causing reduction in porosity and permeability, similar to that of overburden. The tectonic stress may, however, also cause fracturing. Although the porosity increases only by a few per cent by fracturing, the permeability increases by a factor of 100 or even 1000. This is exemplified in the Ruth-1 well, drilled on top of a salt structure.

Pore fluid pressure: Mechanical and chemical compaction is dependent on expulsion of pore fluids. If the expulsion is obstructed, the pore fluid pressure will become higher than the hydrostatic pressure, grain to grain contact will be reduced and pressure solution will cease. In this way primary porosity and permeability can be preserved at much greater depths than those expected from 'normal compaction' curves. This is exemplified in the Dan field, where the fluid pressure is about 500 psi higher than the normal hydrostatic pressure, and the porosity is two times higher than that expected from the depth of burial (fig. 54). In the Danish Central Graben area, the Chalk Group is generally overpressured. The overpressuring is met at a depth of approximately 1200 m, close to top Middle Miocene. The overpressured interval seems to include the Chalk Group and part of the underlying shales.

Presence of hydrocarbons: Early migration of hydrocarbons into the chalk reservoirs reduces loss of porosity during further burial, by decreasing the water content and thereby slowing down its reaction with the rock. This effect cannot be fully evaluated for the Chalk Group in the Central Graben area, as it might be masked by the effects of pore fluid pressure. Oil- and water-wet chalk reservoirs are very similar in their porosity-depth distribution.

Pore water chemistry: The influx of fresh water into chalk tends to accelerate the loss of porosity and permeability. However, this has not been encountered so far in the Danish Central Graben area. The formation water hitherto found has either a normal marine salinity, or a higher chloride concentration. Moreover, salt-saturated brines have been found in wells situated on top of salt piercement structures. Alteration of chalk to dolomite, and associated porosity loss or gain, has been observed only in a few cases.

Redeposition: Allochtonous deposits may vary considerably in thickness and may be difficult to recognize in uncored intervals. In redeposited intervals higher porosities are often encountered, as compared to in situ chalk (R.F.P. Hardmann, pers. comm. 1981). Until now, slumped intervals have been recognized in only few wells in the Danish Central Graben; they may, however, be more common. Provided that the possible distribution areas of the slumped sediments and their nature are better known, there may be a chance of finding prospective reservoirs in allochtonous chalk.

Porosity distribution: In general porosity decreases with depth of burial (fig. 55). The average trend shows a decrease from 40% porosity at 1800 m, to 5% porosity at 3650 m. However, the total range for all wells is from 46% to 3% porosity.

The porosity versus depth distribution has a hourglass shape (fig. 56). The depth interval from 1768-2072 m is a high porosity zone with a porosity range from 14-46%. Another high-porosity interval is found from 2713-3109 m, where the porosity ranges from 2 to 38%. In between the two high porosity intervals, from 2347-2499 m, a rather narrow scatter of porosity values from 18-26% is encountered. From 3109 m, where the porosity range is 10-19%, the porosity gradually decreases downwards to much lower values. This indicates that chalk buried deeper than 3100 m is probably a poor reservoir rock. Chalk at depths shallower than 3100 m is considered a fairly good to good reservoir rock, since it has preserved much of its original primary porosity. In contrast to the small general decrease of porosity downwards, there is a considerable porosity reduction downwards in all individual wells (fig. 55).

Average porosities of the Chalk Units generally decrease with depth of burial. This reduction, however, is relatively small in the upper member of the Chalk-6 and Chalk-5 Units. Therefore these units are considered to be the best resevoirs within the Chalk Group from a matrix porosity point of view.

In fig. 57 the porosity ranges within the deposit zones are plotted against depth of burial. Going from deposit zones 2 to 3, both the structural elevation and the porosity increase. This can be explained as a depth-dependant porosity distribution. In deposit zone 4, the Chalk Group spans depths from above as well as below the values encountered in deposit zones 2 and 3. The porosity range in deposit zone 4, however, is smaller. As most of the reservoirs in deposit zone 4 are situated upon salt piercement structures, tectonic stress may have caused the reduction of up to 15% in porosity in this chalk, which is located equally or even structurally higher than deposit zone 3.

Deposit zone 5 encounters the deepest situated chalk reservoirs and the lowest porosities. The upper

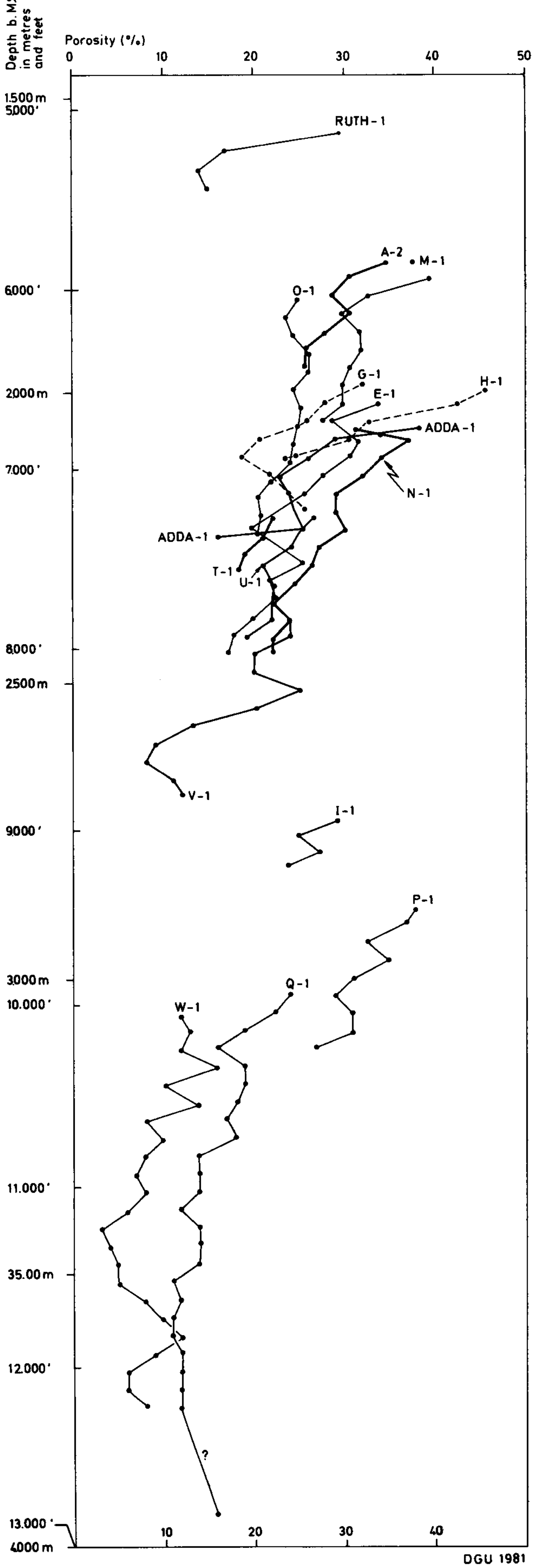


Fig. 55: Porosity v.s. depth plot of the Chalk Group in selected Central Graben wells.

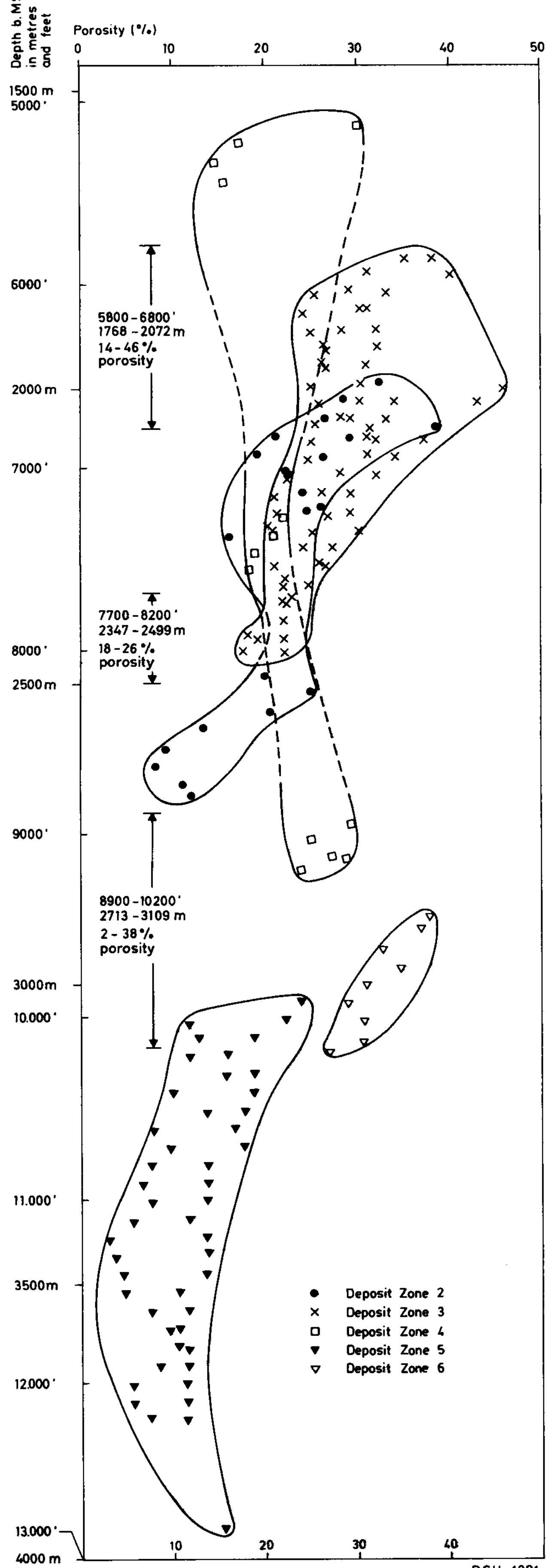


Fig. 56: Porosity v.s. depth plot of the Chalk Group. Data points are grouped and related to the Chalk deposit zones in Central Graben (see fig. 26).

parts of these reservoirs, however, still have fair porosities, similar to the lower values of deposit zones 2, 3, and 4.

