

EFP-95 project: Identification of sequence stratigraphic key surfaces and units

A study based on optical and geochemical parameters

J. Andsbjerg, J.A. Bojesen-Koefoed,
K. Dybkjær, T. Hoelstad and H.I. Petersen

ENS Journal no.: 1313/95-002



EFP-95 project:
Identification of sequence stratigraphic
key surfaces and units

A study based on optical and geochemical parameters

J. Andsbjerg, J. A. Bojesen-Koefoed,
K. Dybkjær, T. Hoelstad and H. I. Petersen

ENS Journal no.: 1313/95-002

Contents

Abstract	3
Introduction	3
Data and methods	4
Geochemical methods	4
Purpose	4
Petroleum source rocks and sequence stratigraphy	5
Methods	5
Results of geochemical methods	5
Results and discussion	5
Palynological methods	7
Size and shape of opaque organic matter	7
Background	7
Methods	8
Electronic image analysis	8
Image analysis sequence	8
Particle size and shape	10
Results of palynological methods	11
Jeppe-1	11
Elin-1	12
Conclusion	13
Mineralogical methods	14
Analytical procedure	14
Mineral identification	16
Quantification	17
Results of mineralogical methods	17
Selected methods applied to the Feda Graben and adjacent plateau areas	18
Selected wells	18
Correlations	18
Sequence stratigraphic units	18
Log expression of geochemical anomalies	19
Location of source rocks	20
Mapping of source rocks	20
Conclusions	21
Acknowledgements	22
References	22
Figure captions	26
Appendices	
Appendix 1: Results from the Geochemical analysis	
Appendix 2: Results from the Palynological analysis	
Appendix 3: Results from the Mineralogical analysis	

Abstract

A number of optical and geochemical methods have been tested with respect to their applicability in locating sequence stratigraphic key-surfaces and units. The study was made solely on ditch cuttings samples from a number of wells from the Danish Central Graben (Jeppe-1, Gert-2, Gwen-2, Rita-1, Elin-1). The tested methods comprise geochemistry (mainly TOC and HI), palynology (size and shape of opaque phytoclast particles), and mineralogy (bulk mineralogy (including clay/quartz ratio), clay mineralogy, grain size, total carbon, total organic carbon and sulphur). The results showed that the tested methods can, to varying degrees, be used to support a sequence stratigraphic subdivision primarily based on well log patterns. None of the tested methods has proven to be reliable sequence stratigraphic indicators unsupported by other methods, when used on cuttings samples. The main problems in using ditch cuttings samples is the low sampling density and the quality of the samples.

Of the tested methods the size of opaque phytoclasts seems to be the best method to point out sequence stratigraphic surfaces and units, while the shape of these particles and the clay/quartz-ratio seem to have some potential. The other mineralogical methods did not seem to vary in relation to the sequence stratigraphy.

Among the tested methods the TOC and HI-index proved useful for detailed basin-wide correlations in organic-rich intervals. Based on a combination of these results and the resistivity logs integrated into the sequence stratigraphic framework discrete source rocks could be identified and mapped. In the Feda Graben - Gertrud Graben area source rock intervals were identified in the Kimm-3, Kimm-4, Volg-1 and Volg-2 sequences. The source rocks extend from the Feda Graben southward to the area south of the Heno Plateau. They do not seem to be present in the Tail End Graben nor in the Salt Dome Province.

Introduction

The main purpose with sequence stratigraphy is to identify and correlate sequence stratigraphic surfaces and units and thus to be able to establish a detailed model of the 3-dimensional distribution of the sediments, especially potential reservoir-units and source-rocks. Such a model will enable the geologist to predict the possible location of e.g. potential reservoir-units in un-drilled areas and to evaluate the petroleum systems.

The sequence stratigraphic concept was defined in the 1960s and 1970s (e.g. Mitchum et al., 1977; Vail et al., 1977) based on the concepts from seismic stratigraphy. In the 1980s it was expanded to be applicable for well-data and outcrops as well (e.g. Vail et al., 1984; Posamentier and Vail, 1988; Posamentier et al., 1988; Van Wagoner et al., 1990). From wells and outcrops sequences has mainly been identified on the basis of lithology (in wells often from geophysical logs). Other types of data/methods such as geochemistry, palynofacies and biostratigraphy have, however, proved to be useful as well (e.g. Vail and Womardt, 1990; Gregory and Hart, 1992; Steffen and Gorin, 1993).

The aim of the present study was to test the applicability of a number of geochemical and optical methods to point out (or support) the location of sequence stratigraphic key-surfaces and systems tracts. These methods could then be of use in wells where the log-

patterns are of low quality, are missing or just not variable enough to allow a safe sequencestratigraphic subdivision based on log-patterns alone. We decided that the basic material for testing these methods should be cuttings samples as that is the only material available from most intervals in North Sea wells. During the study it became clear that the combination of certain geochemical methods and well log based sequence stratigraphy had a high potential for identifying and mapping source rocks on a very detailed scale. This combination of methods has been investigated further during the study.

Data and methods

The investigated succession is the Upper Jurassic Farsund Formation. The medium to dark grey claystones of the Farsund Formation were deposited from suspension in a low energy environment, probably under open marine conditions (Jensen et al., 1986). The wells chosen for this study comprise Jeppe-1, Elin-1, Gwen-2, Gert-2 and Rita-1 (figure 1). These wells were chosen because there has been established a relatively detailed sequence stratigraphic subdivision in these wells on the basis of geophysical log-patterns combined with biostratigraphic data (Andsbjerg and Dybkjær, 1997). The sample material was ditch cuttings samples. It should be kept in mind that every ditch cuttings sample represents an interval (e.g. in Jeppe-1 of 2.5m) of which the lowest depth is referred to in the text. In a few occasions only minor amounts of sample material (ditch cuttings) was available. Therefore, in order to test the different methods on the same sample, we had to amalgamate two ditch cuttings samples into composite samples (see appendices 1-2). When the TOC and HI-index were plotted against the geophysical logs, it was obvious due to the striking similarity between TOC-plots and resistivity log pattern that the sample-depths of the ditch cuttings samples and the log-depths did not match. For example are the depth of the ditch cuttings samples in Elin-1 (as indicated in Appendix 2) about 7ft less than the log-depth. Therefore it was necessary to adjust the location of the ditch cuttings samples in all figures and enclosures, where sample results are plotted with well logs.

A number of geochemical, palynological and mineralogical methods were tested. Analyses of samples for geochemistry and palynology was performed at GEUS. Mineralogical analyses were made at Geological Institute, Aarhus University.

Geochemical methods

Purpose

The purpose of the geochemical study is to test the relationship between sequence stratigraphy and selected geochemical methods, primarily TOC and HI; correlability between TOC/HI-curves and well log patterns; and the use of the combination of TOC/HI-curves and well logs in a sequence stratigraphic framework to identify and map discrete source rocks.

Petroleum source rocks and sequence stratigraphy

Available literature on source rock deposition in a sequence stratigraphic framework is comparatively limited. For an overview, the reader is referred to Curiale et al. (1992), Creaney and Passey (1993), Bessereau et al. (1995), Tyson (1996) and to papers in Katz and Pratt (1993). Consensus exists that the occurrence of petroleum source rocks is predictable within a sequence stratigraphic framework. Creaney & Passey (1993) recognized a recurring pattern of "high TOC at base" units (HTB's), which may occur isolated, stacked or more or less coalesced, and establish a comparatively simple model for development of source rocks, assuming constant oxygen levels in deep water settings. According to the model, source rock units may be developed within the low stand wedge or/and below and/or within the condensed section which includes the maximum flooding surface (MFS). The stacking pattern of the HTB's will depend on the position within the transgressive systems tract. Isolated HTB's are found at comparatively landward settings, stacked HTB's occur further basinwards, and coalesced HTB's forming a "high TOC in the middle" pattern in extreme basinward settings. This is probably an oversimplification, since the best source rocks are not necessarily to be found in the unit which includes the MFS or the unit usually showing the highest GR-response on the log. The best source rocks may be associated with the transgressive systems tract, but Pasley et al. (1993) state that the best source rock are likely to be found below the MFS, rather than within the condensed section. Conversely, Curiale et al. (1992) maintain that sometimes the best source rocks are found in the high stand wedge above the MFS. Thus, the Creaney and Passey model may not be universally applicable, and the assumption of permanent deep basin dysoxia/anoxia as a prerequisite for source rock development is questionable (see discussion in Tyson 1996).

Methods

Rock-Eval/TOC screening pyrolysis was carried out in accordance with the guidelines published by Espitalié et al. (1985) and Bordenave et al. (1993), using analysis cycle 1. Samples used were principally bagged or canned drill cuttings, although a few conventional core samples were analysed as well (appendix 1). Drilling mud was removed from bagged or canned cutting samples by rinsing with lukewarm water on a 63µm brass sieve. Rinsed samples were dried at 60°C/24h, and the 1-4 mm fractions were collected for analysis. Occasionally, parallel sets of raw and solvent-extracted samples were analysed (appendix 1).

Results of geochemical methods

Results and discussion

The investigations reported herein have been focused on three well-defined sequences, the Kimm-3, the Kimm-4, and the Volg-1 (Andsbjerg & Dybkjær, 1997). The development of these sequences has been studied in four wells inferred to be positioned along a depositional proximal – distal trend. The four wells are (from proximal to distal): the Gwen-2, the Jeppe-1, the Gert-2 and the Rita-1 wells (figure 2, enclosure 1).

Based on common conceptions regarding source rock quality in relation to depositional environment, both organic richness (as defined by TOC) and "oil-proneness" (as defined by the Hydrogen Index or S2 pyrolysis yields) are expected to increase from proximal to distal settings.

Plots of the assumed relative position of the four wells along a proximal–distal trend versus average TOC show regular increases in TOC for both the Volg-1 and Kimm-3 sequences, whereas a somewhat irregular, overall increasing trend is observed for the Kimm-4 sequence (figure 3).

A similar development is observed for the Hydrogen Index, although the trends are somewhat irregular for all sequences (figure 4). However, this can to some extent be explained by differences in the level of thermal maturity, since the Hydrogen Index will decrease with increasing maturity, whereas TOC initially will be only marginally affected. In general terms, the relative level of thermal maturity of the deposits of the sequences decreases from the Gwen-2 well to the Jeppe-1 well, further to the Rita-1 well, and to the Gert-2 well. Hence, of the two "distal" wells, Gert-2 and Rita-1, the latter is the more mature, which to some extent may explain the lower average HI in the Rita-1 well, compared to the Gert-2 well (figure 5). However, see also discussion below.

Significant variations in both source richness and quality are observed through the three sequences in the four wells (figure 2, enclosure 1). This is particularly true in the Volg-1 sequence of the Gert-2 well, and, to a lesser extent also, the Rita-1 well, where a notable increase in both organic richness and source potential is evident from the SB towards the MFS, immediately below which the development culminates. The level of thermal maturity of the Volg-1 sequence deposits in the Gert-2 well is insufficient for generation of significant amounts of petroleum, and the observed variation may thus be used to trace changes in type of organic matter input with rising relative sea-level, i.e. through the LST and TST towards the MFS. Figure 6 shows plots of TOC versus Hydrogen Index for the three sequences in the four wells. Changes in original organic matter input with rising relative sea-level are illustrated by the data from the Volg-1 sequence in the Gert-2 well. Up to TOC values of approximately 5% covariance between TOC and HI is evident, whereas at higher values of TOC, the increase in HI tends to level off at values of 600–700. Bearing in mind the low thermal maturity, and the development shown on the log panels, this can be interpreted in terms of input of increasing proportions of marine organic matter to the sediments with rising relative sea level, until the deposits receive more or less exclusively marine algal organic matter with an initial Hydrogen Index in the range 600–700 (see also Creaney & Passey, 1993 and Langford & Blanc-Valleron, 1990). A similar trend is hinted by the data from the Rita-1 well, although somewhat obscured by higher thermal maturity. The deposits in the "proximal" wells (i.e. wells situated relatively landwards) Gwen-2 and Jeppe-1, never received pure marine algal organic matter. This pattern is less clear in the Kimm-4 and Kimm-3 sequences, probably due to a combination of higher overall thermal maturity, and, more importantly, differences in detailed sequence development. In the Kimm-4 sequence the best petroleum source rocks are found above the MFS, whereas in the Kimm-3 sequence they are found below the MFS. However, in neither case, the "best source rocks" are very well defined, nor is the log-pattern particularly clear.

Changes in organic facies along a proximal–distal trend is described above, but the observations can be further substantiated by scrutiny of the full data set (as opposed to

average values) by means of plots of TOC versus S₂ pyrolysis yields (figure 7). The slope of the linear best-fit lines in the plots represent average Hydrogen Indices of the sequences (as an alternative to simple arithmetic Hydrogen Indices ($= 100 \cdot S_2 / TOC$), this method probably provides a more correct indication of the kerogen quality, see also Dahl et al. (submitted). Overall decrease in slopes of the best fit lines from the Volg-1 to the Kimm-3 sequence in all wells is probably in part an indication of increasing thermal maturity with depth, but an effect of organic facies changes is probably present as well. Lateral facies variations are evident from the observed increase in slope of the best-fit lines going from proximal wells (Gwen-2, Jeppe-1), to distal wells (Rita-1, Gert-2). The slopes of the best-fit lines observed for all three sequences in the Gert-2 and Rita-1 wells are largely identical, pointing to similarity in composition of the generative portions of the kerogen. However, the interceptions of the best fit lines and the TOC axis for all three sequences are at a slightly higher level of TOC in the Rita-1 well than in the Gert-2 well, pointing to an initial higher proportions of thermally non-reactive "dead carbon" in the Rita-1 well kerogen, leading to decreased arithmetic HI. This observation may be interpreted in terms of a slightly different depositional regime, involving higher input of reworked and/or inertinitic organic matter.

Palynological methods

Size and shape of opaque organic matter

The purpose of this study is to analyse the size and the shape of the particulate opaque organic matter (the phytoclasts), to compare the results against interpretations of sea level changes and to evaluate the applicability of the method in identifying sequence stratigraphic key surfaces and systems tracts.

Background

The change from lowstand to transgressive and further to highstand system tracts corresponds to a proximal to distal to proximal shift in facies with respect to the siliciclastic sediment source(s). Such changes in terrestrial influence must be expected to be reflected in the palynofacies assemblages and therefore also in the size and shape distributions of particulate opaque organic matter.

The size and shape of particulate opaque matter, based on its appearance in palynological preparations, have previously been recorded and described by a.o. Parry et al. (1981) (Middle Jurassic deltas), Whitaker (1984) (Upper Jurassic marine shales), Gorin & Steffen (1991) (Lower Cretaceous carbonates), Oboh (1992) (Miocene muds and sands), Hoelstad et al., (1994) (Upper Carboniferous lacustrine sediments). The hydrodynamic behaviour of opaque organic matter is comparable to that of inorganic sedimentary particles (Odum et al., 1979), however, sedimentation of organic particles is complex and is dependant on supply, density, origin, morphology, preservation, size and shape (Spicer, 1989; Tyson, 1995). Opaque organic matter originates from charcoal, recycled coal and thermally altered or oxidised plant tissues (Tyson, 1995, pp. 159-162). The distribution of opaque organic matter in various depositional settings have been discussed by e.g.

Manum and Trondsen (1978), Fisher (1980), Barnard and Cooper (1981), Batten (1982), Hoelstad et al. (1994), Habib and Miller (1989), Oboh (1992) and Tyson (1995). These studies indicate that the deposition and the distribution-patterns of organic particles is much more complicated than that of siliciclastic particles. The sorting effects are more complicated, the sources are often multiple and there are distinct seasonal differences in the rates of supply, transport and degradative processing of the different phytoclast types. However, there seem to be some general trends that can be used as indicators of progradation/retrogradation in a marine setting, and thus, with some caution and regional knowledge, to indicate sea-level fluctuations. Figure 8 summarises the "life cycle" of particulate opaque matter.

Methods

Variations in size and shape of opaque wood particles (phytoclasts) have been studied using electronic image analysis. This method was tested in two wells: Jeppe-1 and Elin-1. The results are presented in appendix 2 and are plotted against geophysical logs and geochemical parameters (TOC and HI) in enclosures 2 and 6.

Sampling was made so that series of samples covered intervals that previously were interpreted in a sequence stratigraphic context. In this way well-defined sequence boundaries, maximum flooding surfaces and early and late transgressive and highstand systems tracts is represented in order to test if and how the palynofacies-assemblages change at these surfaces and thus reflect changes in sea-level.

Electronic image analysis

The image analysis system adopted is the IBAS 2 (manufacturer Kontron Bildanalyse GmbH). The IBAS image analysis is a two-processor system with a serial microcomputer as the control unit and an array processor as the image-handling unit. The image handling unit consists of a 2 Mb image memory (VMB), a memory address controller (MAC) and a 10 MIPS microprogrammable array processor (MIAP).

The image analysis configuration is shown in figure 9. The analogous signal generated in the TV-scanner (Bosch) mounted on the microscope (Zeiss universal) is digitized in the analog/digital (A/D) converter and stored in the VMB with a resolution of 512 x 512 pixels and a 8 bit grey value resolution (256 grey values, 0 =black and 255 = white). The stored images can be displayed on a conventional monitor via the D/A converter. The image manipulation is carried out by microprogram orders and microprogram sequences selected from the control computer. The programming is menu-oriented and is controlled via the keyboard and/or the digitizer tablet. The microscope is equipped with a motorised scanning table, a light intensity based autofocus unit and a feedback light control unit.

Image analysis sequence

The image analysis sequence can be subdivided into four main routines. These are calibration, enhancement and segmentation, particle selection and measuring (figure 10).

Before an analysis is initiated, the system must be calibrated. The various buffers are cleared and the appropriate micrometer to pixel conversion factor is selected. For the X10

objective used in the present investigation, the conversion factor is 1.195 micrometer/pixel. The sample is then labelled using the preparation and slide identification code. A measuring frame is introduced in order to achieve unbiased size fraction representation. The microscope-scanning table is set to a pre-defined position - the position of origin (0,0,0) - chosen as the upper right corner of the cover glass. The scanning table is then moved to the first field of view in the meanderpath and the autofocus is initialised.

Three images of the actual field of view are digitised and stored and the average image is computed. This is done to reduce the effect of TV-scanner artefacts (noise). Because microscopes in general do not produce evenly illuminated fields of view, an electronic illumination correction (shading) is necessary. A prerequisite for this correction is knowledge about the grey value distribution of the entire background. This is accomplished by recording an empty field of view. Dividing the original image by this empty field image and multiplying with a fixed value results in grey values in the vicinity of the fixed value for the entire background. The next step is to define a suitable grey value range, which includes all the darkest particles. The interval grey value 0 to grey value 50 omits none of the desired particles. The segmentation converts the background grey values to black (grey value 0) but leaves the particle grey values (0-50) intact. In order to increase the contrast the grey values are linearly transformed to occupy the entire grey level range (0-255). It is now possible to carry out the final segmentation, which leads to the binary image. The reasons for the linear transformation of the grey value histogram are that the absolute threshold setting becomes less sensitive and that elimination of stray light or edge effects becomes possible. A rank order filter is applied to the binary image in order to smooth particle edges, thus emphasising the overall shape characteristics and eliminating small edge irregularities. The rank order filter employs a 3 x 3 matrix and at every position the central pixel is exchanged for the pixel with the seventh highest value. In a binary image this means that besides being smoothed the particle areas increase. The filter is chosen in that way to compensate for the area loss caused by edge effects in the segmentation process.