Chalk in deposit zone 6 is found in a narrow depth interval. These reservoirs are deeper seated than in deposit zones 2, 3, and 4, but equal to the upper part of deposit zone 5. Despite the deep situation the porosities are as high as the higher values of deposit zones 2, 3, and 4, and they may be explained by formation water overpressure.

Permeability: As explained above, the primary permeabilities of chalks are low. Measured primary core permeabilities (air flow) generally range from 0.01 to 20 mD.

The permeability values vary greatly and show no clear relation to depth within the Chalk Units, (fig. 58). It is seen that the permeabilities in the two members of the Chalk-6 Unit cover the same range. Permeability values from the Chalk-3 and 4 Units have a very narrow range despite depth, but still within the range of the Chalk-6 Unit. This distribution, however, is based on much sparser data than those of the overlying units. The Chalk-5 Unit has the highest permeabilities encountered, and they fall allmost entirely outside the field of the other units.

Judged from the matrix permeability distributions described above, the Chalk-5 Unit holds the best reservoir conditions within the Chalk Group.

Porosity versus permeability (fig. 59): Matrix permeability sometimes correlates with matrix porosity as a function of depth. This is seen as a straight-line relationship on a semilog plot. In several cases, however, this relationship cannot be confirmed. This other relationship is probably caused by microfracturing of the chalk.

The existence of fractures has been indicated through comparisons between core permeabilities and permeabilities calculated from tests.

Until now, the presence of fractures has been confirmed by production tests performed in the following wells:

Strongly fractured: Ruth-1
Moderately fractured: T-1, N-1, Adda-1, H-1, I-1
Not fractured: G-1, E-1

The remaining wells in the Danish Central Graben area either have not been tested or permeabilities have not yet been calculated.

Fracture distribution: The fracture distribution seems to be correlatable with the degree of structural elevation. Strong fracturing is found on the high Ruth saltpiercement structure. Moderately fractured chalk reservoirs are generally found on low salt piercement- or shale flow structures, which are mainly found in deposit zones 2, 3, and the northern part of 4.

Exceptions from this general tendency, are the T-1 and Adda-1 wells. The T-1 well is situated on a salt piercement structure, but the fracture permeability is found to be very low. It is possible that this situation simply reflects the fact that only the lowermost part of the chalk section, where open fractures are less likely to exist than in the upper part, has yet been tested.

Tests suggest that the chalk section in the Adda-1 well is fractured. Unfortunately, no core-data are available for comparison. Adda-1 is drilled on a flat-top chalk closure, below which base chalk has a pronounced structural elevation. The oil zones in the Adda-1 well are close to the base of the Chalk Group, suggesting fracturing due to tectonic activity.

Chalk reservoirs where no fracturing is encountered seem to be correlatable to gentle structural mounds, with low structural elevation. This type of chalk reservoir seems to be restricted to deposit zones 2, 3, and 5. We have, however, only evaluated tests performed on the G-1 and E-1 wells in this type of structures.

Flat-top chalk closures have been encountered in deposit zones 2 and 3. These reservoirs should be

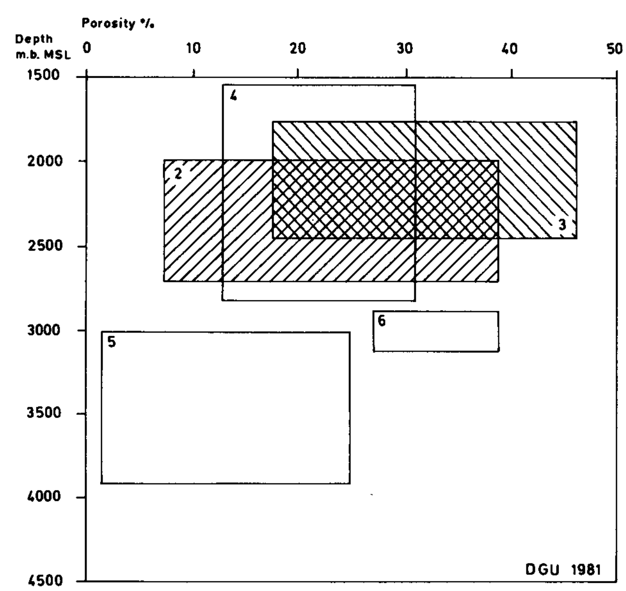


Fig. 57: Schematic presentation of porosity ranges in the Chalk Group related to Chalk deposit zones in the Central Graben. Numbers in squares refer to the individual Chalk deposit zones (cf. fig. 26).

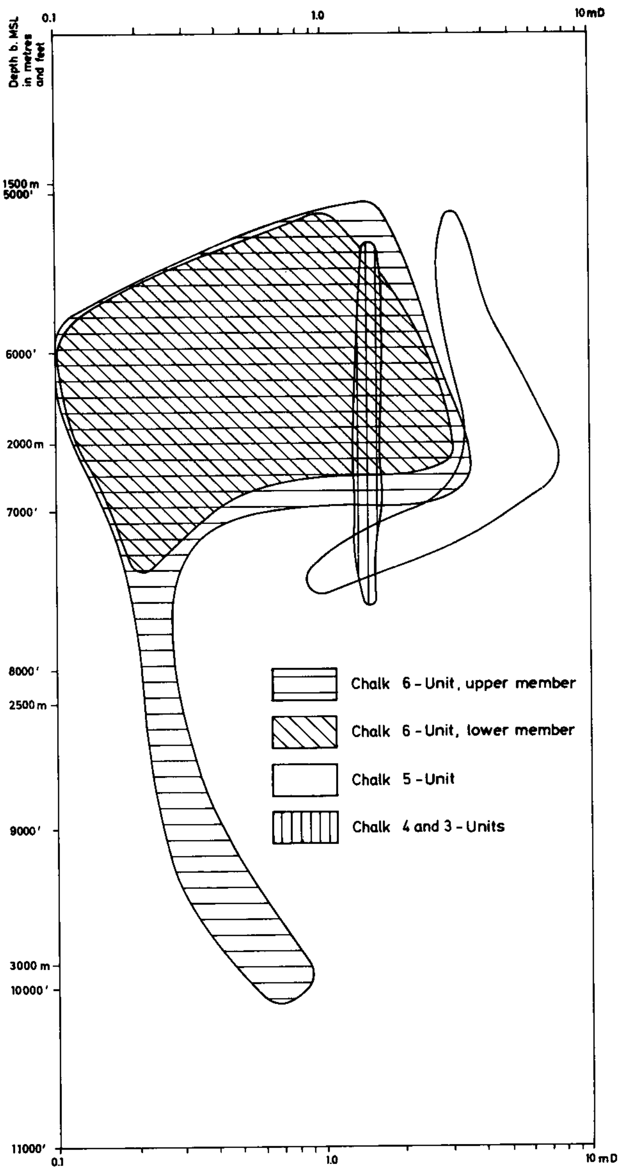


Fig. 58: Permeability distribution of Chalk Units.

expected to have a low fracture potential, provided that they follow the general pattern. It is known, as described above, that the Adda-1 well does not follow this pattern. Core descriptions from the H-1 well indicate fractures, but it is not known whether they contribute to permeability.

In the fracture system it is necessary to distinguish between fractures created by tension and by compression. Fractures and faults created by compression can have sealing properties, as demonstrated in the Gorm and Dan fields. Tension fractures, which are more likely to be open, may, however, later be sealed off by the precipitation of calcite cement.

Summary: Out of 16 released exploration wells in the Chalk Group, only the O-1 well proved (though questionably) to be without hydrocarbon shows. Two of the wells found the production fields - Dan and Gorm - and production has been planned on three other fields - Tyra, Skjold, and Roar.

The Chalk Group in general can be considered as a reservoir at least down to a depth of 3100 m. Within the Chalk Group, the upper member of the Chalk-6 Unit and certainly the Chalk-5 Unit can be considered to have good reservoir properties. This is based on the high primary porosity and fair permeability within these units. When naturally fractured they provide good production rates as exemplified by the Gorm field. The Chalk-6 and Chalk-5 Units are thickest in deposit zones 3 and 4. Through Chalk Units 4 to 1, the primary porosity and permeability generally decreases. If naturally fractured, however, and highly oil saturated, these units have proven to produce oil at fairly high rates as seen in Adda-1 and Ruth-1. The lower member of the Chalk-6 Unit might have the poorest reservoir properties. This is caused by rather low primary porosity and permeability and also by the relatively high clay content found in this unit. When the Formation is highly naturally fractured, however, high production rates can be achieved.

Classification of chalk reservoirs: Chalk reservoirs found in the Central Graben area can be divided into three groups as follows:

1) High primary porosity and fair primary permeability. Good reservoirs of this type have thick oil zones and hydrocarbon saturation up to 95% Sh.
2) Low primary porosity and permeability. These are reasonably good reservoirs even with hydrocarbon saturation as low as 50% Sh, provided a thick oil column is present.
3) High primary porosity and fair primary permeability together with secondary fracture porosity and permeability. These are potentially the best reservoirs.

7.13 North Sea Marl and CEN-1 to CEN-6 Unit (Cenozoic)

Lithologic characteristics: The units consist mainly of clastic material (clays and minor sands). The lowermost unit is dominated by a marl, upwards grading into a non-calcareous claystone or shale with subordinate layers of silt and sandstone. Above this the

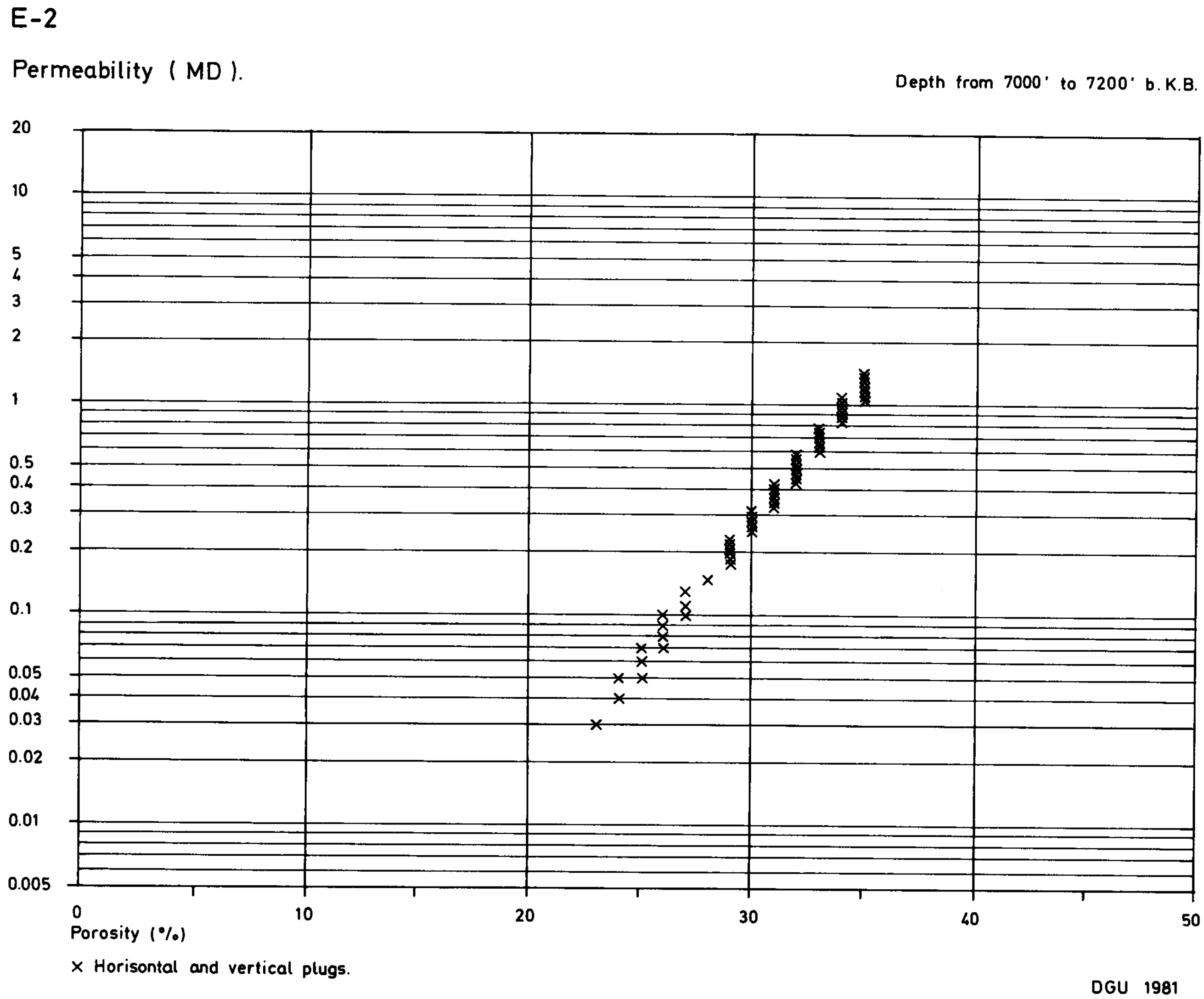


Fig. 59: Core porosity v.s. permeability plot (semi-log) from the E-2 and Ruth-1 wells. a) E-2 well. Non fractured chalk with a linear correlation. b) Ruth-1 well. Probably fractured chalk with a non-linear correlation.

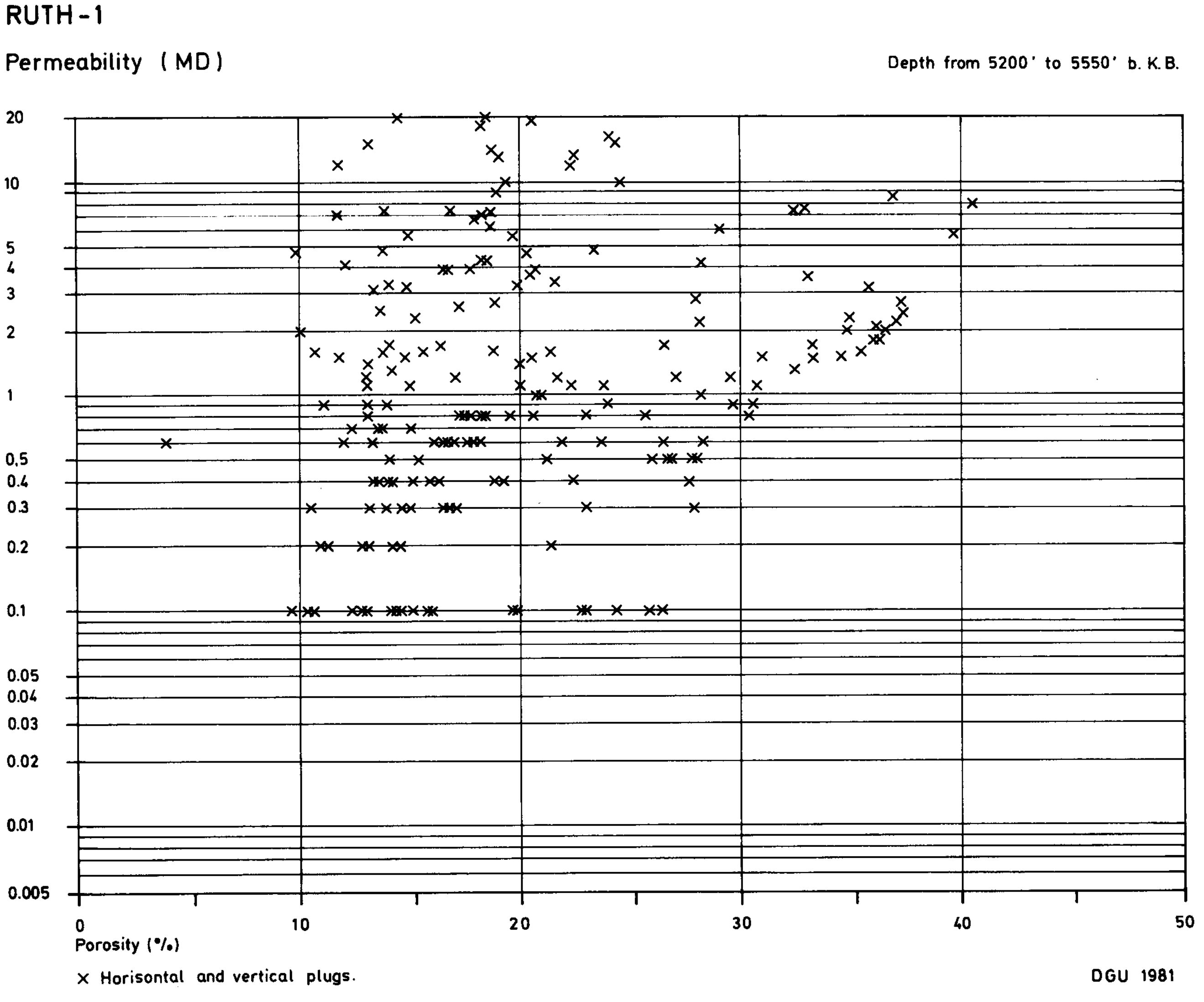
sequence contains layers of volcanic tuff, which succeed into more silty claystones with subordinate interbedded limestone. Sandy intervals become more common upwards, and the uppermost part of the CEN-5 Unit is a thick gravel-containing sandstone bed. The uppermost unit consists of clay, silt- , and sandstone interbedded with lignite and shell-rich beds.

Extension, thickness, and depth: Within the Danish Central Graben the entire sequence is 1700-3100 m thick. The sequence thins towards the northeast and east.

Reservoir parameters: Insignificant hydrocarbon shows are found in the lower units (CEN-3, 2, 1, and North Sea Marl) where they superpose hydrocarbon reservoirs in the chalk. The hydrocarbon accumulations are thought to be formed by leakage from the chalk reservoirs.

Information is restricted to little more than a small amount of core and wire line log data. The only porosity calculation made on the North Sea Marl found an average of 30% porosity in the Adda-1 well.

Porosity and permeability in the tuff/siltstone of the CEN-2 Unit are known from the E-1 and N-1 wells.



The porosity varies from 31-42% and 18-37.5% respectively. The permeability is 10 mD.

Nine limestone stringers in the CEN-3 Unit in the H-1 well, making up 22m net zone, are evaluated to have a porosity from 1 to 17%, whereas the permeability is not known.

The upper part of the Cenozoic sequence becomes more sandy, and the widespread gravelly sandstone in the uppermost part of the CEN-5 Unit is correllatable from one well to another. The porosity of the sandstones ranges from 20% to 45%, averaging 35%.