The binary image is the basis for the measurement, but each particle must be defined as an entity. This involves the use of a connectivity rule, which states that all image object pixels are connected in eight directions whereas background pixels are connected in four directions only. In this way the individual particles are identified and in practice given separate grey values. The identification concerns all true black particles, although these consist of several different kerogen type fractions, e.g. superimposed palynomorphs, inertinite rich amorphous aggregates and aggregates of two or more melanogen particles. The irregularity or ruggedness of the particle circumference is used as a selection criterion. The relation of the convex perimeter (CP) to the actual perimeter (PE) expressed, as the ratio CP/PE is effective when sorting out true simple-shaped melanogen particles. A 0.85 threshold has been established empirically. Examples of various particle shapes and their ruggedness indices are given in Schwartz (1980) and on figure 11. Owing to the chosen objective (x10), measurements of particles less than 150 square micron will reflect resolution rather than textural characteristics and particles larger than 5000 square micron will seldom be entirely contained in the field of view. Thus only the area interval 150-5000 square micron is considered. The ruggedness and area criteria are implemented via a measurement procedure, which eliminates the particles not fulfilling either of the criteria.

The final steps of the image analysis sequence are definition of the measuring parameters (2 shape indices and the area), the actual measurement, the data storage and the data treatment.

Particle size and shape

Textural characteristics of opaque organic matter in palynological preparations are discussed in Hoelstad et al. (1994). Even though textural characteristics are best expressed in three dimensions, the two dimensional representation is useful due to the platy/bladed particle type. This type of particle predominantly settles with the short diameter perpendicular to the surface. Measurements in transmitted light thus are measurements of the maximum projected area. Seen from a hydraulic sorting point of view the area and the shape of this maximum projection may be of greater importance than the mere volume.

The sizes of the particle area projections are measured in square microns and shape indices are expressions of circularity ($PERI = 4\pi \cdot \text{area} / \text{perimeter}$, circle=1 all other shapes <0) and elongation ($ELLIP = \sqrt{b/a}$), where a (= "the long axis") and b (= "the intermediate axis") are the areal principal moments (Medalia, 1967; Schwartz, 1980). Elongation takes a value of unity for all equi-axial particles and values less than unity for all other shaped particles, the smallest values representing the longest particles. The population parameters (the statistics) which best characterise size and shape distributions cannot at the present be convincingly selected. In lack of better, the easy comprehensible mean and standard deviation are consequently used. The size distribution parameters are derived from 1) the logarithm representation (AREA-G-MEAN = geometric mean, STD-AREA-G = geometric standard deviation) and 2) the simple arithmetic representation (AREA-A-MEAN = the arithmetic mean, STD-AREA-A = arithmetic standard deviation) (appendix 2, enclosures 2 and 6).

Distribution of size and shape of opaque organic particles through a sedimentary section is complex reflecting source area characteristics, way of transport and the sedimentary environment. According to former studies the size and shape of such particles have the following potential for interpreting the depositional environment:

- 1) The particles tend to decrease in size with increasing distance from the source (delta front, flood mouth) (e.g. Barnard et al., 1981; Habib, 1982; Caratini et al., 1983, p.339; Whitaker, 1984; Gorin & Monteil, 1990)
- 2) The proportion of elongate ("blade-shaped") opaque particles increases in the more distal facies (Parry et al., 1982, p.11; Whitaker, 1984; Gorin & Steffen, 1991, p. 312; Oboh, 1992).

According to Tyson (1995) a high equant/lath shaped opaque phytoclast ratio indicate proximity to a fluvio-deltaic source area and a low transport distance (this especially applies where the equant particles are also the largest; if this is not true interpretation may be opposite). Furthermore Tyson concludes on the basis of literature studies and personal observations that the ratio of equant/lath shaped opaque phytoclasts is highest in the Early LST, it is high in the Late LST, it decreases within the TST and show the lowest values in the condensed section (at the maximum flooding surface), it is low in the Early HST and high in the Late HST.

Opaque organic particles are low-density particles (0.3 - 1.7 g/cm³ (Tyson, 1995)) which are transported by both wind and water. The particles settle relatively quickly in lakes as inferred from studies of similar particles originating from combustion of fossil fuels (Odgaard, 1993). On the continental shelf, which most likely is the case in the present study, the light opaque organic particles will most likely be suspended in the uppermost part of the water column (above wave-base). It is evident though, that a portion of the particles eventually will settle. It may be argued that the likelihood of sedimentation of the opaque organic particles increases with increasing water depth. It was demonstrated by Hoelstad et al. (1994) that the size of opaque organic particles is independent of the actual clastic textural characteristics, e.g. a silt lamina in a sandy interval contains larger organic particles compared to a similar silt lamina in a claystone interval. A probable conclusion is that time plays an important role. Assuming a more or less constant content of opaque organic particles suspended at any time in the water column, chances of sedimentation will be linked to prolonged calm bottom water conditions - a situation, which occurs more frequent with increasing water depth (figure 12). According to Stokes law, settling velocity is directly proportional to particle/fluid density difference, particle sphericity (regularity), particle size and inversely proportional to fluid density. Assuming sedimentation of opaque organic particles approximate Stokes law, the size and shape distribution will correlate with the length of time of calm water conditions. This means, that during short periods of calm water conditions only the largest and most regular (equant) shaped particles will settle (low sea level) whereas prolonged periods will allow smaller and irregular (lath) particles to settle too (high sea level).

Results of palynological methods

Jeppe-1

The samples from 4872m-4855m show a clear trend towards increased phytoclast grain-size, while the samples from 4855m-4835m show a clear decreasing grain-size trend (enclosure 2). The standard variation-values show the same trends as the grain-size (the lower the values the better sorting and *vice versa*). These variations corresponds very well with the interpreted location of a sequence boundary (SB Volg-1) at about 4862m, a high-stand systems tract (HST) below (here represented by the samples 4872m-4860m) and a transgressive systems tract (TST) above (here represented by the samples 4850m-4835m). The mean grain-size in the sample at 4840m is somewhat higher than the general trend. That may be due to a minor progradation/regressive trend within the otherwise transgressive period. The recorded variations in the equant:lath shaped ratio also support the location of a sequence boundary close to 4862m. The ratios in the samples from 4872m-4860m show a clear increasing trend, as would be expected for an interval representing a HST and the ratios in the samples from 4850m-4835m indicate a clear decreasing trend, as expected for an interval representing a TST. The low equant:lath shaped ratio in the sample at 4855m (close to the sequence boundary) differs from the general increasing-decreasing trend, but may reflect a flooding immediately above the sequence bound-

ary. The decrease in grain size, standard variation and in equant:lath shaped ratio in the interval from 4855m-4835m and the increasing trend from 4835m-4820m support the interpreted maximum flooding surface at about 4840m, the TST below and the HST above very well.

The next series of samples covers the interval from 4782m-4747m. The lowermost four samples (4782m-4765m) show a general trend towards increased grain-size, increased standard deviation and an increase in the equant:lath shaped ratio. The sample at 4770m show a distinctly lower equant:lath shaped ratio than what would be expected from the general trend. The samples from 4765m to 4747m show a decreasing trend in grain-size, standard deviation as well as equant:lath-shaped ratio. The uppermost sample in this series show an opposite trend, possibly reflecting a minor regressive event within this otherwise transgressive period. The observed main-trends correspond very well with the sequence stratigraphic interpretations of this succession, according to which the interval represented by the samples from 4782m-4770m represents a HST, a sequence boundary (SB Volg-2) is located at about 4769m and the interval 4765m-4747m is located within a TST.

The third series of samples covers the interval from 4705m-4642m. The lower part of this series (4705m-4660m) shows a clear trend towards a decreasing equant:lath shaped ratio while the grain-size and standard deviation show weakly decreasing to rather constant values. From the sample at 4660m to 4652m the equant:lath shaped ratio increases suddenly and then show a decreasing trend from sample 4652m to 4642m. In the three samples from 4652m to 4642m the mean grain-size values are slightly smaller than in the samples below and the standard deviation decreases. The weakly decreasing to constant grain sizes and the decreasing equant:lath shaped ratios in the interval from 4705m-4660m correspond very well with the interpreted TST; the logs also show a nearly aggrading trend. The changes from 4660m-4652m, across the interpreted MFS (MFS Volg-2) at about 4667m, towards smaller grainsize probably reflect a change towards more fine-grained sediments. The sudden change in equant:lath shaped ratios across the MFS may reflect an increased terrestrial input in the early HST.

According to the sequence stratigraphic interpretation the four samples from 4622m-4612m represent an early TST, but in an interval with several minor regressive and transgressive episodes, as can be seen from the log-patterns. The results from the four samples seem to reflect such minor episodes, showing no clear, general trends.

The uppermost series of samples in Jeppe-1 represents the interval from 4585m-4525m. Except for the lowermost sample (4585m) the grainsize decreases towards the interpreted MFS (MFS Volg-3) at about 4580m (4582m-4575m) and increases in the HST above it (4570m-4525m), as expected. The standard deviation shows a weakly increasing trend in the TST (4585m-4575m) and a strong increasing trend in the HST (4570m-4525m). The equant:lath shaped ratio generally shows the opposite trend than expected, with an increasing trend from 4582m-4575m and a decreasing trend from 4575m-4525m.

Elin-1

The lowermost series of samples represents the interval 15240ft-15135ft (enclosure 6). The samples from 15220ft-15160ft show an increasing trend in grainsize, followed by a decreasing trend from 15160ft to 15135ft. The equant:lath shaped ratio show a decreasing

trend through the interval from 15220ft-15135ft. The grainsize-variations seem to reflect the log-patterns, indicating a progradation from about 15220ft to 15150ft and a maximum flooding surface (MFS Volg-1) at about 15145ft. The overall decrease in the equant:lath shaped ratio and the decrease in grainsize from 15160ft to 15135ft support the location of a MFS at this level.

The next series of samples covers the interval from 14810ft to 14720ft. The lowermost three samples (14810ft-14740ft) show an increasing grainsize trend, followed by a decrease from 14740ft to 14720ft. The standard deviation shows a corresponding trend. The equant:lath shaped ratio does not show any clear trends in this interval. The increase in grainsize from 14810ft-14740ft and the following decrease from 14740ft to 14720ft correspond very well with the interpreted sequence boundary (SB Volg-2) at about 14750ft.

The next three samples (14660ft, 14490ft and 14300ft) has been taken with so large distance to the samples below, above and in-between them that they cannot be used to describe any trends, but must be seen as point-observations.

The uppermost series of samples (14015ft-13675ft) shows in the lower part (14015ft-13860ft) a decrease in grainsize (the geometric mean) as well as in equant:lath shaped ratio, while the standard deviation increases. From 13860ft to 13805ft a distinct further decrease in grainsize (and in standard deviation) occur. From 13805ft to 13715ft the grainsize and the standard deviation increase followed by a decrease from 13715ft to 13675ft. The equant:lath shaped ratio shows an increasing trend from 13805ft-13675ft. The observed gradual decrease in grainsize and in equant:lath shaped ratio from 14015ft to 13860ft and the distinct decrease in grainsize from 13860ft to 13805ft corresponds very well with the interpreted location of a MFS (MFS Volg-2) at about 13850ft. The increase in grainsize, standard deviation and in equant:lath shaped ratio from 13805ft to 13715ft followed by a decrease in grainsize from 13715ft to 13675ft correspond very well with the interpreted location of a sequence boundary (SB Volg-3) at about 13690ft.

Conclusion

Based on the results described above the following conclusions can be drawn:

- The variations in grainsize reflect changes in sea-level (as interpreted on the basis of geophysical logs) very well, and seem to be a useful method in pointing out sequence boundaries, maximum flooding surfaces and systems tracts. Based on the present study it is not possible to recommend either of the two alternatives used here to represent the mean grainsize (arithmetic mean and geometric mean); generally they show the same trends but on the few occasions where they show different trends, these are weak, and it is not possible to say which one is the best.
- The standard variation in most occasions showed the same trends as the grainsize and as expected. However, in a few occasions an opposite trend was observed.
- The shape-indices also generally seem useful, however, because of the small variation, it turned out to be less useful than the grainsize and in some occasions showed the opposite trends than expected. The elliptical mean seems to be more useful than the pe-

rimeter mean, as the former showed the largest variations (e.g. in the lowermost series of samples in Jeppe-1).

- It must be recommended to take as closely spaced samples as possible (preferably closer than in the present study) in order to achieve a better founded result.

Mineralogical methods

Mineralogical analysis was performed by O. Bjørslev, Geological Institute, University of Aarhus. From Elin-1 were 18 samples and from Jeppe-1 35 samples chosen for mineralogy. The methods used were:

- 1) Quantitative XRD-mineralogy of total rock samples (bulk Mineralogy)
- 2) Quantitative XRD-clay mineral analysis of $< 2 \mu\text{m}$ fractions.
- 3) The percentages of sand-sized-, silt-sized- and clay-sized particles.
- 4) Determination of Total Carbon, Total Organic Carbon (TOC) and Sulphur.

Some of the results originate as part of a cand. scient. project of Morten Zacho Jørgensen.

Analytical procedure

1) Total rock analysis

- a) dried samples were ground in a mortar and mounted in Al-slides
- b) X-ray diffraction is performed on power slides applying $\text{Cu K}\alpha 1-2$ - radiation ($\lambda = 1.5418 \text{ \AA}$) at 40 kV and 30 mA, $1.2^\circ/\text{min}$; 2θ : $2-65^\circ$.

2) Clay mineral analysis

- a) after thorough disintegration (ultrasonic and wettumbling) the samples were wetsieved through a $63 \mu\text{m}$ sieve.
- b) the $< 63 \mu\text{m}$ fraction was further split into two fractions, $2-63 \mu\text{m}$ and $< 2 \mu\text{m}$, by repeated decanting from an aqueous suspension
- c) the $< 2 \mu\text{m}$ fraction was concentrated in a centrifuge, and smeared onto glass-plates
- d) after drying at 20° the slide was X-rayed in the same manner as the total rock powder
- e) the slides were exposed to ethyleneglycol-vapour at 60° C for 72 hours and X-rayed from $2-28^\circ 2\theta$ at a scanning velocity of $1.2^\circ 2\theta$.
- f) the slides were heated to 500° C for 1 hour and X-rayed from $2-28^\circ 2\theta$.
- g) some of the samples were subject to stepwise heating for 1 hour, in steps of 25° C from 450 to 550° C , followed by XRD as described in f)
- h) for some of the samples, the $< 2 \mu\text{m}$ fractions were treated with MgCl_2 , KCL or NaCl and passed an analytical procedure as described in c)-g).

3) Grain-size analysis

The $> 63 \mu\text{m}$ fraction (the sand fraction) obtained in 2a) was weighed and expressed in weight % of the total sample-weight. The $63 \mu\text{m}$ fraction (the silt fraction) obtained in 2b) was weighed and expressed in weight% of the total sample-weight. The amount of the < 2

μm fraction (the clay fraction) was calculated by subtracting the sand- and silt-percentages from 100%. It was not possible to disintegrate the whole sample so that the sand fraction contains for all samples a substantial but varying amount of aggregates. It is therefore not possible to make any geological conclusions from these data. Anyway, the results are enclosed in tables 9 & 10 in appendix 3.

4) Determination of Total Carbon, Total Organic Carbon (TOC) and Sulphur.

Total C and TOC:

Equipment: Leco induction-furnace, HF-10.

Total C%: Approximately 0.25 g of the powder obtained in 1 a) is weighed in a special ceramic LECO crucible. 1 scoop Fe-accelerator and 1.5 scoop Cu-accelerator is added, and a lid placed on the crucible. The necessary amount of material may vary between ca. 0.0500-0.5000 g depending on the C-content. The crucible containing the sample is heated up to 1700° C in the LECO furnace in 7 minutes after proper calibration with standard samples. The generated CO₂ is collected, weighed and recalculated to weight% C of total sample. Two analyses are performed, and the average calculated. If the difference between the two results exceeds ca. 10%, a new set of analyses is performed.

TOC%: The C-content after HCl-treatment - (see below).

The content of C in the HCl-treated sample is determined in the same way as the Total C (see above) and recalculated to weight% of the original sample.

Removal of carbonate with diluted HCl:

Ca. 2 g powder, obtained in 1a), is weighed and suspended in a little demin. H₂O, and 20 ml 10% HCl is added. The suspension is left for ca. 16 hours and then heated to 80° C for 15 minutes. After cooling the suspension is centrifuged 3 times for 10 min. at 3000 revolutions per minute, with re-suspension in distilled water in between. The material is dried for 16 hours at 105° C, cooled, weighed and grounded in a mortar.

Sulphur-analysis:

Equipment: Leco sulphur-titrator model 532-500 combined to Leco induction-furnace, HF-10.

Approximately 0.25 g of the powder obtained in 1 a) is weighed in a special ceramic LECO crucible. 1 scoop Fe-accelerator and 1.5 scoop Lecocel-accelerator is added, and a lid placed on the crucible. The necessary amount of material may vary between 0.0500-0.5000 g depending on the S-content. The crucible containing the sample is heated in the LECO-furnace for 9 minutes after proper calibration with standard samples. The generated SO₂ is successively injected into the titrator, which is filled with a blue starch-potassiumiodide-solution. The SO₂ bleaches the blue colour in the titrator and an automatic photocell-controlled titration with KIO₃ is initiated in order to obtain the original blue colour. The amount of KIO₃ used for the titration is used for calculation of weight% S of total sample. Two analyses are performed, and the average calculated. If the difference between the two sets exceeds ca. 10%, a new set of analyses is performed.

Mineral identification

1) Total rock analysis

QUARTZ is identified by reflections at 3.33 Å (101) and 4.25 Å (100) and by a large number of well defined peaks.

FELDSPAR. Alkalifeldspar was not identified. Plagioclase is identified by the main reflection at 3.20 Å. Additional peaks are usually present.

CARBONATES. Calcite is identified by the main peak at 3.03 Å, and by a series of smaller but well defined reflections. Carbonates of variable composition are present and are defined by reflections at 2.88 and 2.79 Å. Reflections at 2.88-2.90 Å are referred to "mixed dolomite", while reflections at 2.79 Å are referred to siderite. Rhodocrosite is not present in any of the samples. The term mixed dolomite is used for carbonate minerals having crystal dimensions very close to that of dolomite. It is, however, not possible by this method to identify proper dolomite.

PYRITE is identified by reflections at 2.72, 2.42, and 1.63 Å and occasionally also by other less distinct reflections.

BARITE is identified by reflections at 3.44, 3.10 and 3.90 Å.

AMPHIBOLES have not been identified.

CLAY MINERALS are identified by reflections at 4.46, and 2.56 and approximately 1.5 Å. Basal reflections from illite/mica at 10 and 5 Å and from kaolinite at 7.2 and 3.6 Å are present.

2) Clay mineral analysis

ILLITE is identified by reflections at 10, 5 and 3.34 Å, and usually also other less distinct reflections, which do not react on glycollation and heating.

KAOLINITE is identified by sharp reflections at 7.2, 3.6, 2.38 and 1.78 Å, which strongly diminish by heating, but do not react on glycollation. That part of the peak, which remains after heating to 500° C, is believed to originate from a special more heat resistant kaolinite type, occurring in rocks, which have been subject to diagenetic alterations.

CHLORITE is identified by reflections at 14, 7, 4.75 and 3.5 Å. They do not react with ethyleneglycol, but disappear, except the 14 Å and occasionally the 3.5 Å reflection, on heating.

MIXED LAYER CLAY MINERALS are identified by a high background level in the low angle region (glycollated sample) and by a plateau between 10 and 14 Å. On the untreated samples, mixed layer minerals are seen as shoulders on the low-angle side of the 10 Å reflection. Heating leaves the chlorite peak at 14 Å unaffected, but creates a distinctly higher 10 Å reflection, indicating that the mixed structure is composed of illitic and smectitic elements without any distinct degree of ordering.

QUARTZ is identified by reflections at 3.33 Å (101) and 4.25 Å (100) and by a large number of well defined peaks.