8.0 Tables on the formation depth and thickness

Legend

Log	Wire line logs used for identification of the boundary
SP	Spontaneous potential
Res	Resistivity
ITT	Interval transit time
GR	Gamma ray
FDC	Compensated formation density
CNL	Compensated neutron log
Cal	Caliper
/	Upper / lower boundary
DLL	Dual laterolog
TD	Total depth of the well
MSL	Mean sea level
KB	Kelly bushing
‘	Minimum thickness

CA-1 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	not drilled			
Adda-1	not drilled			
B-1	not drilled			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	not drilled			
N-1	not drilled			
N-2	not drilled			
O-1	not drilled			
P-1	11038-11259	ITT-GR/ITT-GR	3327-3394	67
Q-1	not drilled			
Ruth-1	not drilled			
T-1	not drilled			
U-1	not drilled			
V-1	not drilled			
W-1	not drilled			

Rotliegendes volcanics *(with sediments)*

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	not drilled			
Adda-1	not drilled			
B-1	11841-11985	Mudlog/TD	3574-3618	44'
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	not drilled			
N-1	not drilled			
N-2	not drilled			
O-1	not drilled			
P-1	10541-11038*	ITT-GR/ITT-GR	3175-3327	152
Q-1	14515-14745	Mudlog/TD	4386-4457	71'
Ruth-1	not drilled			
T-1	not drilled			
U-1	not drilled			
V-1	not drilled			
W-1	13888-14375	ITT-GR/TD	4199-4347	148'

* base of volcanics and sediments of Rotliegendes

Upper Rotliegendes sediments

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	not drilled			
Adda-1	not drilled			
B-1	11283-11841	Mudlog/Mudlog	3404-3574	170
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	not drilled			
N-1	not drilled			
N-2	not drilled			
O-1	not drilled			
P-1	10353-10541	ITT-GR/ITT-GR	3118-3175	58
Q-1	absent			
Ruth-1	not drilled			
T-1	not drilled			
U-1	not drilled			
V-1	not drilled			
W-1	absent			

Zechstein Group

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	not drilled			
Adda-1	not drilled			
B-1	10282-11283	Well data summary sheets	3068-3403	335
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	not drilled			
N-1	not drilled			
N-2	not drilled			
O-1	not drilled			
P-1	absent			
Q-1	?14385-?14515		4347-4386	39
Ruth-1	5590-5618	Mudlog/TD	1662-1677	8‘
T-1	7686-8713	Well data summary sheets/TD	2318-2631	312‘
U-1	not drilled			
V-1	not drilled			
W-1	?13860-?12888		4190-4199	9

Bacton Group (Bunter Sandstone and Shale Formations)

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	not drilled			
Adda-1	not drilled			
B-1	9990-10190	CNL-GR/CNL-GR	3009-3060	51
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	not drilled			
N-1	not drilled			
N-2	not drilled			
O-1	not drilled			
P-1	absent			
Q-1	13910-14385	ITT-GR/ITT-GR	4203-4348	145
Ruth-1	not drilled			
T-1	not drilled			
U-1	14651-16045	ITT-GR/TD	4437-4962	425‘
V-1	not drilled			
W-1	absent			

Dowsing Dolomitic Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	10050-11143	Mudlog/TD	3027-3360	333
Adda-1	not drilled			
B-1	absent			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	not drilled			
N-1	not drilled			
N-2	not drilled			
O-1	not drilled			
P-1	absent			
Q-1	absent			
Ruth-1	not drilled			
T-1	not drilled			
U-1	13074-14651	ITT-GR/ITT-GR	3957-4437	480
V-1	12080-12654	ITT-GR/TD	3648-3823	175‘
W-1	absent			

Dudgeon Saliferous Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	absent			
Adda-1	not drilled			
B-1	absent			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	11559-12007	ITT-GR/TD	3494-3647	153‘
N-1	not drilled			
N-2	not drilled			
O-1	11193-11740	ITT-GR/TD	3384-3550	166‘
P-1	absent			
Q-1	absent			
Ruth-1	not drilled			
T-1	not drilled			
U-1	12159-13074	ITT-GR/ITT-GR	3678-3957	279
V-1	absent			
W-1	absent			

Triton Anhydritic Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	absent			
Adda-1	not drilled			
B-1	absent			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	10793-11559	ITT-GR/ITT-GR	3260-3494	234
N-1	not drilled			
N-2	not drilled			
O-1	10401-11193	ITT-GR/ITT-GR	3142-3384	242
P-1	absent			
Q-1	absent			
Ruth-1	not drilled			
T-1	not drilled			
U-1	11250-12159	ITT-GR/ITT-GR	3401-3678	277
V-1	absent			
W-1	absent			

Winterton Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	absent			
Adda-1	not drilled			
B-1	absent			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	10771-10793	ITT-GR/ITT-GR	3253-3260	7
N-1	not drilled			
N-2	not drilled			
O-1	10347-10401	ITT-GR/ITT-GR	3126-3142	16
P-1	absent			
Q-1	absent			
Ruth-1	not drilled			
T-1	not drilled			
U-1	11209-11250	ITT-GR/ITT-GR	3389-3401	12
V-1	absent			
W-1	absent			

Fjerritslev Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	absent			
Adda-1	not drilled			
B-1	no evaluation			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	10467-10771	ITT-GR/ITT-GR	3161-3154	93
N-1	not drilled			
N-2	not drilled			
O-1	9838-10347	ITT-GR/ITT-GR	2971-3126	155
P-1	absent			
Q-1	13608-13910	ITT-GR/ITT-GR	4111-4203	92
Ruth-1	not drilled			
T-1	not drilled			
U-1	11048-11209	ITT-GR/ITT-GR	3340-3389	49
V-1	absent			
W-1	absent			

J-2 Unit, all members

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	9920-10050	Mud log	2988-3027	39
Adda-1	not drilled			
B-1	no evaluation			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	10143-10467	ITT-GR/ITT-GR	3062-3161	99
N-1	not drilled			
N-2	not drilled			
O-1	8901- 9840	ITT-GR/ITT	2685-2971	286
P-1	absent			
Q-1	13429-13608	ITT-GR/ITT-GR	4063-4111	48
Ruth-1	not drilled			
T-1	not drilled			
U-1	10665-11048	ITT-GR/CNL-FDC	3222-3339	117
V-1	absent			
W-1	absent			

J-2 Unit, upper member

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	9920- 9970	Mud Log	2988-3003	15
Adda-1	not drilled			
B-1	no evaluation			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	10143-10260	ITT/GR-ITT	3062-3098	36
N-1	not drilled			
N-2	not drilled			
O-1	8901- 9425	ITT-GR/ITT-GR	2685-2845	160
P-1	absent			
Q-1*	? - ?	? - ?	?	
Ruth-1	not drilled			
T-1	not drilled			
U-1	10665-10853	ITT-GR/ITT-GR	3222-3280	58
V-1	absent			
W-1	absent			

* no evaluation

J-2 Unit, lower member

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	9970-10050	Mud Log	3003-3027	24
Adda-1	not drilled			
B-1	no evaluation			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	not drilled			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	10260-10467	ITT-GR/ITT-GR	3098-3161	37
N-1	not drilled			
N-2	not drilled			
O-1	9425- 9838	ITT-GR/ITT	2845-2971	126
P-1	absent			
Q-1*	? - ?		? - ?	?
Ruth-1	not drilled			
T-1	not drilled			
U-1	10853-11048	ITT-GR/FDC-CNL	3280-3339	41
V-1	absent			
W-1	absent			

* no evaluation

W-1 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	absent			
Adda-1	not drilled			
B-1	no evaluation			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	absent			
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	absent			
N-1	not drilled			
N-2	not drilled			
O-1	absent			
P-1	absent			
Q-1	absent			
Ruth-1	not drilled			
T-1	not drilled			
U-1	absent			
V-1	absent			
W-1	13521-13860	ITT-GR/ITT	4087-4184	97

J-3 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	? - 9920	Mudlog	?-2988	?
Adda-1	not drilled			
B-1	no evaluation			
E-1	not drilled			
E-2	not drilled			
E-3	not drilled			
G-1	12037-12517	ITT-GR/TD	3632-3778	146‘
H-1	not drilled			
I-1	not drilled			
M-1	not drilled			
M-2	not drilled			
M-8	8940-10143	ITT-GR/ITT-GR	2695-3062	367
N-1	not drilled			
N-2	not drilled			
O-1	? - 8901	/ITT-GR	?-2685	?
P-1	absent			
Q-1	not drilled			
Ruth-1	not drilled			
T-1	not drilled			
U-1	9595-10665	ITT-GR/ITT-GR	2896-3222	326
V-1	?10601-12080	ITT-GR/ITT-GR	?3198-3648	?450
W-1	absent			

J-4 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	7470- ?	Mudlog	2241- ?	?
Adda-1	8400- 10005	ITT-GR/TD log	2526- 3015	489'
B-1*	? - ?		? - ?	?
E-1	9727- 13403	ITT-GR/TD log	2928- 4048	1120'
E-2	not drilled			
E-3	not drilled			
G-1	8088- 12037	ITT-GR/ITT-GR	2429- 3632	1204
H-1	not drilled			
I-1	11018- 12848	ITT-GR/TD log	3321- 3879	558'
M-1	7190- 7374	ITT-GR/TD log	2158- 2475	117'
M-2	not drilled			
M-8	7517- 8940	ITT-GR/ITT-GR	2262- 2695	433
N-1	not drilled			
N-2	not drilled			
O-1*	? - ?		? - ?	?
P-1	absent			
Q-1*	? - ?		? - ?	?
Ruth-1	not drilled			
T-1	not drilled			
U-1	8190- 9595	ITT-GR/ITT-GR	2468- 2896	428
V-1	9462-?10601	ITT-GR/ITT-GR	2833-?3198	?347
W-1	12333-13521	ITT-GR/ITT-GR	3725- 4087	362

* no evaluation

LC-1 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	absent			
Adda-1	absent			
B-1	no evaluation			
E-1	absent			
E-2	not drilled			
E-3	not drilled			
G-1	absent			
H-1	not drilled			
I-1	absent			
M-1	absent			
M-2	not drilled			
M-8	absent			
N-1	not drilled			
N-2	not drilled			
O-1	absent			
P-1	absent			
Per-1	absent			
Q-1	absent			
Ruth-1	absent			
T-1	no evaluation			
U-1	absent			
V-1	8972-9462	GR,FDC,CNL,ITT/ GR,FDC,CNL,ITT	2702-2851	149
W-1	absent			

Valhall Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	7260- 7470	Mudlog/Mudlog	2177-2241	64
Adda-1	7530- 8400	ITT-GR/ITT-GR	2262-2526	264
B-1	no evaluation			
E-1	8297- 9727	ITT-GR/ITT-GR	2492-2928	236
E-2	not drilled			
E-3	8350- 8722	GR/GR	2515-2628	113‘
G-1	7410- 8088	ITT-GR/ITT-GR	2222-2429	207
H-1	no evaluation			
I-1	9508-11018	ITT-GR/ITT-GR	2862-3321	459
M-1	6902- 7190	ITT-GR/ITT-GR	2071-2159	88
M-2	not drilled			
M-7	8934- 9070	Mudlog/Mudlog	2691-2733	42‘
M-8	7280- 7517	ITT-GR/ITT-GR	2190-2262	72
N-1	not drilled			
N-2	not drilled			
O-1	7580- ?	CNL-GR/ ?	2283- ?	
P-1	absent			
Per-1	absent			
Q-1 ?				
Ruth-1	absent			
T-1	no evaluation			
U-1	8112-8190	ITT-GR/ITT-GR	2445-2468	23
V-1	8937-8972	GR-ITT/ GR,GDC,CNL,ITT	2691-2702	12
W-1	?			

Rødby Formation

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	not drilled			
A-2	7240-7260	Mudlog/Mudlog	2171-2177	6
Adda-1	7512-7530	ITT-GR/ITT-GR	2256-2262	6
B-1	no evaluation			
E-1	8162-8297	ITT-GR/ITT-GR	2451-2492	41
E-2	not drilled			
E-3	8305-8350	ITT-GR/GR	2502-2515	13
G-1	absent			
H-1	not drilled			
I-1	9355-9508	ITT-GR/ITT-GR	2815-2862	47
M-1	6858-6902	ITT-GR/ITT-GR	2057-2071	14
M-2	not drilled			
M-8	7212-7280	ITT-GR/ITT-GR	2169-2190	21
N-1	not drilled			
N-2	not drilled			
O-1	7570-7580	CNL-GR/CNL-GR	2280-2283	3
P-1	absent			
Per-1	absent			
Q-1	no evaluation			
Ruth-1	absent			
T-1	no evaluation			
U-1	absent			
V-1	absent			
W-1	absent			

Chalk-1 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	no logs			
A-2	no logs			
Adda-1	7420-7512	ITT-GR/ITT-GR	2227-2256	28
B-1	absent			
E-1	8115-8162	ITT-GR/ITT-GR	2436-2451	14
E-2	absent			
E-3	absent			
G-1	no logs			
H-1	absent			
I-1	absent			
M-1	absent			
M-2	no evaluation			
M-8	absent			
N-1	not drilled			
N-2	no evaluation			
O-1	7500-7580	ITT-GR/ITT-GR	2258-2282	24
P-1	absent			
Q-1	?no logs*			
Ruth-1	absent			
T-1	absent			
U-1	absent			
V-1	absent			
W-1	absent			

*No logs from 12270-12950'

Chalk-2 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	no logs			
A-2	no logs			
Adda-1	7138- 7420	ITT-GR/ITT-GR	2142-2227	85
B-1	7520- 7595	ITT-GR/ITT-GR	2256-2279	23
E-1	7500- 8115	ITT-GR/ITT-GR	2249-2436	187
E-2	no evaluation			
E-3	no evaluation			
G-1	7120- 7410	ITT-GR/ITT-GR	2133-2222	89
H-1	absent			
I-1	absent			
M-1	6590- 6858	ITT-GR/ITT-GR	1975-2057	82?
M-2	no evaluation			
M-8	6880- 7212	ITT-GR/ITT-GR	2067-2169	102
N-1	7904-TD 8155	ITT-GR/ITT-GR	2377-2453	76'
N-2	no evaluation			
O-1	7408- 7500	ITT-GR/ITT-GR	2230-2258	28
P-1	absent			
Q-1	12128-13000	ITT-GR/ITT-GR	3659-3925	266
Ruth-1	absent			
T-1	absent			
U-1	7898- 8109	ITT-GR/ITT-GR	2379-2443	64
V-1	8375- 8937	ITT-GR/ITT-GR	2519-2690	171
W-1	11782-12333	ITT-GR/ITT-GR	3557-3725	168

Chalk-3 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	no logs			
A-2	no logs			
Adda-1	7063- 7138	ITT-GR/ITT-GR	2119-2142	23
B-1	7447- 7520	ITT-GR/ITT-GR	2234-2256	22
E-1	7325- 7500	ITT-GR/ITT-GR	2195-2249	54
E-2	no evaluation			
E-3	no evaluation			
G-1	6875- 7120	ITT-GR/ITT-GR	2067-2142	75
H-1	absent			
I-1	absent			
M-1	6471- 6590	ITT-GR/ITT-GR	1939-1975	?36
M-2	no evaluation			
M-8	6681- 6880	ITT-GR/ITT-GR	2007-2067	60
N-1	7745- 7904	ITT-GR/ITT-GR	2328-2377	49
N-2	no evaluation			
O-1	7349- 7408	ITT-GR/ITT-GR	2212-2230	?18
P-1	absent			
Q-1	11640-12128	ITT-GR/ITT-GR	3510-3659	149
Ruth-1	absent			
T-1	absent			
U-1	7800- 7898	ITT-GR/ITT-GR	2339-2369	30
V-1	8025- 8375	ITT-GR/ITT-GR	2412-2519	107
W-1	11267-11782		3400-3557	157

Chalk-4 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1				
A-2	6262-(6650)*	ITT-GR/ITT-GR	1873-1991	118'
Adda-1	absent			
B-1	7402- 7447	ITT-GR/ITT-GR	2220-2234	14
E-1	7072- 7325	ITT-GR/ITT-GR	2118-2195	77
E-2	no evaluation			
E-3	no evaluation			
G-1	6830- 6875	ITT-GR/ITT-GR	2045-2058	13
H-1	6981-TD 7100	ITT-GR/ITT-GR	2091-2127	36'
I-1	9241- 9355	ITT-GR/ITT-GR	2779-2814	35
M-1	6118- 6471	ITT-GR/ITT-GR	1831-1935	108
M-2	no evaluation			
M-8	6256- 6681	ITT-GR/ITT-GR	1877-2007	130
N-1	7147- 7745	ITT-GR/ITT-GR	2146-2328	182
N-2	no evaluation			
O-1	7187- 7349	ITT-GR/ITT-GR	2163-2212	49
P-1	9865-10350	ITT-GR/ITT-GR	2969-3117	148
Q-1	10730-11640	ITT-GR/ITT-GR	3233-3510	277
Ruth-1	5290- 5586	ITT-GR/ITT-GR	1577-1668	91
T-1	7519- 7685	ITT-GR/ITT-GR	2267-2317	50
U-1	7594- 7800	ITT-GR/ITT-GR	2286-2349	63
V-1	7639- 8025	ITT-GR/ITT-GR	2295-2412	117
W-1	10695-11267	ITT-GR/ITT-GR	3226-3400	174

* (6650') base log.

Chalk-5 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1				
A-2	6125- 6262	ITT-GR/ITT-GR	1831-1873	42
Adda-1	7040- 7063	ITT-GR/ITT-GR	2112-2119	7
B-1	absent	ITT-GR/ITT-GR		
E-1	6880- 7072	ITT-GR/ITT-GR	2060-2118	58
E-2	no evaluation			
E-3	no evaluation			
G-1	6790- 6830	ITT-GR/ITT-GR	2032-2045	13
H-1	6713- 6981	ITT-GR/ITT-GR	2009-2091	82
I-1	9182- 9241	ITT-GR/ITT-GR	2761-2779	18
M-1	6032- 6118	ITT-GR/ITT-GR	1805-1831	26
M-2	no evaluation			
M-8	6152- 6256	ITT-GR/ITT-GR	1846-1877	31
N-1	6937- 7147	ITT-GR/ITT-GR	2082-2146	64
N-2	no evaluation			
O-1	6254- 7187	ITT-GR/ITT-GR	1878-2163	285
P-1	9818- 9865	ITT-GR/ITT-GR	2955-2969	14
Q-1	10378-10730	ITT-GR/ITT-GR	3125-3233	108
Ruth-1	5266- 5290	ITT-GR/ITT-GR	1570-1577	7
T-1	7419- 7519	ITT-GR/ITT-GR	2236-2267	31
U-1	7430- 7594	ITT-GR/ITT-GR	2236-2286	50
V-1	7550- 7639	ITT-GR/ITT-GR	2268-2295	27
W-1	10413-10695	ITT-GR/ITT-GR	3140-3226	86