PYRITE is defined by reflections at 2.72, 2.42, 2.21 and 1.63 Å.

CARBONATES are present and identified based on reflections at approximately the same positions as for the bulk samples.

Quantification

1) Total rock analysis

The quantification is based on measurements of the peak height for different reflections, one from each identified mineral. The height is multiplied by correction factors established through multiple experiments.

2) Clay mineral analysis

The quantification is based on measurements of the peak area in the glycollated diffractograms for basal reflections of clay minerals, one for each identified mineral. The area is multiplied by correction factors, and the corrected areas are summed up and recalculated to a sum of 100. The content is also calculated in percent of total sample.

The amount of mixed layer clay minerals is calculated using the area above the base line and between the 10 and 14 Å reflections on the glycollated diffractogram. A correction factor of 1 is used here although its magnitude is not documented properly by experiments. The increase in the 10 Å reflection on the heated diffractogram relative to that on the untreated diffractogram is also indicative for the magnitude of mixed layer illite/smectite.

Results of mineralogical methods

The results of the mineralogical investigation are shown in tables 1-8 in appendix 3. Bulk and clay-mineral results are also shown in figures 13-18. Heat treatments data are shown in figures 19-26. Grain size data and clay/quartz ratios from bulk-mineralogy are listed in tables 9-10 in appendix 3. Quartz/clay ratios are also presented in figures 27-28. The contents of sulphur, total carbon and total organic carbon (TOC) are listed in tables 11-12 in appendix 3. These tables also contain normative contents of pyrite and calcite. The tables are calculated by using all the sulphur for pyrite and all the non organic carbon for calcite. However, the figures have not been corrected for sulphur included in barite and for other carbonate minerals present.

In both Jeppe-1 and Elin-1 the mineral data varies slightly, but it is not very obvious that there is any variation with relation to the established sequence stratigraphic surfaces for most parameters. As the mineralogical composition comprises diagenetic and biogenic particles mixed with detrital ones it is believed that the ratio between the clay mineral content and the quartz content calculated from X-ray diffraction of the bulk samples represents the best measure of changes of the original detrital sediment input.

In some intervals the clay/quartz-ratio seem to reflect the lithology variations that are the basis for the sequence stratigraphic subdivision (e.g. Jeppe-1 4782m-4765m) with low ratios close to sequence boundaries and highest ratios at maximum flooding surfaces. However, it is difficult to relate the clay/quartz-ratio to other lithology indicators in sections characterized by high-frequency lithology-shifts (e.g. Jeppe-1 4872m-4835m), probably due to a too low sampling density.

The other mineralogical methods did not seem to relate to the sequence stratigraphic subdivision.

Selected methods applied to the Feda Graben and adjacent plateau areas

Selected wells

Four wells, Gwen-2, Jeppe-1, Gert-2 and Rita-1 (figures 1 and 2) were chosen as key wells in the Feda Graben - Gertrud Plateau area, with one or more of the testing methods being applied to each well. Furthermore the wells Gert-1, Gert-4 and N 2/12-1 (figure 1) were used to improve detailed correlations within the study area and organic geochemical data supported by logs from a large number of wells was used to trace the lateral extent of the identified source rock intervals.

Correlations

Correlations were based on gamma ray and resistivity logs supported by sonic logs and to a lesser degree density/neutron logs. Whereas the major lithology shifts and important sequence stratigraphic key-surfaces stand out well on the gamma ray logs a large number of subtle units can be discerned and correlated on the resistivity logs. Both the major units and their bounding key-surfaces and many of the more subtle units can be correlated throughout the southern part of the Feda Graben and across much of the Gertrud Plateau and Heno Plateau.

Sequence stratigraphic units

The sequences correlated in the present study were defined by Andsbjerg and Dybkjær (1997). In the study analysis and their results have been related to those sequences and their systems tracts. However, in the study of Andsbjerg and Dybkjær (1997) sequences were defined, that could be traced in all of the Danish Central Graben, although it was evident that some sequences locally could be further subdivided. This is clearly the case for several sequences in the wells of the Feda Graben, and it has to be taken into account when analysis results are related to the sequence stratigraphic framework (enclosure 1).

In the present study emphasis has been on the sequences Kimm-3, Kimm-4, Volg-1 and Volg-2. The lowermost sequence Kimm-3 is a complex sequence which can clearly be subdivided into several higher order sequences in the deeper wells of the Feda Graben. One, possibly two higher order sequences can be discerned in the sand- and siltstone dominated lower part of the sequence (Kimm-3A and -3B, 4458-4548 m in Rita-1 and 4779-4828 m in Gert-2; encl.). The upper part of Kimm-3 can be seen either as two separate higher order sequences (Kimm-3C and -3D in Rita-1) or as one higher order sequence with Kimm-3C of Rita-1 constituting a parasequence lowermost in the TST of the sequence (Gert-2) (enclosure 1).

The Kimm-4 sequence can be subdivided into three higher order sequences (Kimm-4A, -4B and -4C), although only two higher order sequences are easily discernible in the more condensed successions of wells Jeppe-1 and Gwen-2.

Whereas there is no reason to further subdivide sequence Volg-1, there is good reason to modify the Volg-2 sequence. A pronounced gamma ray peak sitting much lower in the sequence than the maximum flooding surface suggested by Andsbjerg and Dybkjær (1997) at 4344 m in Gert-2 and 4748 m in Jeppe-1 can be interpreted as the maximum flooding surface of the lower of two higher order sequences (Volg-2A and -2B) with the same spatial dimensions as the Kimm-3, Kimm-4 and Volg-1 sequences in the deeper parts of the basin.

In the absence of cores outside the sand intervals the sequence stratigraphic subdivision is completely based on the interpretation of log patterns. The underlying assumption is, that gamma log variations mainly reflect lithology changes, and that the lithology changes reflect relative sea-level changes. When relating changes in the organic content in the sediments and other geochemical parameters to the sequence stratigraphic framework it should be kept in mind that large variations in organic content may influence gamma log response. In the present study it has been attempted to get estimates of lithology variations from mud-logs and from clay - quartz analysis made specifically for the study on data from the Jeppe-1 well. Although the number of samples analysed for clay/quartz ratio are insufficient to test the relationship between lithology and gamma-log expression for all key surfaces, examples of such a relationship are present in the data from Jeppe-1. High clay/quartz ratios are found in the Volg-1 MFS and in the bed 8 metres below it shown to be a clean mudstone or shale by the gamma-log (enclosure 2). An increasing clay/quartz ratio is shown in the Volg-2 TST, coinciding with the increasing gamma ray values between 4770 and 4750 m, and relatively low, stable clay/quartz values are shown in the unit characterised by an aggradational pattern of relatively low gamma ray values between 4730 and 4680 m in Volg-2 (enclosure 2). The stacked parasequences with high gamma ray flooding surfaces between 4680 m and the MFS at 4580 m are characterised by strongly fluctuating clay/quartz ratios.

Log expression of geochemical anomalies

Results of geochemical, palynological and mineralogical investigation were plotted on log sheets with Gr, sonic and resistivity logs and with sequence stratigraphic key-surfaces marked (enclosures 2 - 6). Trends in the plotted values were compared with the log patterns considered typical for systems tracts, sequence boundaries and maximum flooding surfaces. Deviations from patterns considered normal were interpreted. In particular geochemical results showed a good correlation with well log patterns.

In the lower part of the Farsund Formation resistivity logs of wells in the study area show a characteristic high amplitude serrate pattern with significant shifts in log values, commonly occurring as distinctive peaks (enclosure 1 and figure 2). The resistivity log peaks match perfectly with plotted values of HI and in particular TOC. The characteristic pattern of bundled high amplitude resistivity peaks is primarily a result of frequent and significant changes of organic content in the sediments. Minute details of the characteristic resistivity patterns can be correlated from well to well in the study area, even to such a degree that missing sections due to faulting (Rita-1) or onlap (Gwen-2) are clearly disclosed (enclosure 1 and figure 2). The use of resistivity logs for source rock identification

has previously been suggested by several authors (i.e. Meyer & Nederlof, 1984; Rider, 1986; Passey et al., 1990; and Stocks & Lawrence, 1990), however, none of these authors showed the striking similarities between log resistivity patterns and laboratory derived TOC-values or used the resistivity logs for regional mapping of subtle source rock units.

Not all source rock intervals of the Jurassic in the Danish Central Graben show the relationship between resistivity values and source rock quality. The high resistivity values depend upon the presence of a certain amount of free oil in the pores of the claystones. Thus, only rocks that have attained a certain level of maturity can be expected to show this relationship. It is therefore important that laboratory derived TOC and HI values are available from representative wells.

Location of source rocks

The source rock units identified on resistivity logs in the lower part of the Farsund Formation in the Feda Graben Area occur concentrated in five 10 - 80 metres thick units, characterised by bundles of high frequency, high amplitude resistivity peaks (figure 2 and enclosure 1). The source rock units occur within the sequences Kimm-3 (HIK-3), Kimm-4 (HIK-4A, -4B), Volg-1 (HIV-1MF, -1A, -1B) and Volg-2 (HIV-2A). The names of the source rock units refer to hydrogen index (HI) and sequence name e.g. V-1 for Volg-1. In two of the four sequences, Kimm-4 and Volg-1, are the source rocks restricted to the highstand systems tract and the section close to the MFS. In the Kimm-3 (not present in Gwen-1) and Volg-2 (Gert-2 and Jeppe-1 only) sequences the source rocks are located within the TST. However, in the Kimm-4 sequence that part of the TST consists of progradational to aggradational parasequences with stacking characteristics more typically seen in a HST. In Volg-2 the source rock interval occur right below a surface interpreted as a MFS of a higher order sequence. Two of the source rock units occurring in the Kimm-4 and Volg-1 sequences occur as two or more separate subunits in all the studied wells except for Gwen-2, where the succession and the source rock units are more condensed.

Mapping of source rocks

For the identified source rock units high values seem exclusively to occur in the northern and north-western part of the Danish Central Graben. TOC values of 5 or more are found in the Feda Graben, on the Heno Plateau, in the transitional area between the Heno Plateau and the Rosa Basin to the south, on the Gertrud Plateau and in the western part of the Søgne Basin. The highest values are found in the Gert area of the Feda Graben (TOC: 22.2 in Gert-2) and in the Ravn-1 well of the Heno Plateau (TOC: 18.1). A similar pattern is characteristic for the distribution of high HI measurements, although the transition to the low HI values of the Salt Dome Province to the south and the Tail End Graben to the east seems to be more gradual than for the TOC measurements.

Based on the sequence stratigraphic framework the identified source rock units can be traced throughout the study area and to wells outside the study area. In many wells outside the study area the source rock units can be traced and mapped by application of resistivity logs and the GEUS organic geochemical database. Examples of mapped maxi-

mum TOC and HI values of source rock unit HIV-1A and HIV-1B in the Danish Central Graben are shown on figures 29 and 30. It is noticeable that high TOC and HI values in this unit are concentrated along the western margin of the Danish Central Graben. Highest values are found in the Feda Graben, on the Gertrud Plateau and on the Heno Plateau. However, the results from wells not included as key wells in this study are in many cases based on less dense data sets, and should be seen as tentative.

The geographical extent of the identified source rocks shows small variations. The lowermost source rock interval, HIK-3, probably is restricted by onlap with the plateau areas. Also the uppermost source rock unit, HIV-2A, seems to occur in a more restricted area than most of the underlying units.

Conclusions

- The tested methods can, at a varying degree, be used to support a sequence stratigraphic subdivision primarily based on well log patterns. None of the tested methods has proven to be reliable sequence stratigraphic indicators unsupported by other methods, when used primarily on cuttings samples.
- Of the tested methods the size of opaque phytoclasts seems to be the best method to point out sequence stratigraphic surfaces and units, while the shape of these particles and the clay/quartz-ratio seem to have some potential. The other mineralogical methods did not seem to vary in relation to the sequence stratigraphy.
- The Gamma ray log is normally a reliable lithology indicator even in units with high organic content. High TOC values seem to enhance Gr-readings in mud-rich intervals.
- Resistivity logs are useful for regional correlations in basins or intervals with high TOC values (e.g. The Feda Graben - Gertrud Plateau area).
- The resistivity log correlates on a detailed scale with the TOC-curve and the HI-curve.
- As shown by the good correlations between TOC/HI curves and resistivity logs geochemical methods can be used for detailed correlations in source rock intervals using cuttings samples, when there is a high sampling density.
- The combined use of resistivity logs and TOC/HI-data may be useful for identification and mapping of discrete source rock units.
- A number of discrete source rock units have been identified in the Feda Graben - Gertrud Plateau area in the Kimm-3, Kimm-4, Volg-1 and Volg-2 sequences. The source rock units extend from the Feda Graben - Gertrud Plateau area southward to the area south of the Heno Plateau. The mapped source rocks do not seem to be present in the Tail End Graben or in the southern Salt Dome Province.

- The location of the discrete source rock units does not seem to be related to any specific key surface or system tract.

Acknowledgements

We would like to thank Susanne W. Harslund, Yvonne Desezar, Ditte Kiel-Dühring, Lisbeth Løvig Nielsen, Carsten Guvad and Hans Peter Nytoft for laboratory assistance. Ole Bjørsløv Nielsen and Morten Zacho Jørgensen from Geological Institute, University of Aarhus made the mineralogical analysis and interpretations. Pia Andersen assisted with drawings.

References

- Andsbjerg, J. & Dybkjær, K. 1997: Jurassic sequence stratigraphy of the Danish Central Graben. In: Danmarks og Grønlands Geologiske Undersøgelse rapport 1997/74, EFP-92 project: Jurassic sequence stratigraphy of the Danish Central Graben, ENS Journal no.: 1313/92 - 0002, Completion report to the Energy Agency.
- Barnard, P.C. and Cooper, B.S., 1981: Oils and source rocks of the North Sea area. In: Petroleum Geology of the Continental Shelf of North-West Europe (eds. Illing & Hobson) Heyden, London, 169-75.
- Batten, D.J., 1982: Palynofacies, palaeoenvironments, and petroleum. *Journal of Micropalaeontology*, 1, 107-14.
- Bessereau, G., Guillocheau, F. & Huc, A.-Y. 1995. Source rock occurrence in a sequence stratigraphic framework: the example of the Lias of the Paris Basin. In: Huc, A.-Y. (ed.), *Paleogeography, paleoclimate and source rocks*. AAPG Studies in Geology #40, 273-301
- Bordenave, M. L., Espitalié, J., Leplat, P., Oudin, J. L. & Vandenbroucke, M. 1993: Screening techniques for Source Rock Evaluation. In: Bordenave, M. L. (ed.) *Applied Petroleum Geochemistry*, Éditions Technip, Paris, 219-278
- Caratini, C., Bellet, J. and Tissot, C., 1983: Les palynofaciés: représentation graphique, intérêt de leur étude pour les reconstitutions paléogéographiques. In: *Géochimie Organique des Sédiments Marins d'ORGON À MISEDOR*, Éditions du Centre National de la Recherche Scientifique, Paris, 327-51.
- Creaney, S. & Passey, Q. R. 1993. Recurring patterns of total organic carbon and source rocks quality within a sequence stratigraphic framework. *AAPG Bulletin* 77, 386-401
- Curiale, J. A., Cole, R. D. & Witmer, R. J. 1992. Application of organic geochemistry to sequence stratigraphic analysis: Four Corners Platform area, New Mexico, U.S.A. *Organic Geochemistry* 19, 53-75

Dahl, B., Bojesen-Koefoed, J. A. & Thomsen, E., submitted. A method to deduce gross kerogen components using Rock-Eval pyrolysis and TOC data. Submitted to *Petroleum Geoscience* ultimo 1997

Espitalié, J., Deroo, G. & Marquis, F., 1985: La pyrolyse Rock-Eval et ses applications - Première partie. *Revue de l'Institut Français du Pétrole* 40, 563-579

Fisher, M.J., 1980: Kerogen distribution and depositional environments in the Middle Jurassic of Yorkshire, U.K. *Proc. IV int. palynol. conf. Lucknow (1976-1977)* 2, 574-580.

Gorin, G. and Monteil, E., 1990: Preliminary note on the organic facies, thermal maturity, and dinoflagellate cysts of the Upper Mastrichtian Wang Formation in the northern Subalpine Massifs (western Alps, France). *Eclogae Geologicae Helvetiae* 83, 265-85.

Gorin, G. and Steffen, D., 1991: Organic facies as a tool for recording eustatic variations in marine fine-grained carbonates - example of the Berriasian stratotype at Berrias (Ardèche, SE France). *Palaeogeography, Palaeoclimatology, Palaeoecology* 85, 303-20.

Gregory, W.A. and Hart, G.F., 1992: Towards a Predictive Model for the Palynologic Response to Sea-Level Changes. *Palaios* 7, 3-33.

Habib, D. and Miller, J.A., 1989: Dinoflagellate species and organic facies evidence of marine transgression and regression in the Atlantic coastal plain. *Palaeogeography, Palaeoclimatology and Palaeoecology* 74, 23-47.

Habib, D., 1982: Sedimentary supply origin of Cretaceous black shales. In: *Nature and Origin of Cretaceous Carbon-Rich Facies* (eds. Schlanger & Cita), Academic Press, London, 113-27.

Hoelstad, T., Piasecki, S. & Stemmerik, L., 1994: Shape and size of lacustrine deposited melanogen (opaque organic matter) Upper Carboniferous, East Greenland. *Rapp. Grønlands geol. Unders.* 164, 19-28.

Jensen, T.F., Holm, L., Frandsen, N. and Michelsen, O., 1986: Jurassic - Lower Cretaceous lithostratigraphic nomenclature for the Danish Central Trough. *Geol. Surv. of Denmark Ser. A* 12, 65pp.

Katz, B. J. & Pratt, L. M. 1993 (eds.). *Source rocks in a sequence stratigraphic framework*. AAPG Studies in Geology #37, 247 pp.

Langford, F. F. & Blanc-Valleron, M.-M. 1990. Interpreting Rock-Eval pyrolysis data using graphs of pyrolyzable hydrocarbons vs. total organic carbon. *AAPG Bulletin* 74, 799-804

Manum, S.B. and Trondsen, T., 1978: Dispersed organic matter (kerogen) in the Spitsbergen Tertiary. *Norsk Polarinstitut Årbok* 1978, 179-87.

Medalia, A.I., 1967: Morphology of aggregates. *Journ. Colloid and Interface Sci.* 24, 393-404.

Meyer, B. L. & Nederlof, M. H. 1984: Identification of source rocks on wireline logs by density/resistivity and sonic transit time-resistivity crossplots. *AAPG Bulletin* 68, 121-129.

Mitchum, R.M. Jr., Vail, P.R., and Sangree, B., 1977: Stratigraphic interpretation of seismic reflection patterns in depositional sequences. In: *Seismic Stratigraphy: Application to Hydrocarbon Exploration* (ed. C.E. Payton). *AAPG Memoir* 26, 63-97.

Oboh, F.E., 1992: Multivariate statistical analyses of palynodebris from the Middle Miocene of the Niger Delta and their environmental significance. *Palaos* 7, 559-73.

Odgaard, B. V., 1993: The sedimentary record of spheroidal carbonaceous fly-ash particles in shallow Danish lakes. *Journal of Paleolimnology* 8, 171-187.

Odum, W.E., Fisher, J.S. and Pickral, J.C., 1979: Factors controlling the flux of particulate organic carbon from estuarine wetlands. In: *Ecological Processes in Coastal and Marine Systems* (ed. R.J. Linington), Plenum Press, New York, pp. 69-80.

Parry, C.C., Whitley, P.K.J. & Simpson, R.D.H., 1981: Integration of Palynological and Sedimentological Methods in Facies Analysis of the Brent Formation. *Petroleum Geology of the Continental shelf of NW Europe*. Institute of Petroleum, London, 205-215.