Chalk-6 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1				
A-2	5950- 6125	ITT-GR/ITT-GR	1778-1831	52
Adda-1	6866- 7040	ITT-GR/ITT-GR	2059-2112	53
B-1	7373- 7402	ITT-GR/ITT-GR	2212-2220	8
E-1	6735- 6880	ITT-GR/ITT-GR	2016-2060	44
E-2	no evaluation			
E-3	no evaluation			
G-1	6610- 6790	ITT-GR/ITT-GR	1978-2032	54
H-1	6680- 6713	ITT-GR/ITT-GR	1999-2009	10
I-1	9070- 9182	ITT-GR/ITT-GR	2727-2761	34
M-1	5902- 6032	ITT-GR/ITT-GR	1765-1805	40
M-2	no evaluation			
M-8	6013- 6152	ITT-GR/ITT-GR	1803-1846	43
N-1	6897- 6937	ITT-GR/ITT-GR	2070-2082	12
N-2	no evaluation			
O-1	6097- 6254	ITT-GR/ITT-GR	1830-1878	48
P-1	9580- 9818	ITT-GR/ITT-GR	2882-2955	73
Q-1	10058-10378	ITT-GR/ITT-GR	3028-3125	97
Ruth-1	5205- 5266	ITT-GR/ITT-GR	1551-1570	19
T-1	7283- 7419	ITT-GR/ITT-GR	2195-2236	41
U-1	7300- 7434	ITT-GR/ITT-GR	2197-2238	41
V-1	7356- 7550	ITT-GR/ITT-GR	2208-2268	60
W-1	10135-10413	ITT-GR/ITT-GR	3055-3140	85

North Sea Marl

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	absent			
A-2	5950- 5952	ITT-GR/GR	1778-1778	
Adda-1	6841- 6866	ITT-GR/GR	2051-2059	8
B-1	absent			
E-1	6725- 6735	ITT-GR/GR	2013-2016	3
E-2	absent			
E-3	absent			
G-1	absent			
H-1	absent			
I-1	9011- 9070	ITT-GR/GR	2709-2727	18
M-1	absent			
M-2	absent			
M-8	absent			
N-1	6839- 6897	ITT-GR/GR	2052-2070	18
N-2	absent			
O-1	6043- 6097	ITT-GR/GR	1814-1830	16
P-1	9504- 9580	ITT-GR/GR	2859-2882	23
Q-1	9971-10072	ITT-GR/GR	3001-3032	17
Ruth-1	absent			
T-1	7228- 7283	ITT-GR/GR	2178-2195	17
U-1	7279- 7300	ITT-GR/GR	2190-2197	7
V-1	absent			
W-1	10040-10094	ITT-GR/GR	3026-3043	17

CEN-1 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	no evaluation			
A-2	5898 - 5950	ITT-GR/ITT-GR	1762-1778	16
Adda-1	6819 - 6841	ITT-GR/ITT-GR	2044-2051	7
B-1	7305 - 7372	ITT-GR/ITT-GR	2191-2211	20
E-1	6683 - 6725	ITT-GR/ITT-GR	2000-2013	13
E-2	6530 - 6547	ITT-GR/ITT-GR	1953-1958	5
E-3	no evaluation			
G-1	6512 - 6610	ITT-GR/ITT-GR	1948-1977	29
H-1	6670 - 6680	ITT-GR/ITT-GR	1969-1999	3
I-1	8942 - 9011	ITT-GR/ITT-GR	2688-2709	21
M-1	5832 - 5910	ITT-GR/ITT-GR	1744-1768	24
M-2	no evaluation			
M-8	no evaluation			
N-1	6800 - 6839	ITT-GR/ITT-GR	2040-2052	12
N-2	6545 - 6590	ITT-GR/ITT-GR	1964-1977	13
O-1	6035 - 6043	ITT-GR/ITT-GR	1811-1814	3
P-1	9892 - 9504	ITT-GR/ITT-GR	2791-2859	68
Q-1	9790 - 9971	ITT-GR/ITT-GR	2946-3001	55
Ruth-1	5188 - 5205	ITT-GR/ITT-GR	1546-1551	5
T-1	7157 - 7228	ITT-GR/ITT-GR	2156-2178	22
U-1	7233 - 7279	ITT-GR/ITT-GR	2176-2190	14
V-1	7300 - 7356	ITT-GR/ITT-GR	2192-2209	17
W-1	9945 -10040	ITT-GR/ITT-GR	2997-3029	29

CEN-2 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	5727-5810	ITT-GR/ITT-GR	1736-1761	25
A-2	5823-5898	ITT-GR/ITT-GR	1739-1762	23
Adda-1	6760-6819	ITT-GR/ITT-GR	2026-2044	18
B-1	7230-7305	ITT-GR/ITT-GR	2168-2191	23
E-1	6640-6683	ITT-GR/ITT-GR	1987-2000	13
E-2	6485-6530	ITT-GR/ITT-GR	1939-1953	14
E-3	no evaluation			
G-1	6450-6512	ITT-GR/ITT-GR	1929-1948	19
H-1	6620-6670	ITT-GR/ITT-GR	1981-1996	15
I-1	8880-8942	ITT-GR/ITT-GR	2669-2688	19
M-1	5787-5832	ITT-GR/ITT-GR	1730-1744	14
M-2	5985-6030	ITT-GR/ITT-GR	1793-1807	14
M-8	5900-5950	ITT-GR/ITT-GR	1769-1784	15
N-1	6765-6800	ITT-GR/ITT-GR	2030-2040	10
N-2	6495-6545	ITT-GR/ITT-GR	1948-1964	16
O-1	5983-6035	ITT-GR/ITT-GR	1796-1811	15
P-1	9200-9282	ITT-GR/ITT-GR	2766-2791	25
Q-1	9717-9790	ITT-GR/ITT-GR	2924-2946	22
Ruth-1	5132-5188	ITT-GR/ITT-GR	1529-1546	17
T-1	7090-7157	ITT-GR/ITT-GR	2136-2156	20
U-1	7195-7233	ITT-GR/ITT-GR	2165-2176	11
V-1	7256-7300	ITT-GR/ITT-GR	2178-2192	14
W-1	9850-9945	ITT-GR/ITT-GR	2968-2997	29

CEN-3 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	4800-5727	ITT-GR/ITT-GR	1454-1736	282
A-2	4925-5823	ITT-GR/ITT-GR	1465-1739	274
Adda-1	5344-6760	ITT-GR/ITT-GR	1595-2026	431
B-1	5035-7230	ITT-GR/ITT-GR	1499-2168	669
E-1	5460-6640	ITT-GR/ITT-GR	1627-1987	360
E-2	5270-6485	ITT-GR/ITT-GR	1569-1939	370
E-3	no evaluation			
G-1	5330-6450	ITT-GR/ITT-GR	1587-1929	342
H-1	5255-6620	ITT-GR/ITT-GR	1565-1981	416
I-1	5515-8880	ITT-GR/ITT-GR	1644-2669	1025
M-1	4900-5787	ITT-GR/ITT-GR	1460-1730	270
M-2	4980-5985	ITT-GR/ITT-GR	1487-1793	306
M-8	4940-5900	ITT-GR/ITT-GR	1476-1769	293
N-1	5480-6765	ITT-GR/ITT-GR	1638-2030	392
N-2	5340-6495	ITT-GR/ITT-GR	1596-1948	352
O-1	4945-5983	ITT-GR/ITT-GR	1479-1796	317
P-1	5490-9200	ITT-GR/ITT-GR	1636-2766	1130
Q-1	6140-9717	ITT-GR/ITT-GR	1834-2924	1090
Ruth-1	4658-5132	ITT-GR/ITT-GR	1385-1529	144
T-1	5397-7090	ITT-GR/ITT-GR	1620-2136	516
U-1	5870-7195	ITT-GR/ITT-GR	1761-2165	404
V-1	5553-7256	ITT-GR/ITT-GR	1659-2178	519
W-1	5600-9850	ITT-GR/ITT-GR	1673-2968	1295

CEN-4 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	4040-4800	ITT-GR/ITT-GR	1222-1454	232
A-2	4134-4925	ITT-GR/ITT-GR	1224-1465	241
Adda-1	3893-5344	ITT-GR/ITT-GR	1152-1595	443
B-1	4745-5035	ITT-GR/ITT-GR	1411-1499	88
E-1	4200-5460	ITT-GR/ITT-GR	1243-1627	384
E-2	4210-5270	ITT-GR/ITT-GR	1246-1569	323
E-3	no evaluation			
G-1	3885-5330	ITT-GR/ITT-GR	1147-1587	440
H-1	4364-5255	ITT-GR/ITT-GR	1293-1565	272
I-1	4928-5515	ITT-GR/ITT-GR	1465-1644	179
M-1	4015-4900	ITT-GR/ITT-GR	1190-1460	270
M-2	4070-4980	ITT-GR/ITT-GR	1209-1487	278
M-8	4028-4940	ITT-GR/ITT-GR	1198-1476	278
N-1	4633-5480	ITT-GR/ITT-GR	1380-1638	258
N-2	4570-5340	ITT-GR/ITT-GR	1362-1596	234
O-1	4087-4945	ITT-GR/ITT-GR	1218-1479	261
P-1	4895-5490	ITT-GR/ITT-GR	1454-1636	182
Q-1	4997-6140	ITT-GR/ITT-GR	1485-1834	349
Ruth-1	3978-4658	ITT-GR/ITT-GR	1177-1385	208
T-1	4660-5397	ITT-GR/ITT-GR	1395-1620	225
U-1	4870-5870	ITT-GR/ITT-GR	1456-1761	305
V-1	3860-5553	ITT-GR/ITT-GR	1143-1659	516
W-1	5050-5600	ITT-GR/ITT-GR	1505-1673	168

CEN-5 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	1600-4040	ITT-GR/ITT-GR	478-1222	744
A-2	1675-4134	ITT-GR/ITT-GR	475-1224	749
Adda-1	1580-3893	ITT-GR/ITT-GR	447-1152	705
B-1	?2430-4745	ITT-GR/ITT-GR	?705-1411	706
E-1	1695-4200	ITT-GR/ITT-GR	479-1243	764
E-2	1820-4210	ITT-GR/ITT-GR	518-1246	728
E-3	no evaluation			
G-1	1480-3885	ITT-GR/ITT-GR	414-1147	733
H-1	1942-4364	ITT-GR/ITT-GR	555-1293	738
I-1	1901-4928	ITT-GR/ITT-GR	542-1465	923
M-1	1585-4015	ITT-GR/ITT-GR	450-1190	740
M-2	1630-4070	ITT-GR/ITT-GR	466-1209	743
M-8	1598-4028	ITT-GR/ITT-GR	458-1198	740
N-1	2028-4633	ITT-GR/ITT-GR	586-1380	794
N-2	2095-4570	ITT-GR/ITT-GR	607-1362	755
O-1	1453-4087	ITT-GR/ITT-GR	415-1218	803
P-1	2093-4895	ITT-GR/ITT-GR	600-1454	854
Q-1	2075-4997	ITT-GR/ITT-GR	595-1485	890
Ruth-1	1750-3978	ITT-GR/ITT-GR	498-1177	679
T-1	1720-4660	ITT-GR/ITT-GR	499-1395	896
U-1	2073-4870	ITT-GR/ITT-GR	604-1456	852
V-1	1340-3860	ITT-GR/ITT-GR	375-1143	768
W-1	1944-5050	ITT-GR/ITT-GR	558-1505	947

CEN-6 Unit

Well	Depth b.KB (feet)	Log (characterizing)	Depth b.MSL (m)	Thickness (m)
A-1	177 - 1600	ITT-GR/ITT-GR	45 - 478	433
A-2	263 - 1675	ITT-GR/ITT-GR	44 - 475	431
Adda-1	237 - 1580	ITT-GR/ITT-GR	38 - 447	409
B-1	252 -?2430	ITT-GR/ITT-GR	41 -?705	664
E-1	245 - 1695	ITT-GR/ITT-GR	37 - 479	442
E-2	256 - 1820	ITT-GR/ITT-GR	41 - 518	477
E-3	no evaluation			
G-1	282 - 1480	ITT-GR/ITT-GR	49 - 414	365
H-1	274 - 1942	ITT-GR/ITT-GR	46 - 555	509
I-1	310 - 1901	ITT-GR/ITT-GR	57 - 542	485
M-1	250 - 1585	ITT-GR/ITT-GR	43 - 450	407
M-2	236 - 1630	ITT-GR/ITT-GR	41 - 466	425
M-8	237 - 1598	ITT-GR/ITT-GR	43 - 458	415
N-1	234 - 2028	ITT-GR/ITT-GR	39 - 586	547
N-2	223 - 2095	ITT-GR/ITT-GR	37 - 607	570
O-1	233 - 1453	ITT-GR/ITT-GR	43 - 415	372
P-1	339 - 2093	ITT-GR/ITT-GR	66 - 600	534
Q-1	321 - 2075	ITT-GR/ITT-GR	60 - 595	535
Ruth-1	243 - 1750	ITT-GR/ITT-GR	39 - 498	459
T-1	298 - 1720	ITT-GR/ITT-GR	66 - 499	433
U-1	235 - 2073	ITT-GR/ITT-GR	43 - 604	561
V-1	271 - 1340	ITT-GR/ITT-GR	49 - 375	326
W-1	285 - 1944	ITT-GR/ITT-GR	53 - 558	555

9.0 Tables on reservoir parameters

Recorded and calculated values of the reservoir properties.

Reservoir Parameters for: CA-1 Unit (Early Carboniferous)

Well Name	Depth b. KB	Depth b. MSL	Thickn.	Unit no.	Shows	Net.res. zone	Log type	Porosity %						Permeability MD				Test Type
								log			core			core			test	
	FT	M	M			M		Ømax	Ømin	Ø̄	Ømax	Ømin	Ø̄	Kmax	Kmin	K̄	K	
P-1	11038-11259	3327-3394	67			14		15	5	11								

Reservoir Parameters for: Rotliegendes Group

Well Name	Depth b. KB	Depth b. MSL	Thickn.	Unit no.	Shows	Net.res. zone	Log type	Porosity %						Permeability MD				Test Type
								log			core			core			test	
	FT	M	M			M		Ømax	Ømin	Ø̄	Ømax	Ømin	Ø̄	Kmax	Kmin	K̄	K	
B-1	11283-TD11985	3404-3618	214+			0												
P-1	10350-11038	3119-3327	208			20.5	FDC/CNL	10	2	5								
W-1	13888-TD14375	4196-4345	149+			0												

Reservoir parameters for: Zechstein Group

Well Name	Depth b. KB	Depth b. MSL	Thickn.	Unit no.	Shows	Net.res. zone	Log type	Porosity %						Permeability MD				Test Type
								log			core			core			test	
	FT	M	M			M		Ømax	Ømin	Ø̄	Ømax	Ømin	Ø̄	Kmax	Kmin	K̄	K	
B-1	10190-11283	3009-3404	395			6		10	4	5								
Ruth-1	5586-TD5618	1668-1678	10+			0												
T-1	7690-TD8713	2319-2631	312+			0					4a	0.3a	1a	1a	0a	0a		

a) Non res. zone

Reservoir parametres for: Bacton Group

Well Name	Depth b. KB	Depth b. MSL	Thickn.	Unit no.	Shows	Net.res. zone	Log type	Porosity %						Permeability MD				Test Type
								log			core			core			test	
	FT	M	M			M		Ømax	Ømin	Ø̄	Ømax	Ømin	Ø̄	Kmax	Kmin	K̄	K	
B-1	9990-10190	3009-3060	51			0												
Q-1	13910-14620	4203-4420	217		+	a												
U-1	14651-TD16045	4437-4862	425+			43b	FDC/CNL	11	8	10								
						8c		21	14	17								

a) Very thin. Very poor data
b) Bunter Sandstone Formation
c) Bunter Shale Formation

Reservoir parameters for: J-2 Unit

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
Upper Member																		
A-2	9920-9970	2988-3003	15			?												
M-8	10143-10260	3062-3098	36			0												
O-1	8901-9425	2685-2845	160			39	FDC/CNL	27	15	25								
U-1	10665-10853	3222-3280	58			0												
Lower Member																		
A-2	9970-10050	3003-3027	24		+	?												
M-8	10260-10467	3098-3161	37		+	3	FDC/CNL	21	18	19							?	FT
O-1	9425-9838	2845-2971	126			9	FDC/CNL	25	18	20								
U-1	10853-11048	3280-3339	41		+	27	FDC/CNL	30	15	20							3	FT

Reservoir parameters for: W-1 Unit

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
W-1	13521-13839	4087-4184	97			67	FDC	14	6	11							?	FIT

Reservoir parameters for: J-3 Unit

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
A-2	- 9920				+	?												
G-1	12037-TD12517	3632-3778	146+		+	?												
M-8	8940-10143	2695-3062	367			0?												
O-1	- 8901	-2685				?												
U-1	9595-10665	2896-3222	326			0	FDC/CNL			19								
V-1	?10601-12080	?3198-3648	?450			?												

Reservoir Parameters for: J-4 Unit

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
A-2	7470-?				+	? a)												
Adda-1	8400-TD10005	2526-3015	489+		+	13 22	FDC/CNL	20	14	18								
E-1	9727-TD13403	2928-4048	1120+		+	38 62											0	DST
G-1	8088-12037	2429-3632	1204		+	89 134	ITT	18	4	11								
I-1	11018-TD12848	3321-3879	558+			21 35	ITT	13	3	7								
M-1	7190-TD7574	2158-2275	117+			?												
M-8	7517- 8940	2262-2695	433			16 26												
O-1	?					?												
Q-1	?					?												
U-1	8190- 9595	2468-2896	428		+	27 44	FDC/CNL	19	13	18								
V-1	9462-10601?	2851-3198?	?347			4 7												
W-1	12333-13521	3725-4087	362		+	7 11	FDC/CNL	8	4	5								

a) Numbers of dolostone stringers

Reservoir parameters for: LC-1 Unit

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
V-1	8972-9462	2702-2851	149		+	62	CNL	36	3	22								

Reservoir parameters for: Valhall Formation

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
A-2	7260- 7470	2177-2241	64			?												
Adda-1	7530- 8400	2262-2526	264		+	22	FDC/CNL	36	24	28							8.55 87a mDft	PT
E-1	8297- 9727	2492-2928	436		+	7	FDC	24	7	19							0	DST FT
E-3	8350-TD8722	2515-2628	113+			38	FDC/CNL	34	19	25	28	17	24					
G-1	7410- 8088	2222-2429	207			16	ITT			17								
I-1	9508-11018	2862-3321	459		+	11	?			27								
M-1	6902- 7190	2071-2159	88			5	ITT	31	13	26								
M-7	8934-TD9070	2691-3733	42+			0				?								
M-8	7280- 7517	2190-2262	72			0				?								
O-1	7580-?	2283-?				?												
Q-1	?																	
U-1	8112- 8190	2445-2468	23		+	7	FDC/CNL	30	13	23								
V-1	8937- 8972	2691-2702	12			9	FDC/CNL	25	9	20								

a) Prod. test 5, test after acid

Reservoir parameters for: Rødby Formation

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	core K̄	test K	Test Type
A-2	7240-7260	2171-2177	6			?												
Adda-1	7512-7530	2256-2262	6			?	FDC/CNL	38	21	29								
E-1	8162-8297	2451-2492	41		+	?	FDC	36	15	23							none flow	DST
E-3	8305-8350	2502-2515	13			?	FDC/CNL	35	20	26			18					
I-1	9355-9508	2815-2862	47			?	FDC	27	13	20								
M-1	6858-6902	2057-2071	14			?	FDC	21	11	16								
M-8	7212-7280	2169-2190	21			?	FDC/CNL	40	13	27								
O-1	7570-7580	2280-2283	3			?	ITT											
Q-1	?																	
W-1	?																	