Pasley, M. A., Riley, G. W. & Nummedal, D. 1993. Sequence stratigraphic significance of organic matter variations: example from the Upper Cretaceous Mancos Shale of the San Juan Basin, New Mexico. In: Katz, B. J. & Pratt, L. M. 1993 (eds.). *Source rocks in a sequence stratigraphic framework*. *AAPG Studies in Geology* #37, 221-241.

Passey, Q. R., Creaney, S., Kulla, J. B., Moretti, F. J. & Stroud, J. D. 1990: A practical model for organic richness from porosity and resistivity logs. *AAPG Bulletin* 74, 1777-1794.

Posamentier, H.W. and Vail, P.R., 1988: Eustatic controls on clastic deposition. II - sequence and systems tract models. In: Wilgus, C.K. Hastings, B.S., Kendall, C.G.St.C., Posamentier, H.W., Ross, C.A., & van Wagoner J.C. (eds) *Sea-level Changes: an Integrated Approach*. *Soc. Econ. Paleontol. Mineral., Spec. Publ.* 42, 125-154.

Posamentier, H.W., Jervey, M.T. and Vail, P.R., 1988: Eustatic controls on clastic deposition. I - conceptual framework. In: Wilgus, C.K. Hastings, B.S., Kendall, C.G.St.C., Posamentier, H.W., Ross, C.A., & van Wagoner J.C. (eds) *Sea-level Changes: an Integrated Approach*. *Soc. Econ. Paleontol. Mineral., Spec. Publ.* 42, 109-124.

Rider, M. H. 1986: *The geological interpretation of well logs*. Blackie and Son Limited, Glasgow 1986.

Schwartz, H., 1980: Two-dimensional Feature-Shape Indices. *Mikroskopie* (Wien) 37 (Suppl.), 64-67.

Spicer, R.A., 1989: The formation and interpretation of plant fossil assemblages. *Advances in Botanical Research* 16, 95-191.

Steffen, D. and Gorin, G., 1993: Palynofacies of the Upper Tithonian-Berriasian deep-sea carbonates in the Vocontian Trough (SE France). *Bulletin des Centres Recherche et Exploration - Production Elf-Aquitaine* 17, 235-47.

Stocks, A. E. & Lawrence, S. R. 1990: Identification of source rocks from wireline logs. In: Hurst, A., Lovell, M. A. & Morton, A. C. (eds.): *Geological applications of wireline logs*. Geological Society Special Publication 48, 241-252.

Tyson, R.V., 1995: *Sedimentary organic matter - organic facies and palynofacies*. Chapman & Hall, London, 615pp.

Tyson, R. V. 1996. Sequence stratigraphic interpretation of organic facies variations in marine siliciclastic systems: general principles and application to the onshore Kimmeridge Clay Formation, UK. In: Hesselbo, S. P. & Parkinson, D. N. (eds.) *Sequence stratigraphy in British Geology*. Geological Society Special Publication No. 103, 75-96

Vail, P.R., Mitchum, R.M., Todd, R.G., Widmier, J.M., Thompson, S., Sangree, J.B., Bubb, J.N. and Hatlelid, W.G. 1977: Seismic stratigraphy and global changes of sea-level. In: Payton, C.E. (ed) *Seismic Stratigraphy - Application to Hydrocarbon Exploration*. AAPG Memoir 26, 49-133.

Vail, P.R., Hardenbol, J. and Todd, R.G., 1984: Jurassic unconformities, chronostratigraphy and sea level changes from seismic stratigraphy and biostratigraphy. In: Scholle, P.A., Bebout, D.G. & Moore, C.H. (eds.) *Carbonate Depositional Environments*. AAPG Memoir 33, 129-144.

Vail, P.R. and Wornardt, W.W., 1990: Well log - seismic sequence stratigraphy: an integrated tool for the 90's. Eleventh Annual Research Conference, Gulf Coast Section, SEPM, Program and Abstracts, December 2-5, 379-388.

Van Wagoner, J.C., Mitchum, R.M., Campion, K.M. & Rahmanian, V.D., 1990: Siliciclastic sequence stratigraphy in well logs, cores and outcrops: concepts for high-resolution correlation of time and facies. *AAPG Methods in Exploration Series* 7, 1-55.

Whitaker, M.F., 1984: The usage of palynology in definition of Troll Field geology. In: *Reduction of Uncertainties in Innovative Reservoir Geomodelling*, 6th Offshore Northern Seas Conference and Exhibition, Stavanger 1984, Norsk Petroleumsforening, Paper G6, 44pp.

Figure captions

Figure 1

Location of the studied wells.

Figure 2

Correlation of the investigated succession in the wells Rita-1, Gert-2, Jeppe-1 and Gwen-2.

Figure 3

Assumed relative positions of the Gwen-2, Jeppe-1, Gert-2 and Rita-1 well on a proximal–distal trend versus average TOC for the Volg-1, Kimm-4, and Kimm-3 sequences. Note the overall increase in average TOC along the trend.

Figure 4

Assumed relative positions of the Gwen-2, Jeppe-1, Gert-2 and Rita-1 well on a proximal–distal trend versus average Hydrogen Index (HI) for the Volg-1, Kimm-4, and Kimm-3 sequences. Note the overall increase in average HI along the trend.

Figure 5

Average Tmax versus average Hydrogen Index (HI) for the Volg-1, Kimm-4, and Kimm-3 sequences. Note variation in overall level of thermal maturity.

Figure 6

Plots of TOC versus Hydrogen Index for the Volg-1, Kimm-4, and Kimm-3 sequences. See text for discussion.

Figure 7

Plots of TOC versus S2 pyrolysis yield for the Volg-1, Kimm-4, and Kimm-3 sequences. Slope of best linear fit lines represent average Hydrogen Indices. See text for discussion.

Figure 8

"Life cycle" of particulate opaque organic matter.

Figure 9

Simplified block diagram of the IBAS image analysis system.

Figure 10

The image analysis sequence.

Figure 11

Particle shapes and their corresponding indices. CP = convex perimeter, PE = perimeter, a and b = areal principal moments.

Figure 12

The relationship between sea depth and the size distribution of opaque organic particles seen as a function of weather conditions. The probabilities given are speculative.

Figure 13

Bulk mineralogy, Elin-1.

Figure 14

Bulk mineralogi, Jeppe-1.

Figure 15

Bulk mineralogy, Elin-1.

Figure 16

Bulk mineralogi, Jeppe-1.

Figure 17

Clay mineralogy, Elin-1.

Figure 18

Clay mineralogy, Jeppe-1.

Figure 19

Size of 7Å kaolinite XRD-reflection, Elin-1.

Figure 20

Size of 7Å kaolinite XRD-reflection, Elin-1.

Figure 21

Size of 7Å kaolinite XRD-reflection, Jeppe-1.

Figure 22

Size of 7Å kaolinite XRD-reflection, Jeppe-1.

Figure 23

Size of 7Å kaolinite XRD-reflection, Jeppe-1.

Figure 24

Size of 7Å kaolinite XRD-reflection, Jeppe-1.

Figure 25

Size of 10Å illite XRD-reflection, Elin-1.

Figure 26

Size of 10Å illite XRD-reflection, Jeppe-1.

Figure 27

Clay/quartz-ratio, Elin-1.

Figure 28

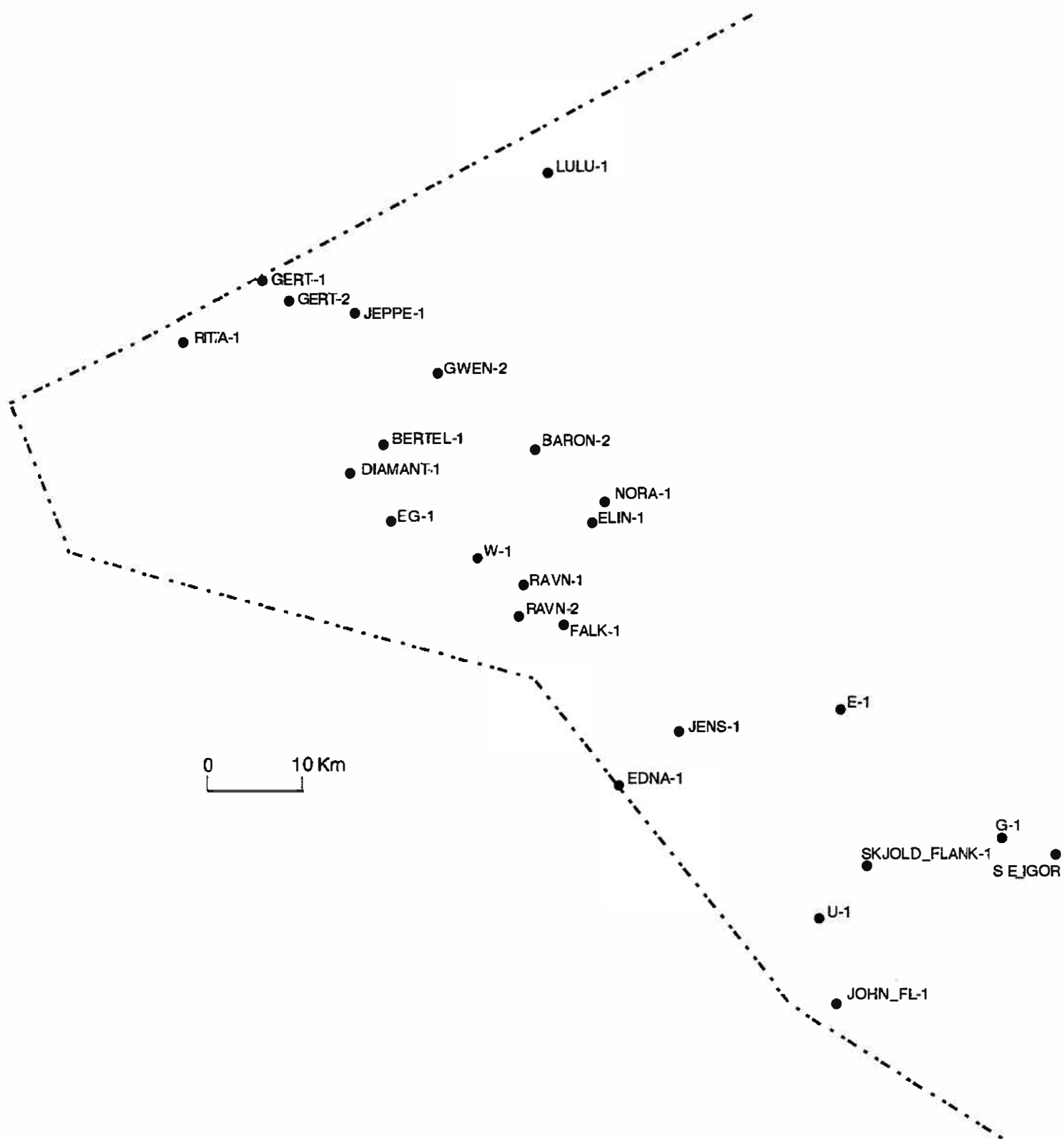
Clay/quartz-ratio, Jeppe-1.

Figure 29

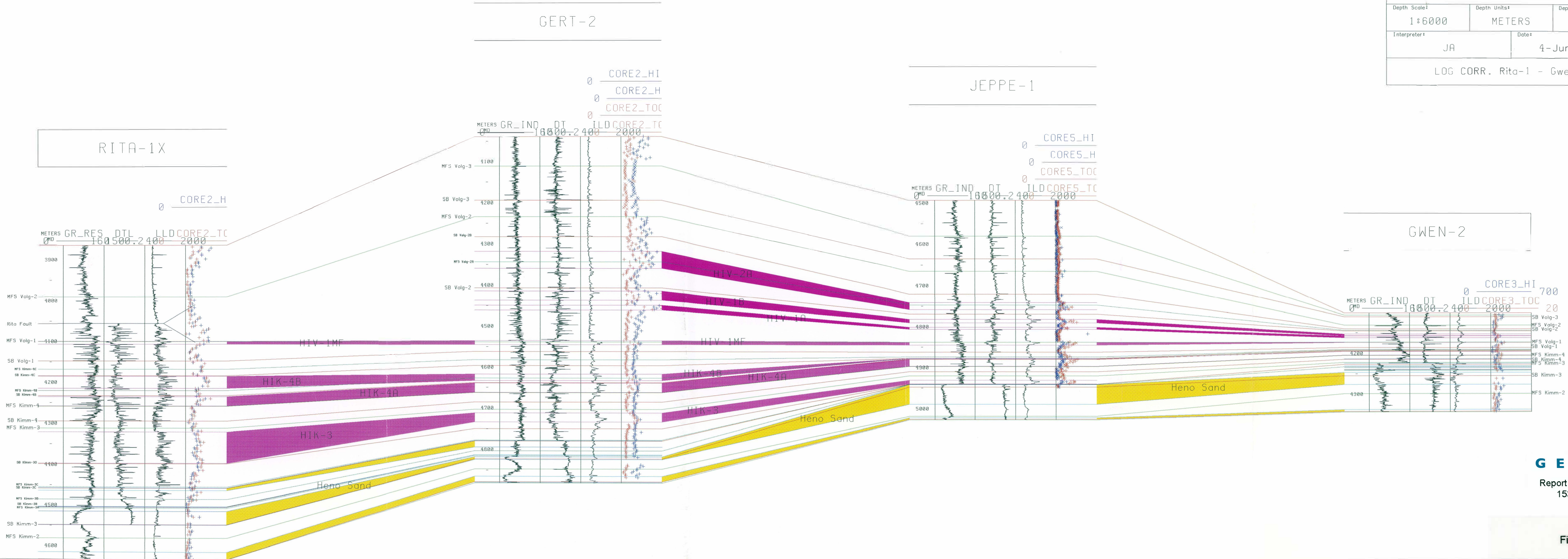
Map showing the TOC distribution of source rock units HIV-1A and HIV-1B.

Figure 30

Map showing the HI distribution of source rock units HIV-1A and HIV-1B.



GEUS		
GEOKEMI		
DK CENTRAL GRABEN		
Depth Scale†	Depth Units†	Depth Type†
1 : 6000	METERS	MD
Interpreter†	Date†	
JA	4-June-1998	
LOG CORR. Rita-1 - Gwen-2		

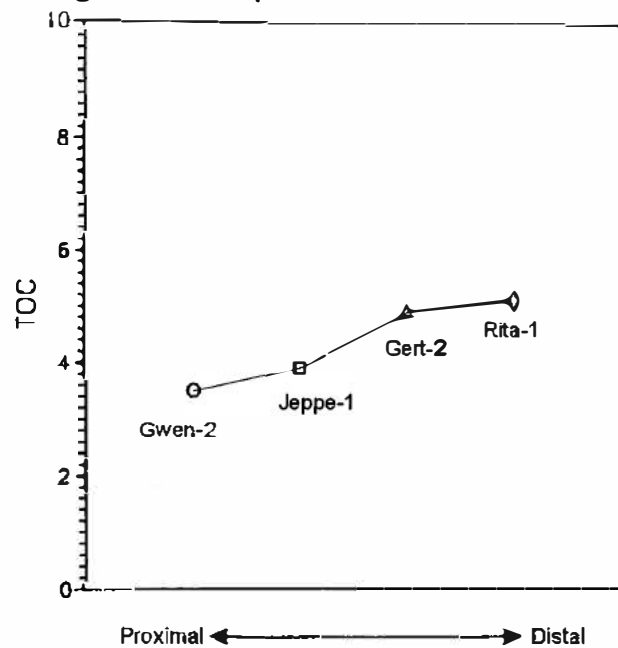


GEUS

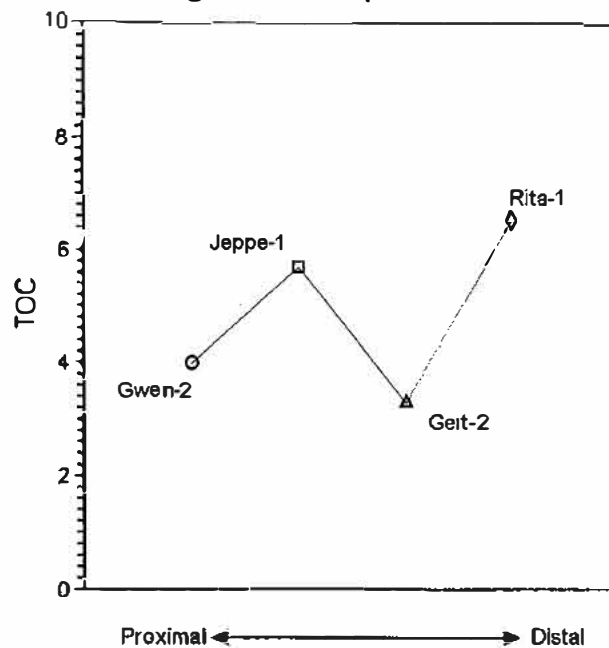
Report file no.
15338

Fig. 2

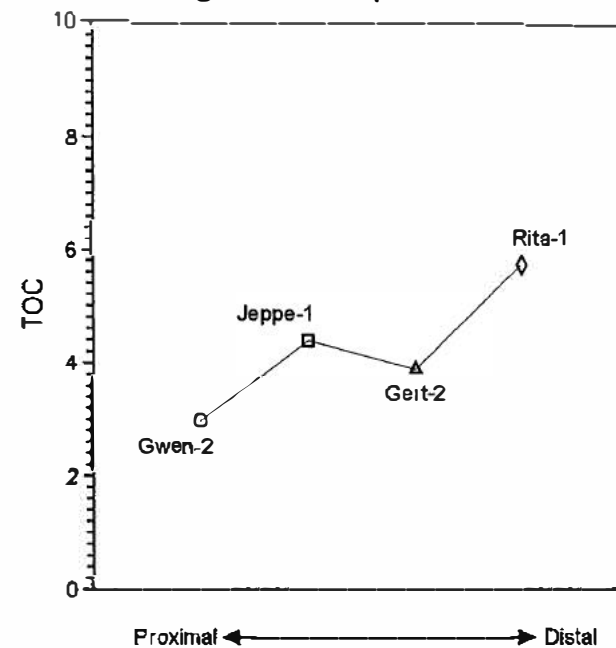
Volgian-1 sequence



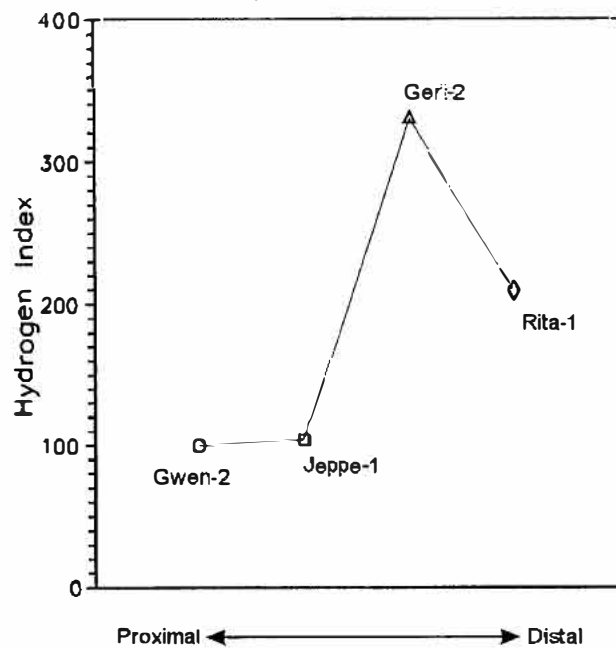
Kimmeridgian-4 sequence



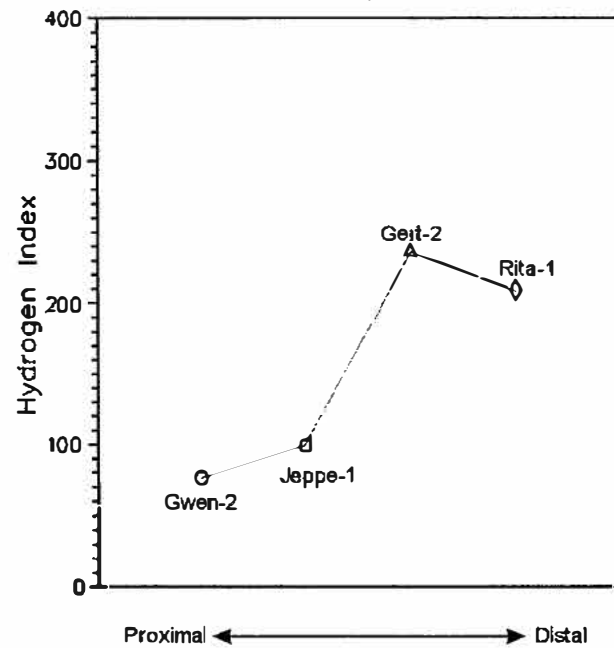
Kimmeridgian-3 sequence



Volgian-1 sequence



Kimmeridgian-4 sequence



Kimmeridgian-3 sequence

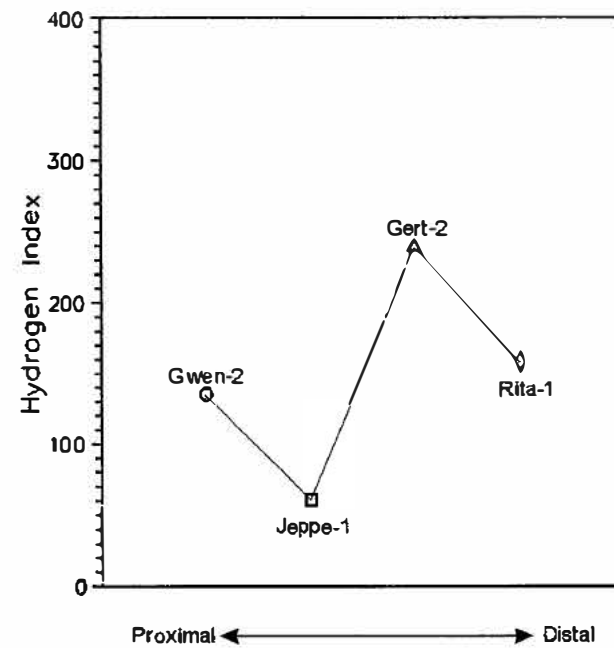
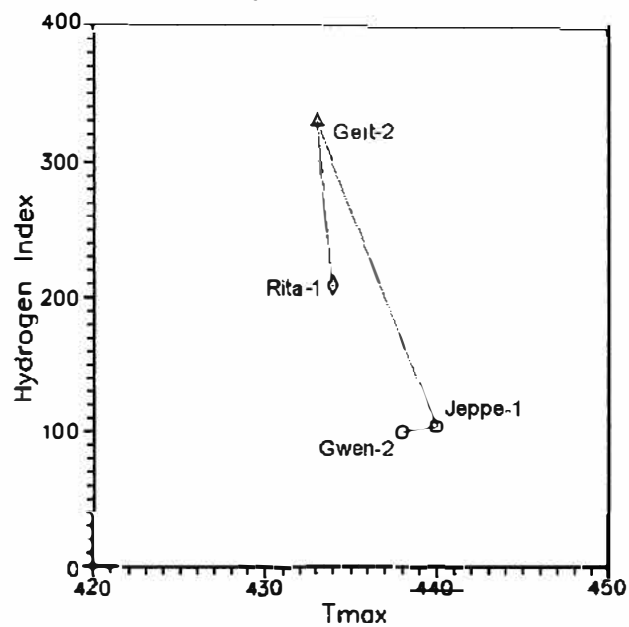
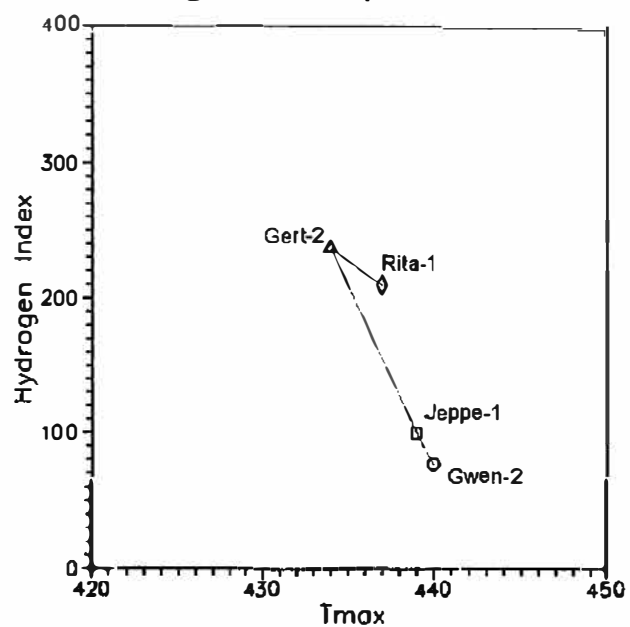


Fig. 4

Volgian-1 sequence



Kimmeridgian-4 sequence



Kimmeridgian-3 sequence

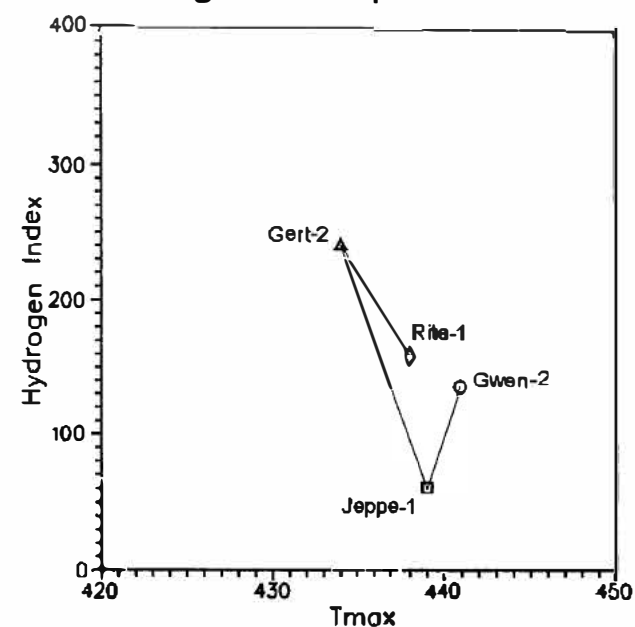
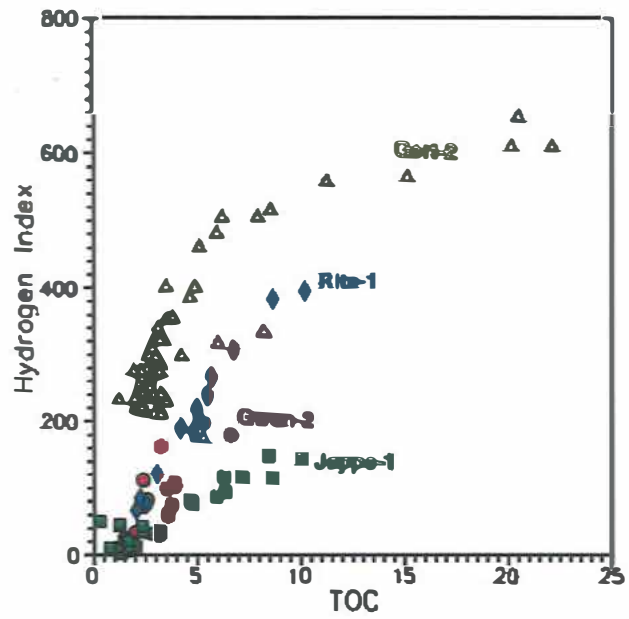
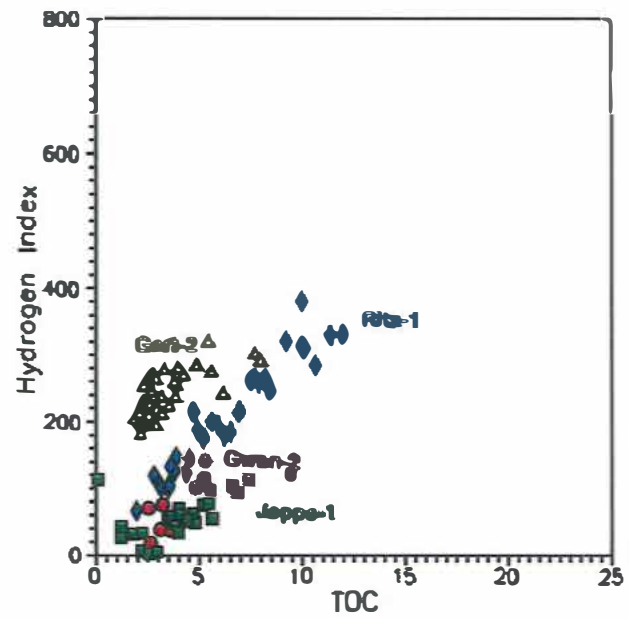