Reservoir parameters for: Chalk Group

Well Name	Depth b. KB FT	Depth b. MSL M	Thickn. M	Unit no.	Shows	Net.res. zone M	Log type	Porosity % log Ømax	log Ømin	log Ø̄	core Ømax	core Ømin	core Ø̄	Permeability MD core Kmax	core Kmin	K̄	test K	Test Type
A-2	5952-6015	1778-1797	19	6 U	+	19	ITTa	38	27	35	38	12	28	4	0	0.1	66-166	DST
A-2	6015-6125	1797-1831	34	6 L	+	34	ITTa	35	22	31	35	12	22	5	0	0	2-28	DST
A-2	6125-6262	1831-1873	42	5	+	42	ITTa	33	29	30							3	DST
A-2	6262-6650	1873-1991	118	4	+	118	ITTa	30	23	27								
Adda-1	6866-6959	2059-2087	28	6 U	+	28	FDC/CNL/ ITT	40	28	37								
Adda-1	6959-7040	2087-2112	25	6 L		25	”	34	22	28								
Adda-1	7040-7063	2112-2119	7	5	+	7	”	35	26	29							1	FT
Adda-1	7063-7138	2119-2142	23	3	+	23	”	27	16	22								
Adda-1	7138-7420	2142-2227	85	2	+	85	”	35	18	24							103, 51	SF, FT
Adda-1	7240-7512	2227-2556	28	1	+	28	”	28	16	21								
E-1	6735-6810	2016-2039	23	6 U	+	23	ITT	36	32	34	39	16	36	5	0.2	2		DST, FT
E-1	6810-6880	2039-2060	21	6 L	+	21	ITT	32	22	29	37	12	30	2	0.03	1		DST, FT
E-1	6880-7072	2060-2118	58	5	+	58	ITT	37	27	31	33	25	30	5	2	3		DST
E-1	7072-7325	2118-2195	77	4	+	77	ITT	31	21	27								
E-1	7325-7500	2195-2249	54	3	+	54	ITT	24	16	20								
E-1	7500-8115	2249-2436	187	2	+	187	ITT	28	17	22								
E1	8115-8162	2436-2451	14	1	+	14	ITT	18	16	18								DST
G-1	6610-6675	1978-1997	19	6 U	+	19	ITT/GR	37	33	36	38	25	36	2	0.13	1	0.45	DST
G-1	6675-6790	1997-2032	35	6 L	+	35	ITT/GR	34	20	29	39	20	30	2	0.03	0.3	0.07	DST
G-1	6790-6830	2032-2045	13	5	+	13	ITT/GR	32	23	29								DST
G-1	6830- 6875	2045-2058	13	4	+	13	ITT/GR	25	20	23								
G-1	6875- 7120	2058-2133	75	3	+	75	ITT/GR	22	19	21								
G-1	7120- 7410	2133-2222	89	2	+	89	ITT/GR	27	23	25								
H-1	6680- 6713	1999-2009	10	6 b	+	10	FDC	49	42	46	46	40	43	12	1	3		DST
H-1	6713- 6981	2009-2091	82	5	+	82	FDC	49	22	36	46	32	39	17	3	7		DST
H-1	6981-TD7100	2091-2127	36+	4	+	36	FDC	29	18	24								
I-1	9070- 9138	2727-2748	21	6 U	+	21	ITT	33	26	30	32	15	29	1	0.05	0.3		DST
I-1	9138- 9182	2748-2761	13	6 L	+	13	ITT	28	9	24	28	5	17	0.23	0.01	0.05		DST
I-1	9182- 9241	2761-2779	18	5	+	18	ITT	32	21	28	24	18	20	1	0.01	0.1	30	DST
I-1	9241- 9355	2779-2814	35	4	+	35	ITT	28	18	25								
M-1	5902- 5962	1765-1784	19	6 U	+	19	ITT	42	36	39	42	23	35	6	0.02	2		
M-1	5962- 6032	1784-1805	21	6 L	+	21	ITT	42	31	34	37	17	27	3	0.01	0.2		
M-1	6032- 6118	1805-1831	26	5	+	26	ITT	42	35	40	45	25	35	10	2	5		
M-1	6118- 6471	1831-1939	108	4	+	108	ITT	34	31	32	33	20	27	9	0.3	2		FT
M-1	6471- 6590	1939-1975	36	3	+	36	ITT	33	31	31	27	21	24	4	1	2		FT
M-1	6590- 6858	1975-2057	82	2		82	ITT	31	29	30								
N-1	6897- 6918	2070-2076	6	6 U	+	6	ITT/GR	35	31	34	37	18	28	6	0.16	3		FT
N-1	6918- 6937	2076-2082	6	6 L	+	6	ITT/GR	33	25	30	?	?	27	0.35	0.18	0.26		FT
N-1	6937- 7147	2082-2146	64	5	+	64	ITT/GR	37	32	26	34	33	34	4	3	3		FT
N-1	7147- 7745	2146-2328	182	4	+	182	ITT/GR	32	25	28								
N-1	7745- 7904	2328-2377	49	3		49	ITT/GR	24	22	23								
N-1	7904-TD8155	2377-2453	76+	2		76	ITT/GR	24	22	23								
O-1	6097- 6180	1830-1856	26	6 U		26	CNL			27	32	19	25	2	0.01	0.05		
O-1	6180- 6254	1856-1878	22	6 L		22	CNL			25								
O-1	6254- 7187	1878-2163	285	5		285	CNL	28	25	26								
O-1	7187- 7349	2163-2212	49	4		49	CNL	23	21	22								
O-1	7349- 7408	2212-2230	18	3		18	CNL	22	21	21								
O-1	7408- 7500	2230-2258	28	2		28	CNL			21								
O-1	7500- 7580	2258-2282	24	1		24	CNL			21								
P-1	9580- 9745	2882-2932	50	6 U	+	50	ITT	39	33	37								
P-1	9745- 9818	2932-2955	23	6 L	+	23	ITT	35	33	33								
P-1	9818- 9865	2955-2969	14	5	+	14	ITT			35								
P-1	9865-10350	2969-3117	148	4	+	148	ITT	31	27	30								
Q-1	10058-10195	3028-3097	69	6 U	+	69	ITT	25	23	24	17	3	13	0.29	0.01	1		
Q-1	10195-10378	3097-3125	28	6 L	+	28	ITT	20	16	18								
Q-1	10378-10730	3125-3233	108	5		108	ITT	20	16	19								
Q-1	10730-11640	3233-3510	277	4		277	ITT	19	12	14								
Q-1	11640-12128	3510-3659	149	3		149	ITT	13	11	12								

Q-1	10378-10730	3125-3233	108	5		108	ITT	20	16	19								
Q-1	10730-11640	3233-3510	277	4		277	ITT	19	12	14								
Q-1	11640-12128	3510-3659	149	3		149	ITT	13	11	12								
Q-1	12128-13000	3659-3925	265	2		265	ITT	16	13	15								
T-1	7283- 7355	2195-2217	22	6 U	+	22	FDC/CNL	30	19	23	32	12	27	8	0.007	0.2		
T-1	7355- 7419	2217-2236	19	6 L	+	19	ITT	26	18	21	38	8	21	10	0.006	0.07		
T-1	7419- 7519	2236-2267	31	5	+	31	ITT	28	14	20	31	12	23	20	0.007	1		
T-1	7519- 7685	2267-2317	50	4	+	50	ITT	27	14	18	28	2	18	19	0.005	2	5	DST
U-1	7300- 7360	2197-2215	18	6 U	+	18	FDC/CNL	30	23	26								
U-1	7360- 7434	2215-2238	23	6 L	+	23	FDC/CNL	27	21	25								
U-1	7434- 7594	2238-2286	48	5	+	48	FDC/CNL	25	24	24								
U-1	7594- 7800	2286-2349	63	4	+	63	FDC/CNL	24	20	22								
U-1	7800- 7898	2349-2379	30	3	+	30	FDC/CNL	24	20	22								
U-1	7898- 8109	2379-2444	65	2	+	65	FDC/CNL	26	17	21								
V-1	7355- 7470	2208-2243	39	6 U	+	35	FDC/CNL	25	23	25								
V-1	7470- 7550	2243-2268	35	6 L	+	35	FDC/CNL	25	23	24								
V-1	7550- 7639	2268-2295	27	5	+	27	FDC/CNL	24	22	23								
V-1	7639- 8025	2295-2412	117	4	+	117	FDC/CNL	24	22	23								
V-1	8025- 8375	2412-2519	107	3	+	107	FDC/CNL	24	20	22								
V-1	8375- 8937	2519-2690	171	2	+	171	FDC/CNL	24	8	14								
W-1	10135-10249	3055-3090	35	6 U	+	35	FDC/CNL	13	12	12								
W-1	10249-10413	3090-3140	50	6 L	+	50	FDC/CNL	13	12	13								
W-1	10413-10695	3140-3226	86	5	+	86	FDC/CNL	17	11	13								
W-1	10695-11267	3226-3400	174	4	+	174	FDC/CNL	10	6	8								
W-1	11267-11782	3400-3557	157	3	+	157	FDC/CNL	8	4	5								
W-1	11782-12333	3557-3725	168	2	+	168	FDC/CNL	12	6	9								

a) No logs below 6650'. Base chalk at 7230' b. KB

b) Unit 6 cannot be subdivided

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