Fig. 5

Volgian-1 sequence



Kimmeridgian-4 sequence



Kimmeridgian-3 sequence

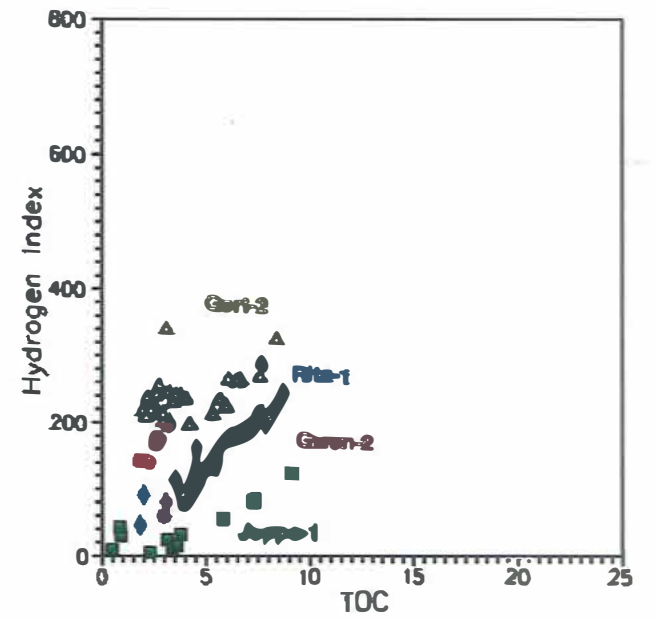


Fig. 6

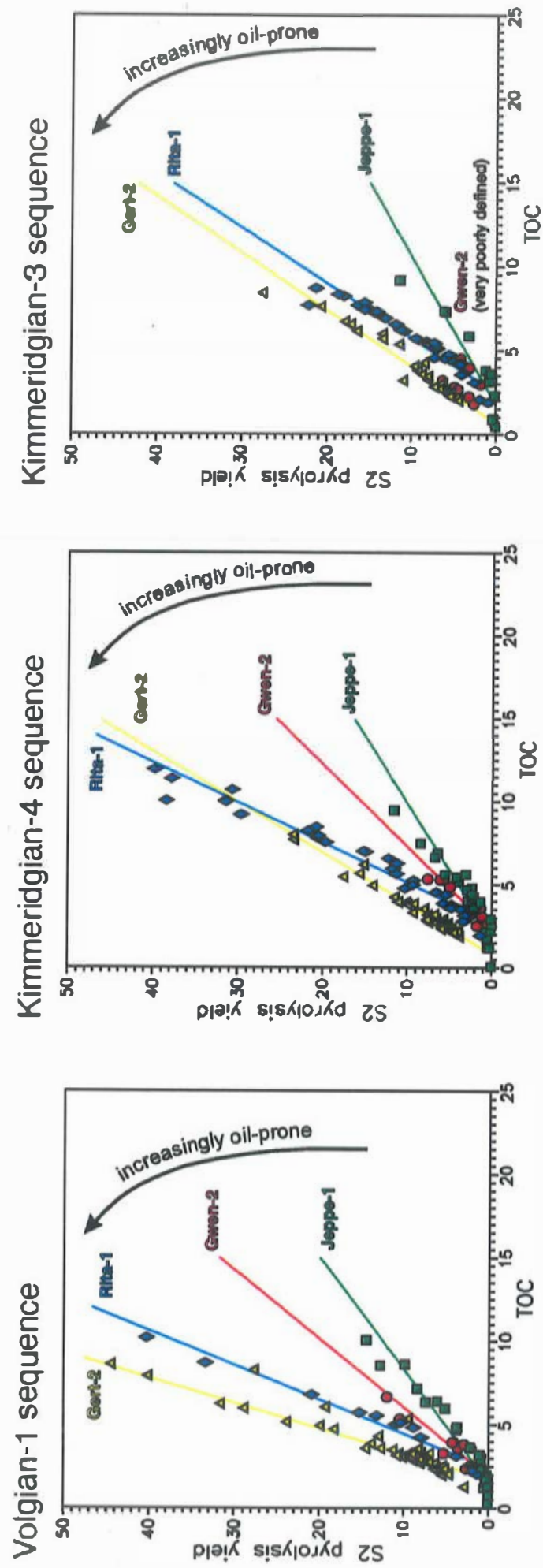


Fig. 7

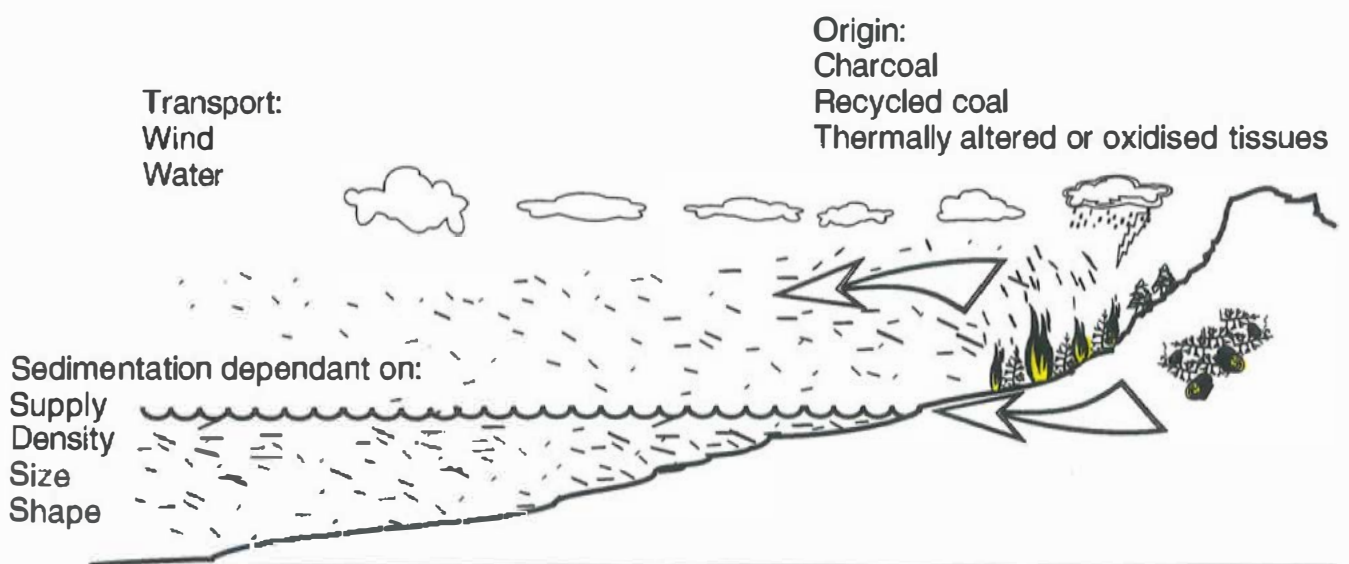


Fig. 8

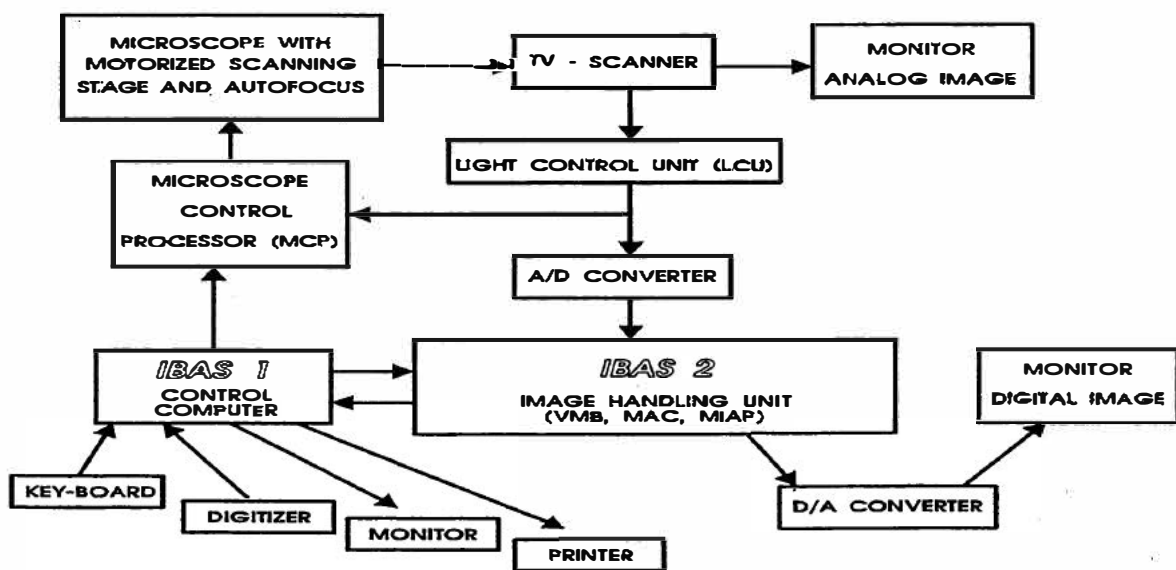


Fig. 9

CALIBRATION

*ENHANCEMENT &
SEGMENTATION*

PARTICLE SELECTION

MEASURING

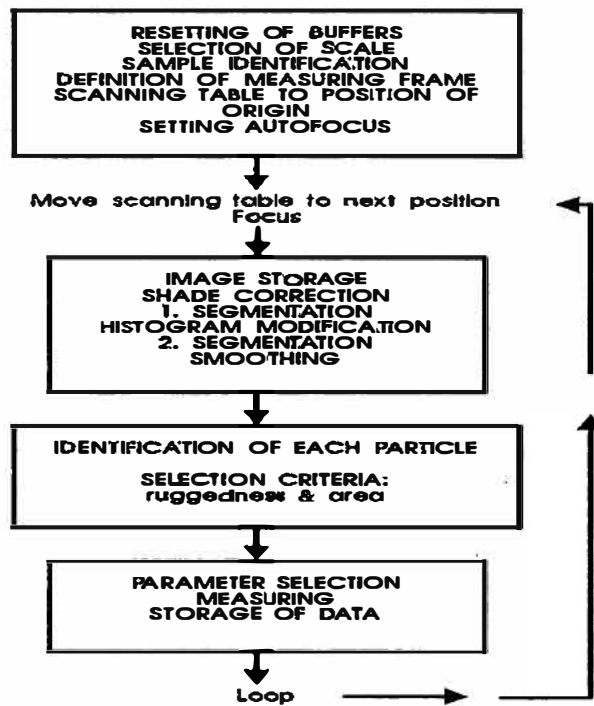


Fig. 10

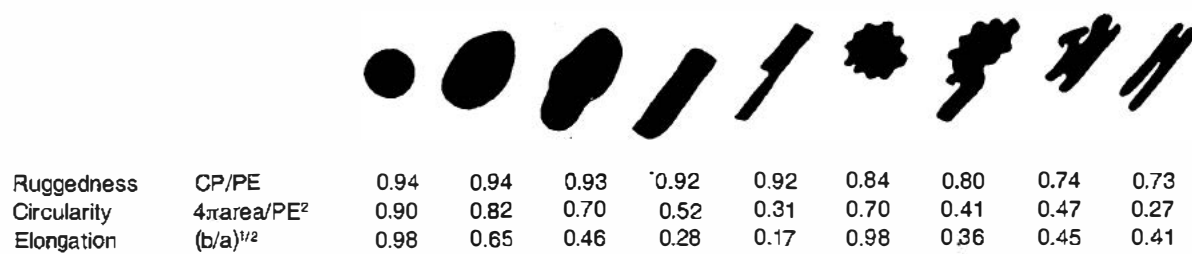


Fig. 11

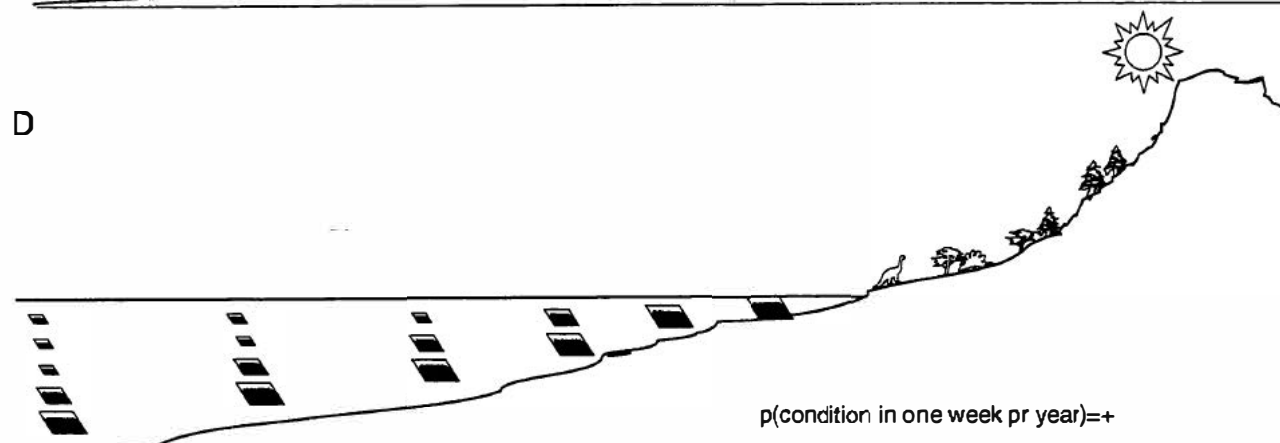
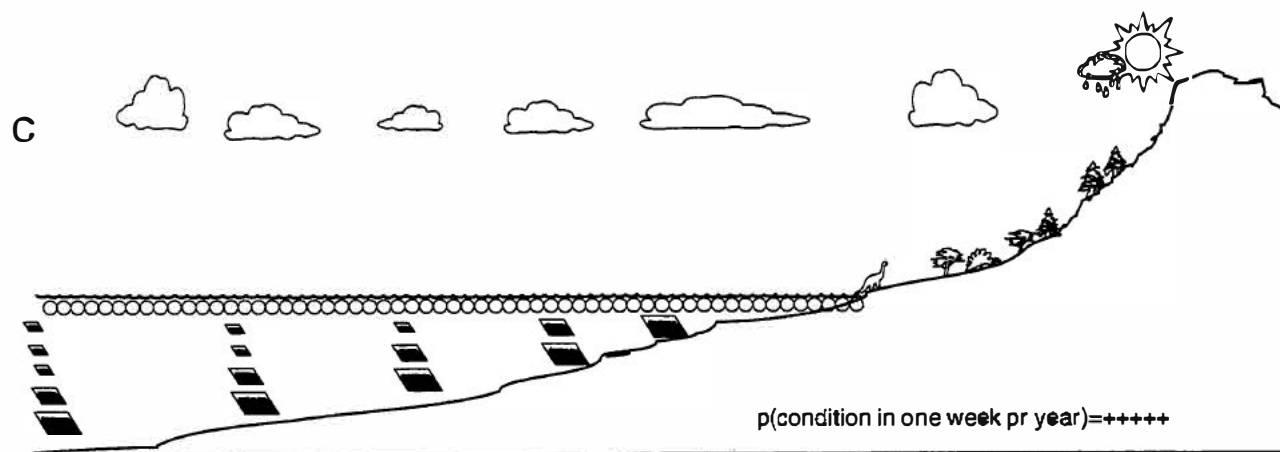
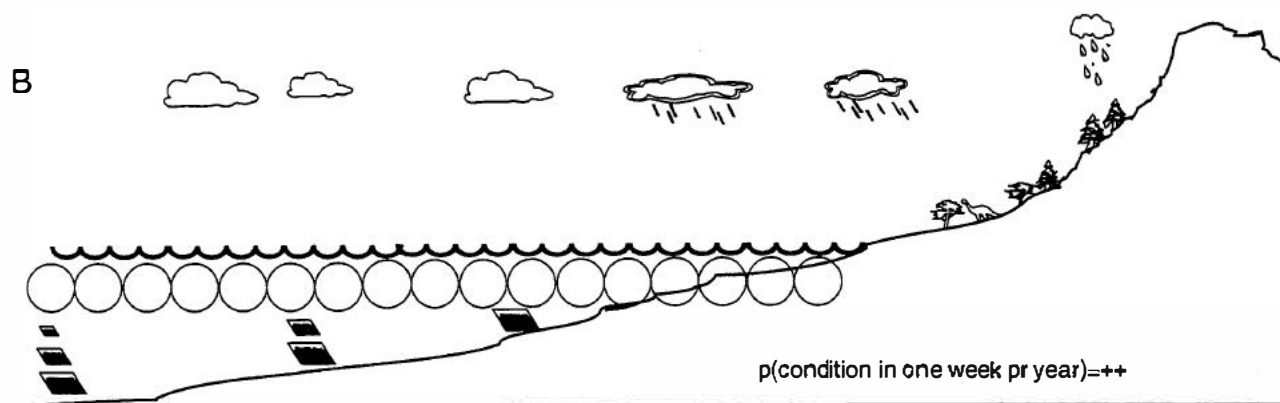
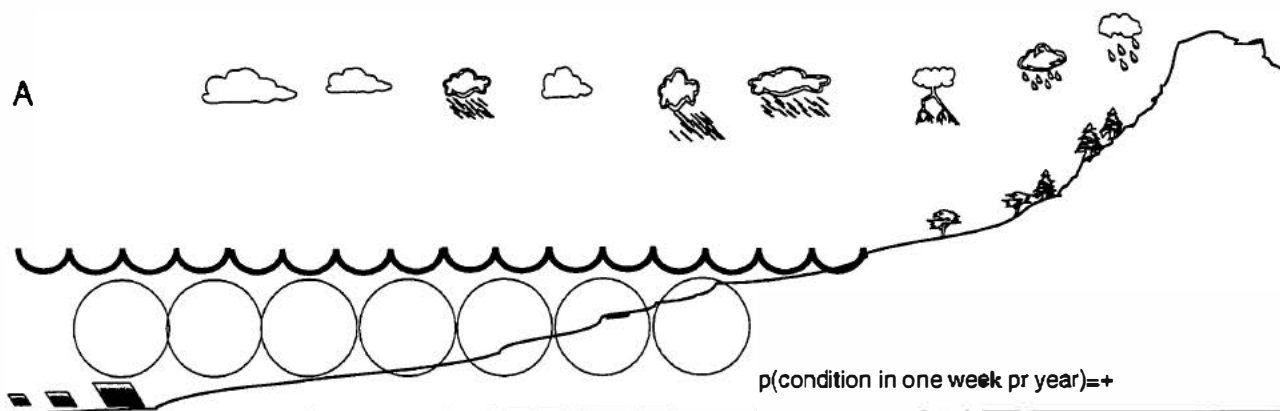


Fig. 12

WELL: ELIN-1

BULK MINERALOGY

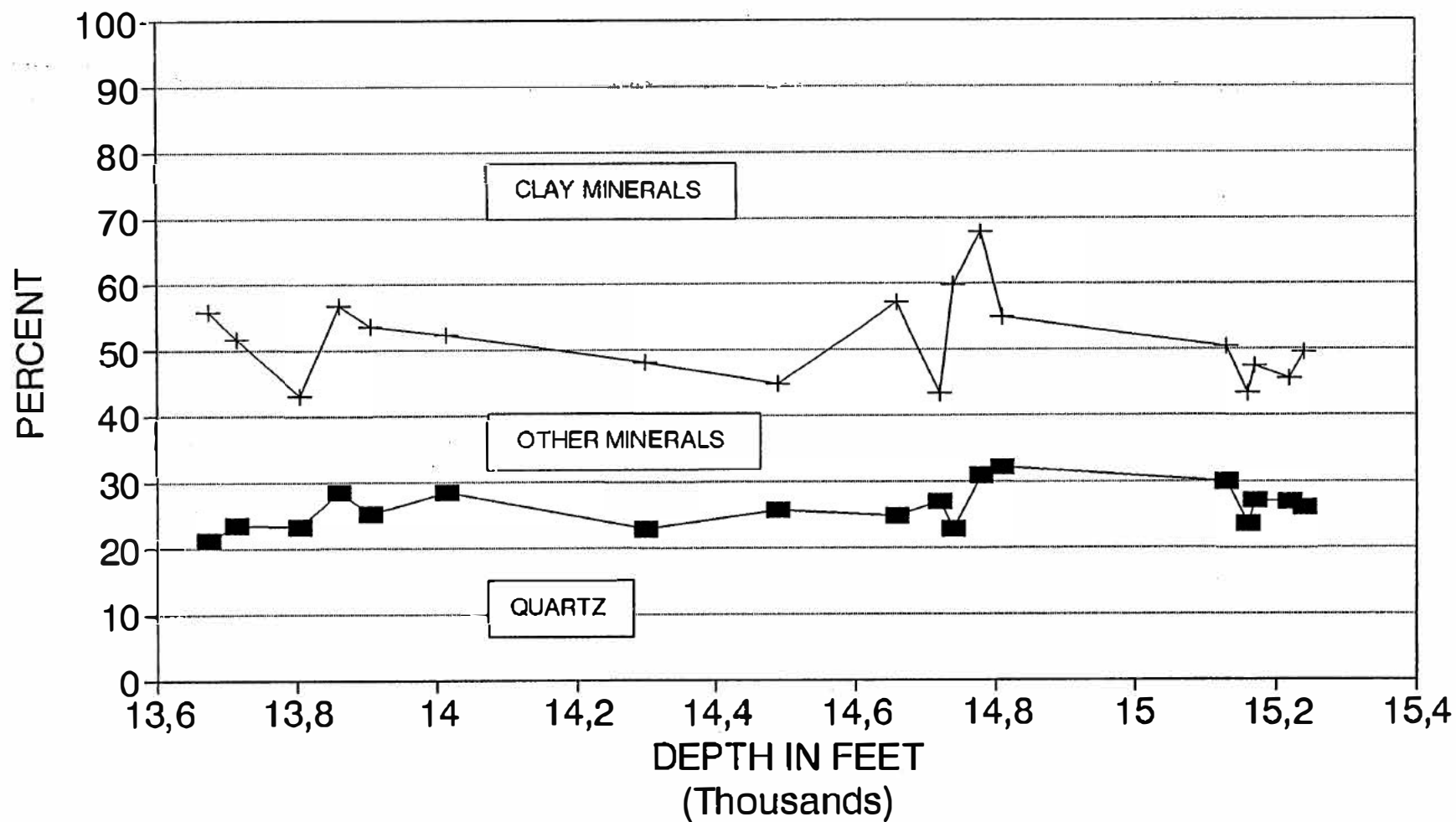


Fig. 13

WELL: JEPPE-1

BULK MINERALOGY

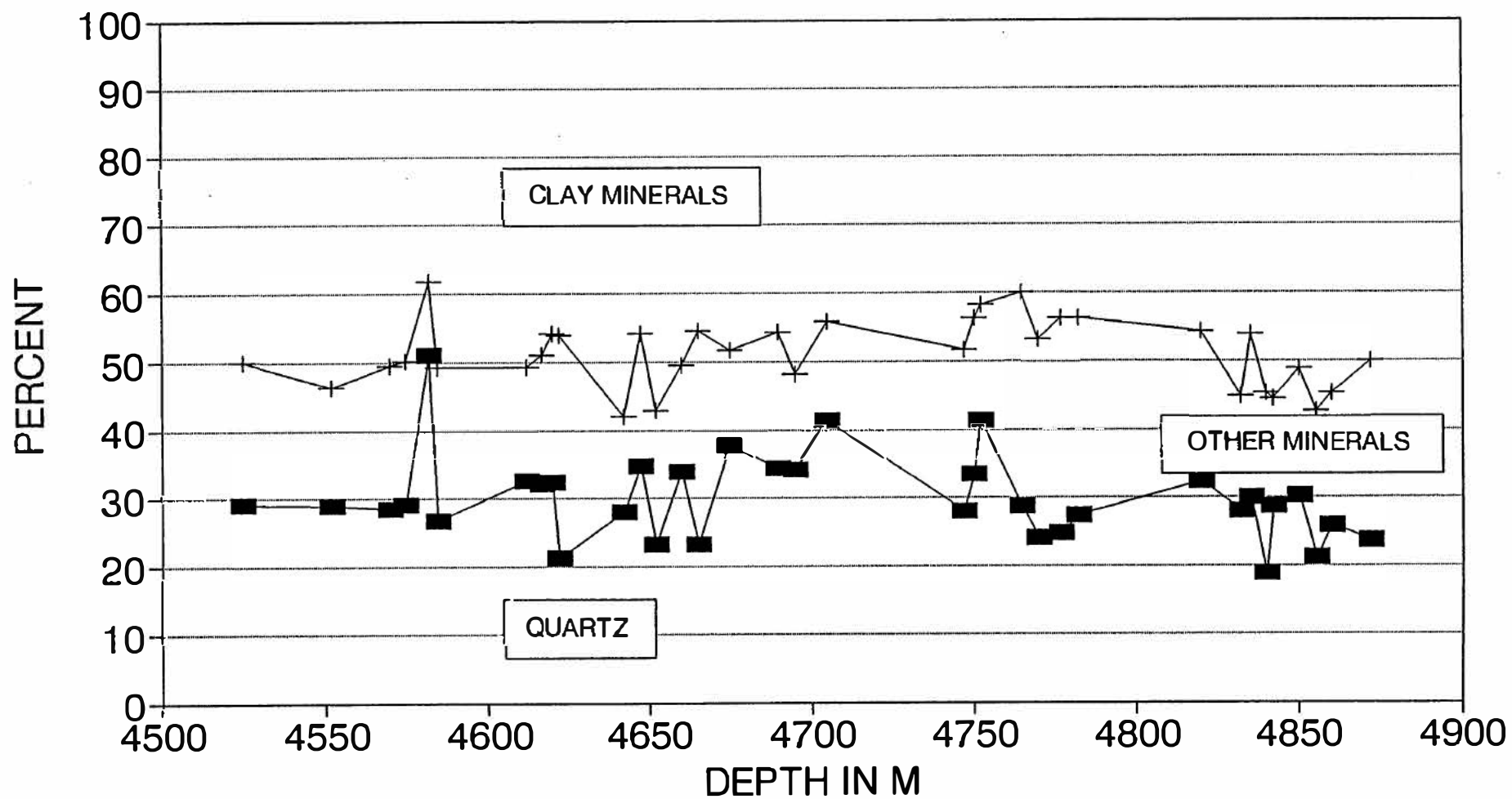


Fig. 14

WELL: ELIN-1

BULK MINERALOGY

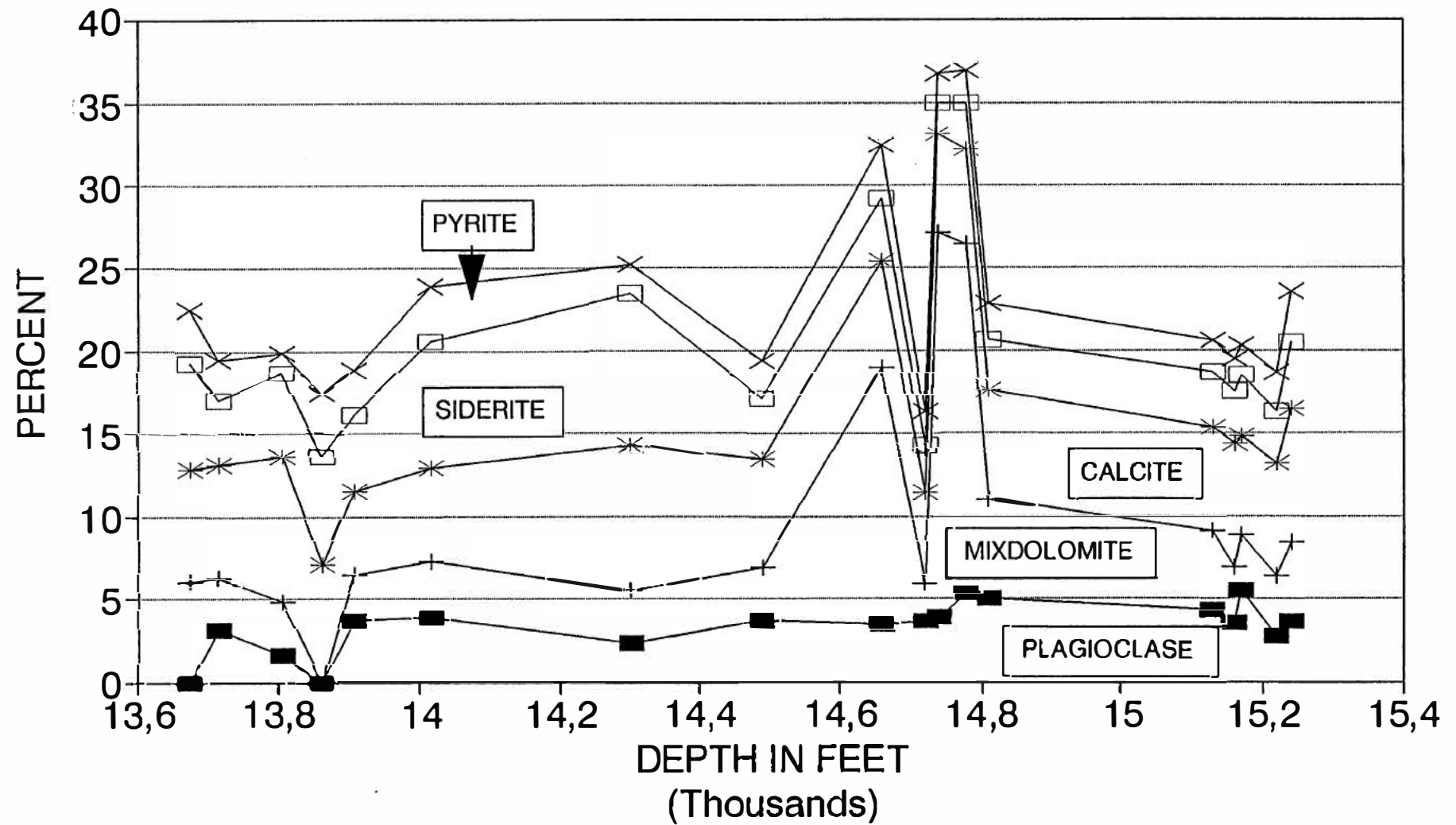


Fig. 15

WELL: JEPPE-1

BULK MINERALOGY

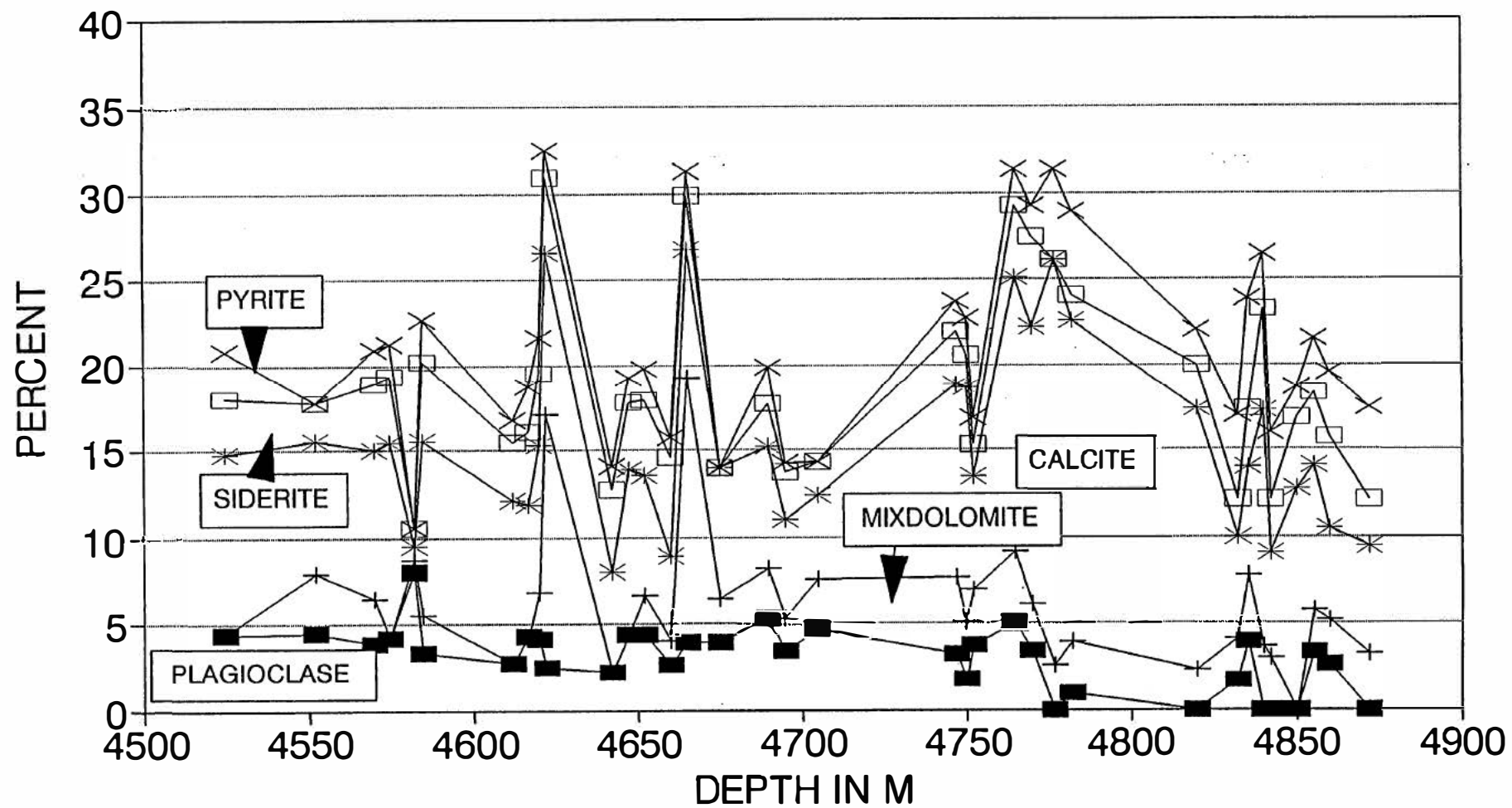


Fig. 16

WELL: ELIN-1

CLAY MINERALOGY

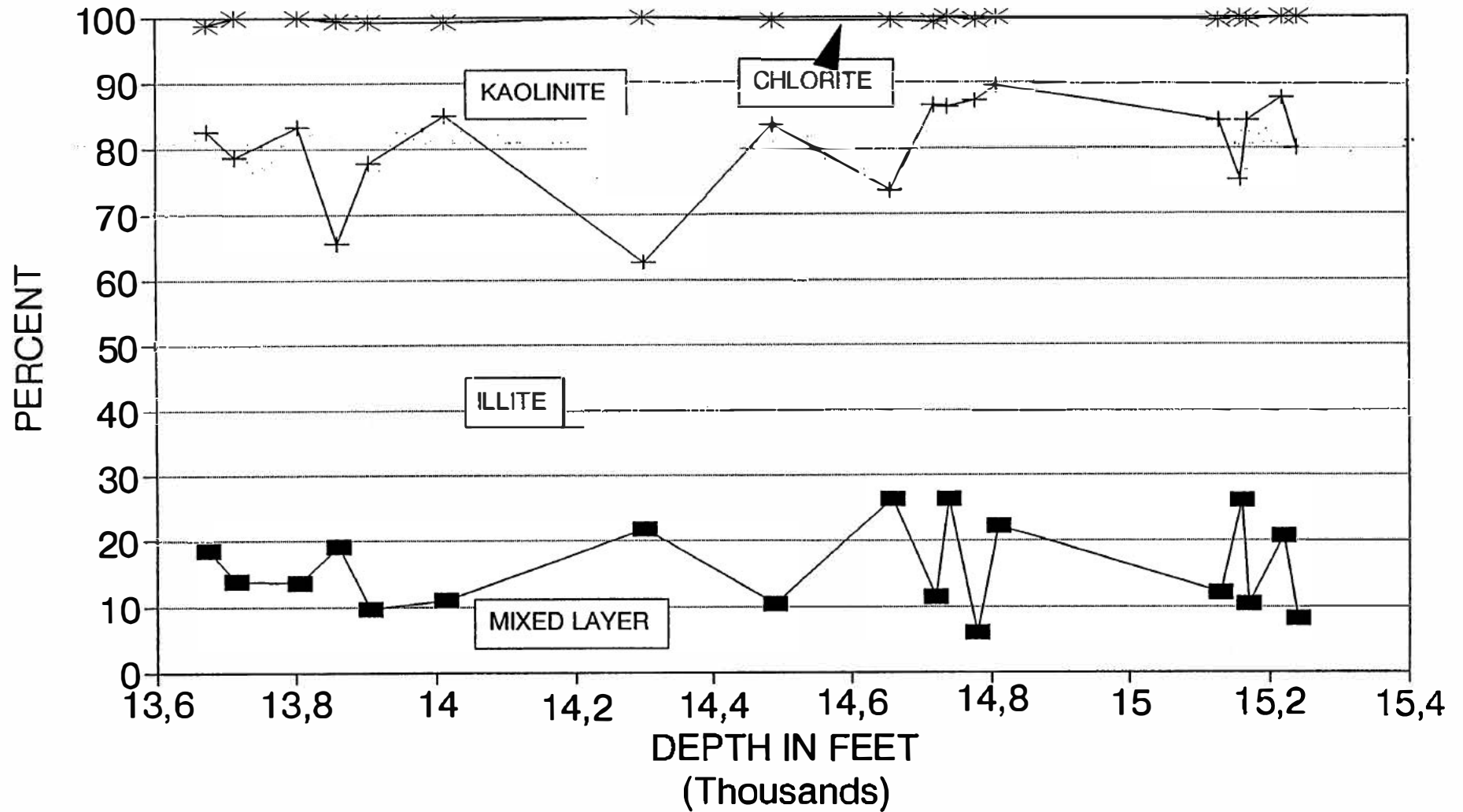


Fig. 17

WELL: JEPPE-1

CLAY MINERALOGY

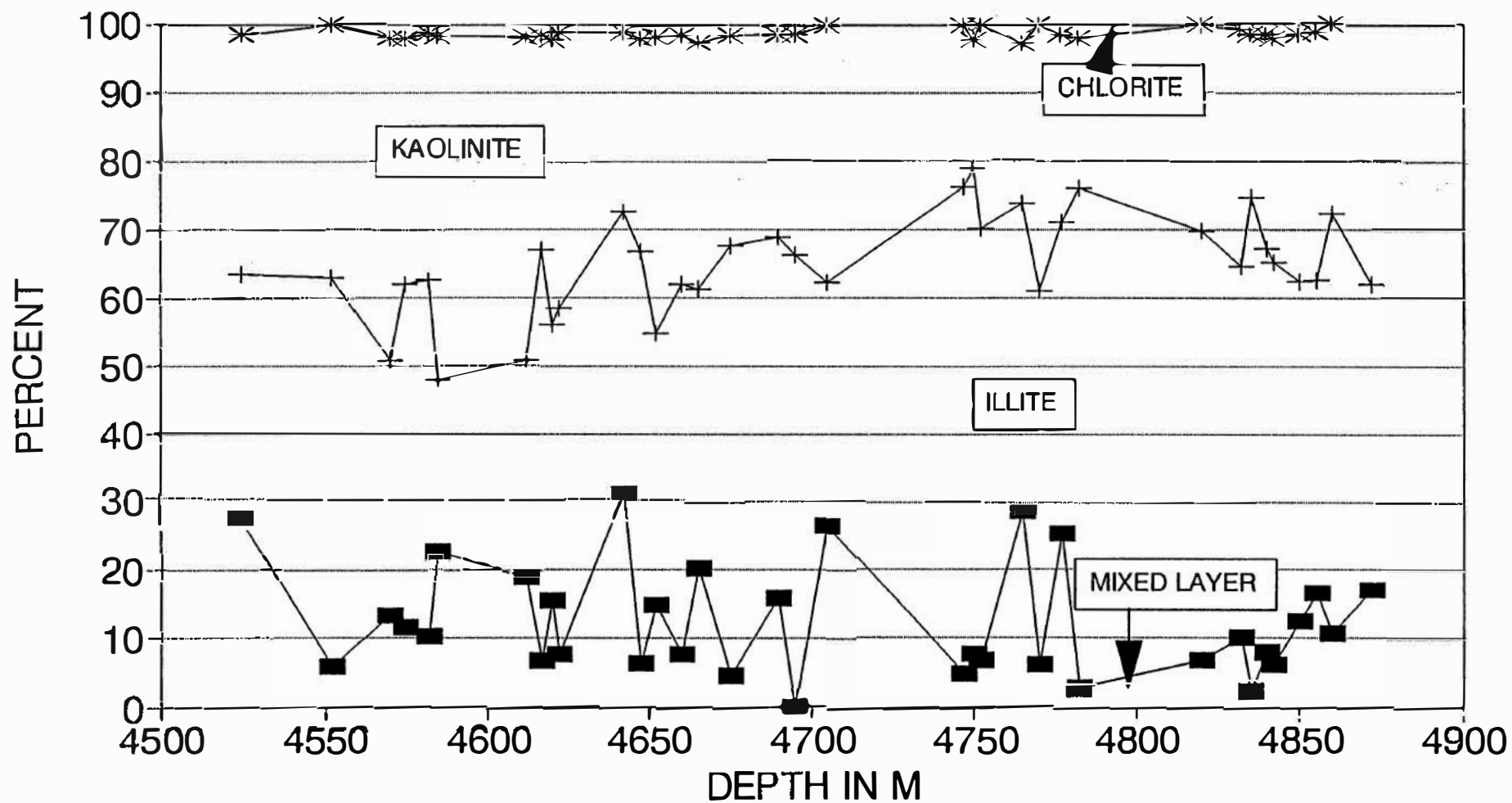
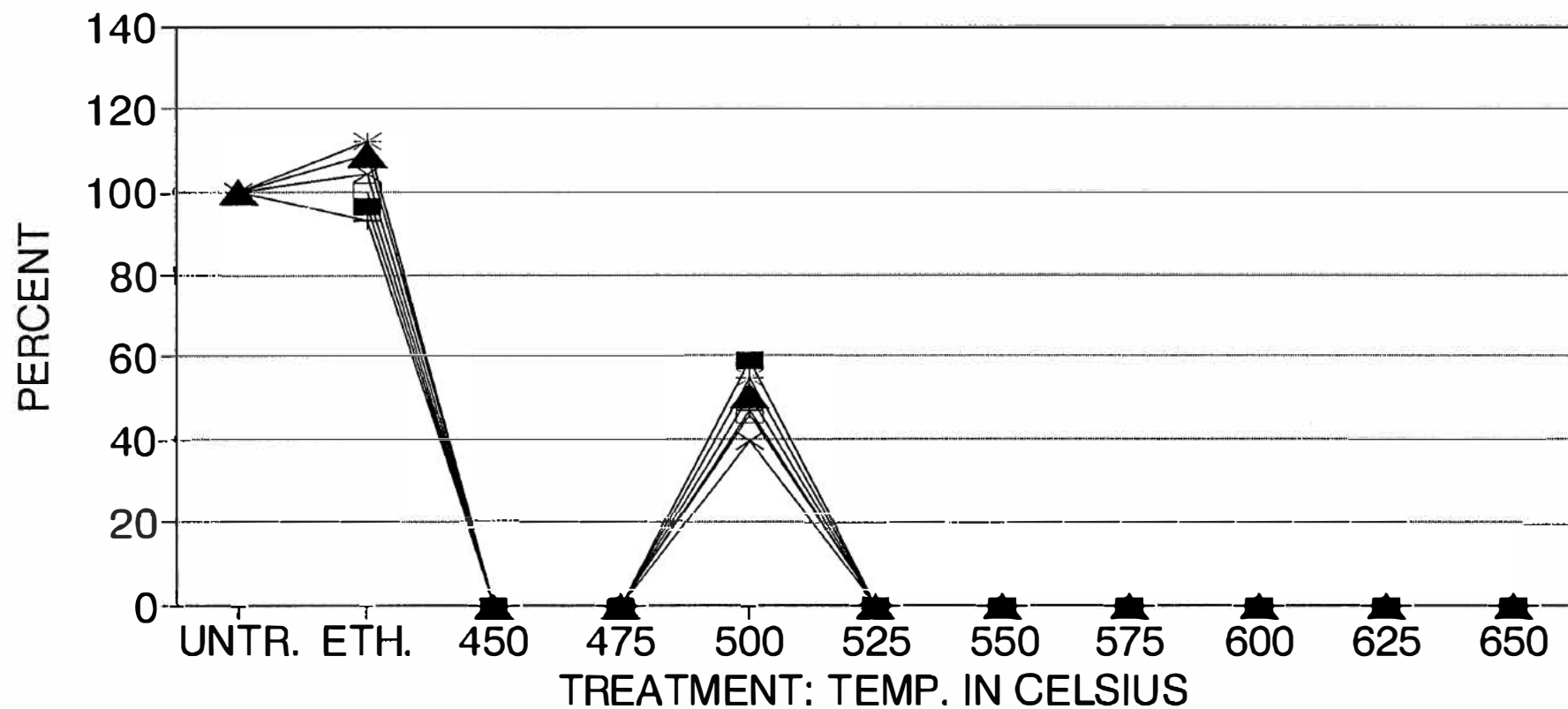


Fig. 18

WELL: ELIN-1

SIZE OF 7Å KAOLINITE XRD-REFLECTION



—■— 13805 FEET BEL. KB. —+— 13905 FEET BEL. KB. —*— 14015 FEET BEL. KB.
 —□— 14720 FEET BEL. KB. —x— 15135 FEET BEL. KB. —▲— 15170 FEET BEL. KB.

Fig. 19

WELL: ELIN-1

SIZE OF 7Å KAOLINITE XRD-REFLECTION

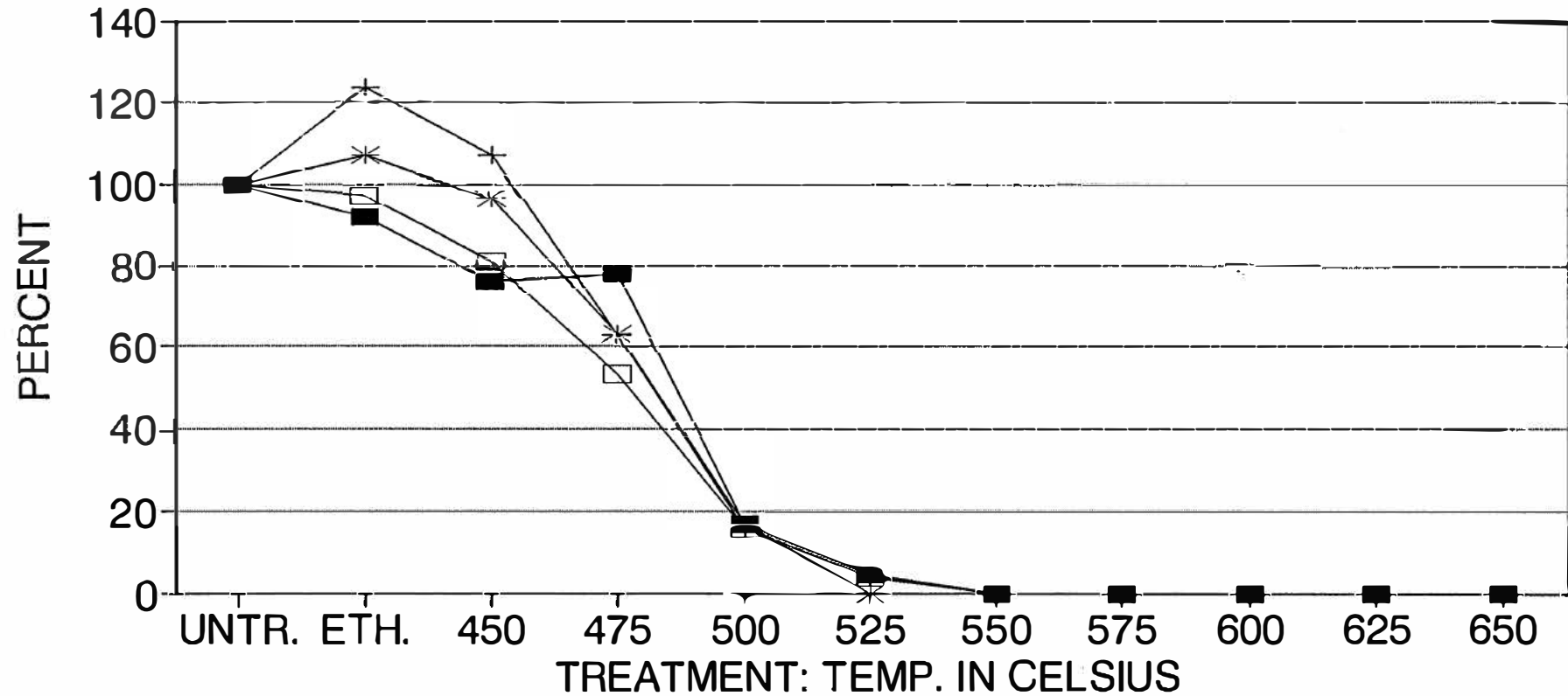
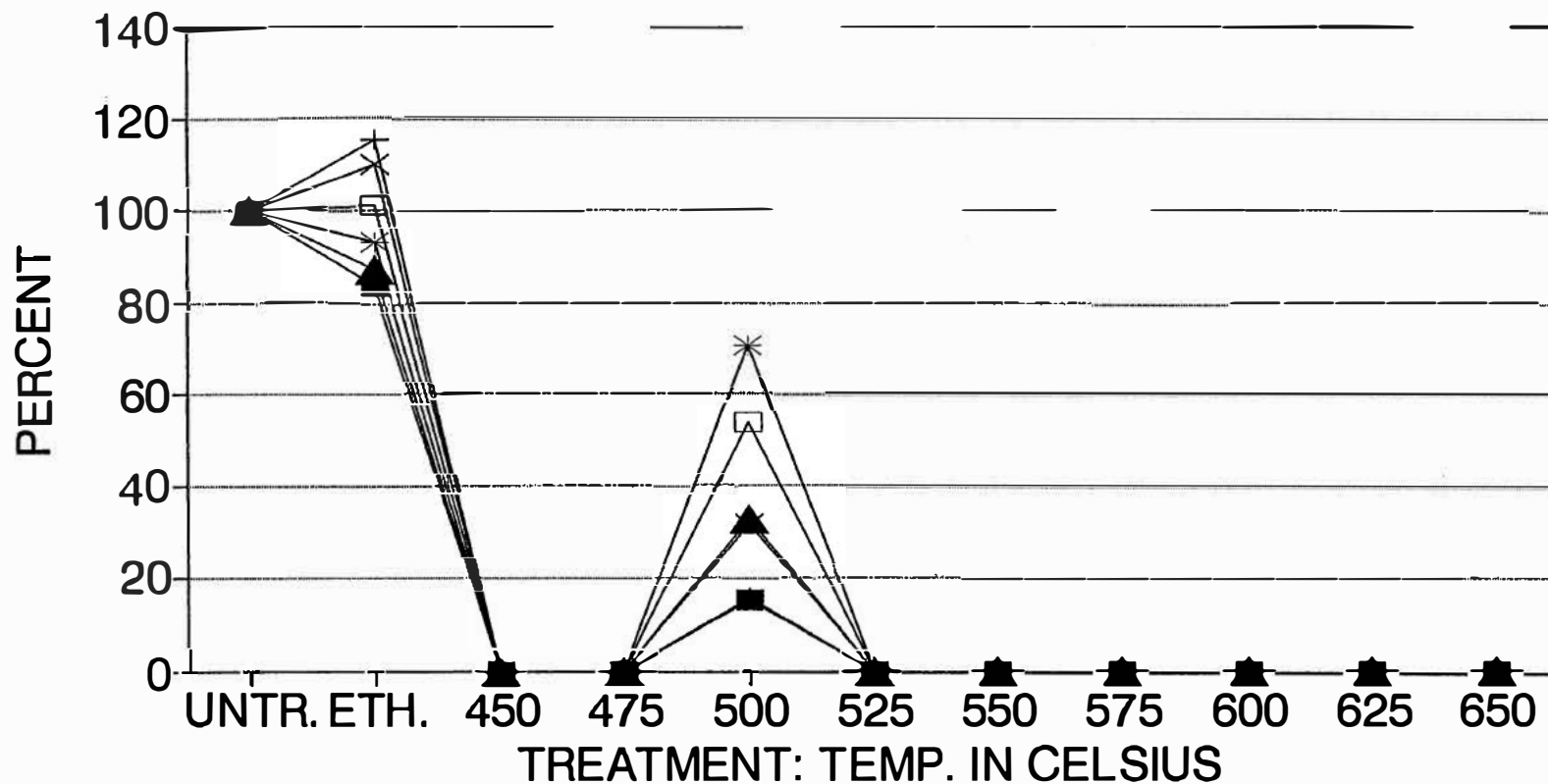


Fig. 20

—■— 13715 FEET BE —+— 14490 FEET BE —*— 14780 FEET BE —□— 15240 FEET BE

WELL: JEPPE-1

SIZE OF 7Å KAOLINITE XRD-REFLECTION



—■— 4752 M BEL. KB. —+— 4770 M BEL. KB. —*— 4782 M BEL. KB.
 —□— 4835 M BEL. KB. —x— 4840 M BEL. KB. —▲— 4842 M BEL. KB.

WELL: JEPPE-1

SIZE OF 7Å KAOLINITE XRD-REFLECTION

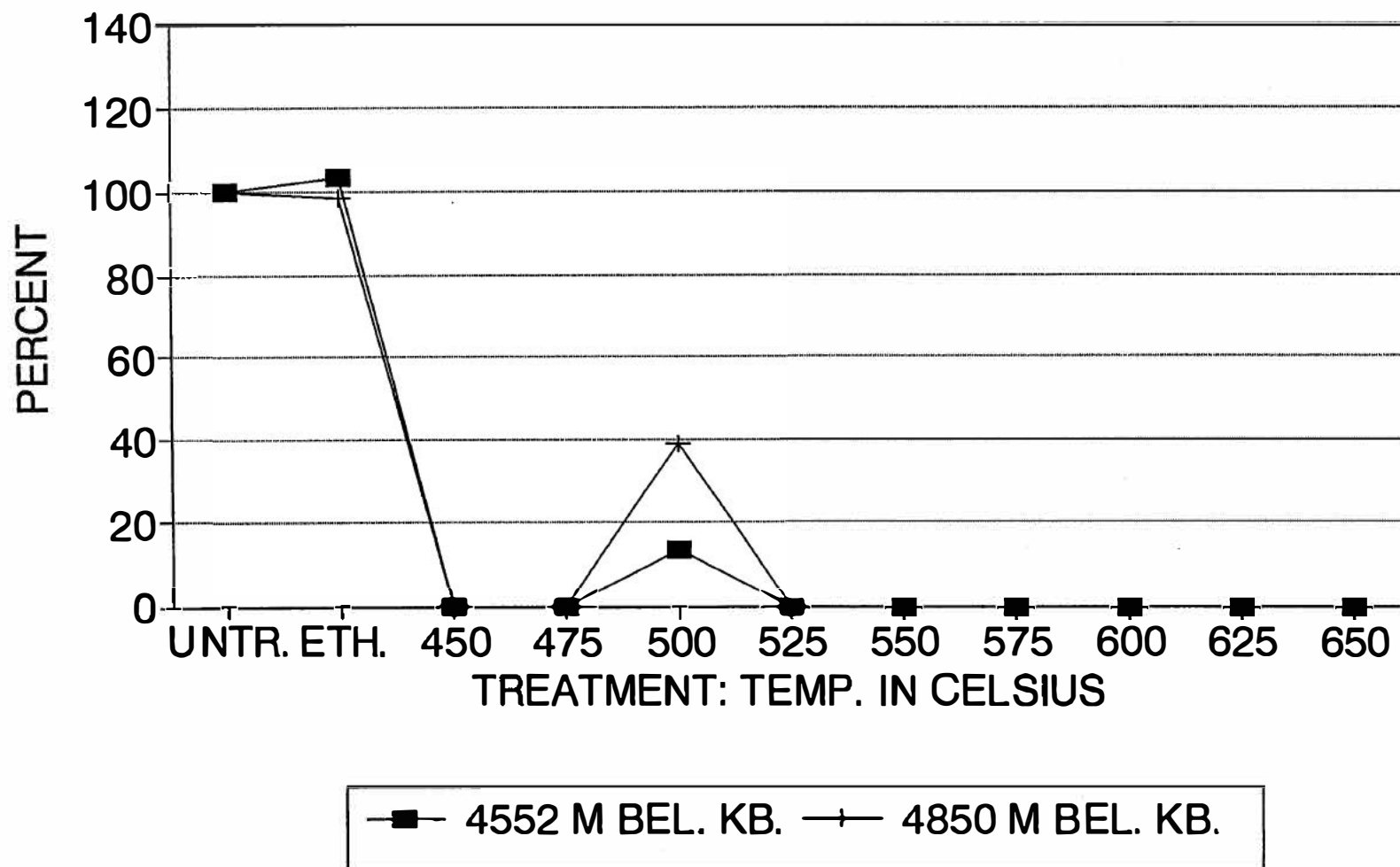
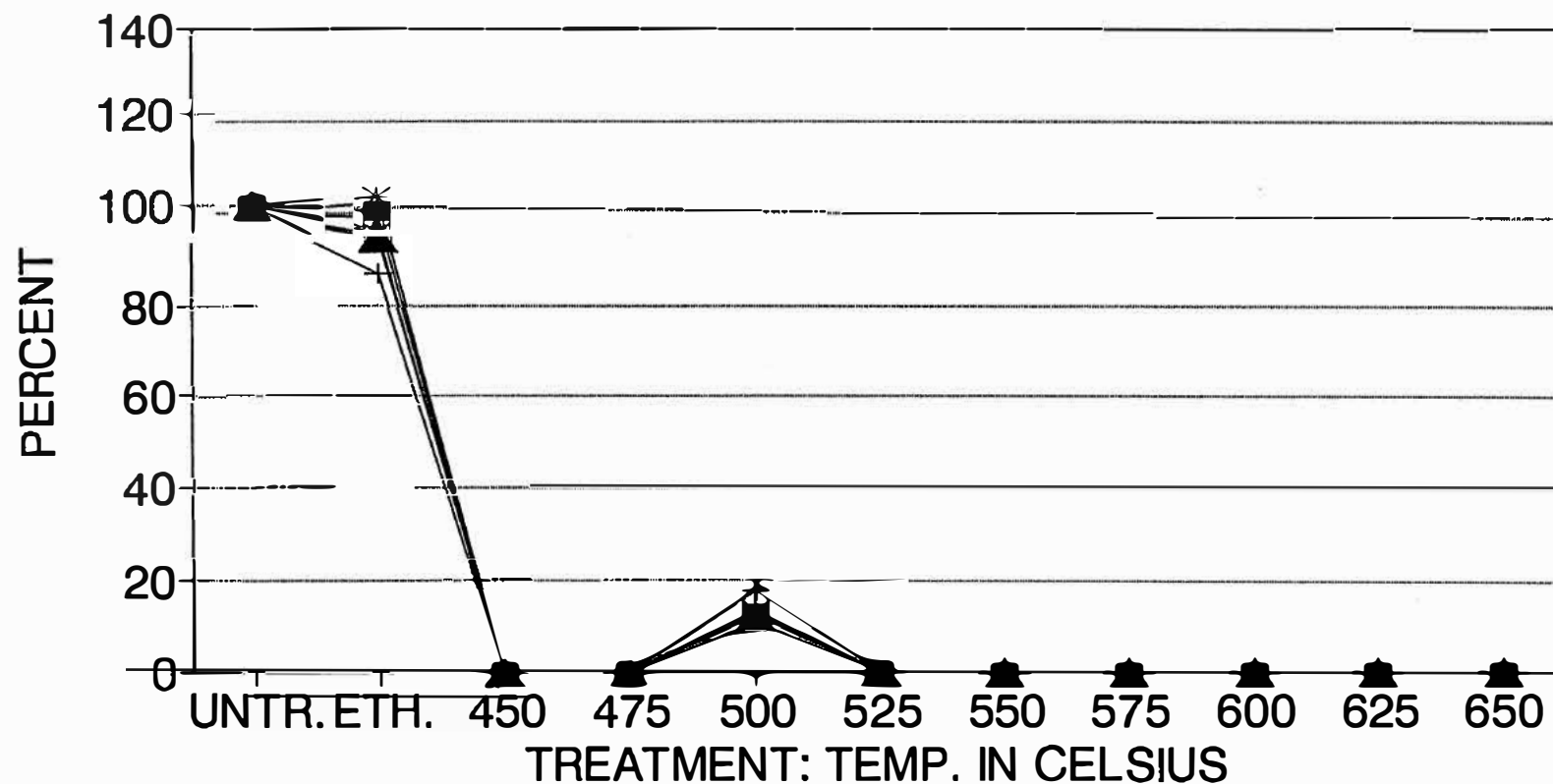


Fig. 22

WELL: JEPPE-1

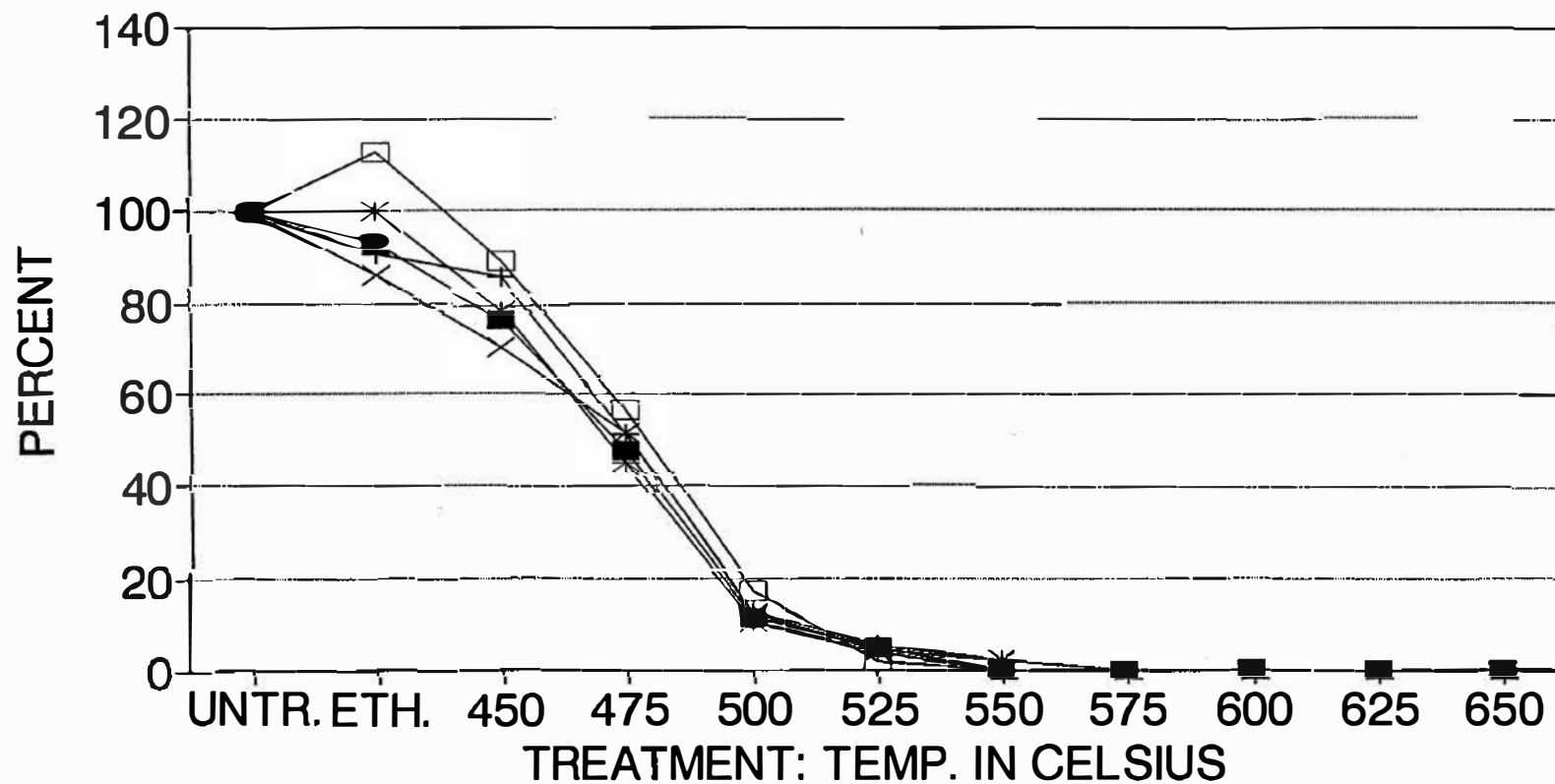
SIZE OF 7Å KAOLINITE XRD-REFLECTION



—■— 4582 M BEL. KB. —+— 4617 M BEL. KB. —*— 4647 M BEL. KB.
 —□— 4660 M BEL. KB. —x— 4675 M BEL. KB. —▲— 4747 M BEL. KB.

WELL: JEPPE-1

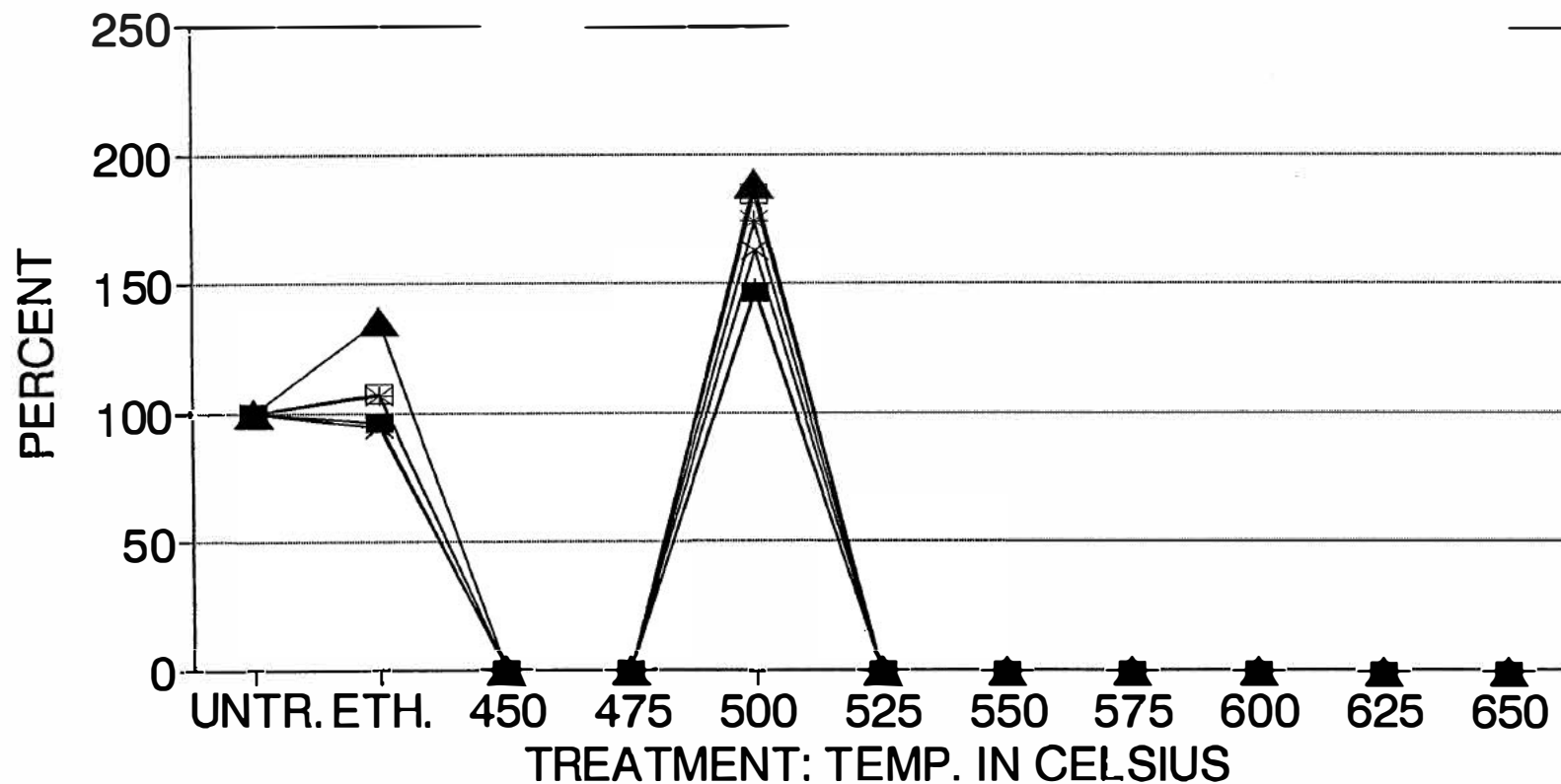
SIZE OF 7Å KAOLINITE XRD-REFLECTION



■ 4575 M BEL. KB. + 4622 M BEL. KB. * 4695 M BEL. KB.
 □ 4820 M BEL. KB. × 4860 M BEL. KB.

WELL: ELIN-1

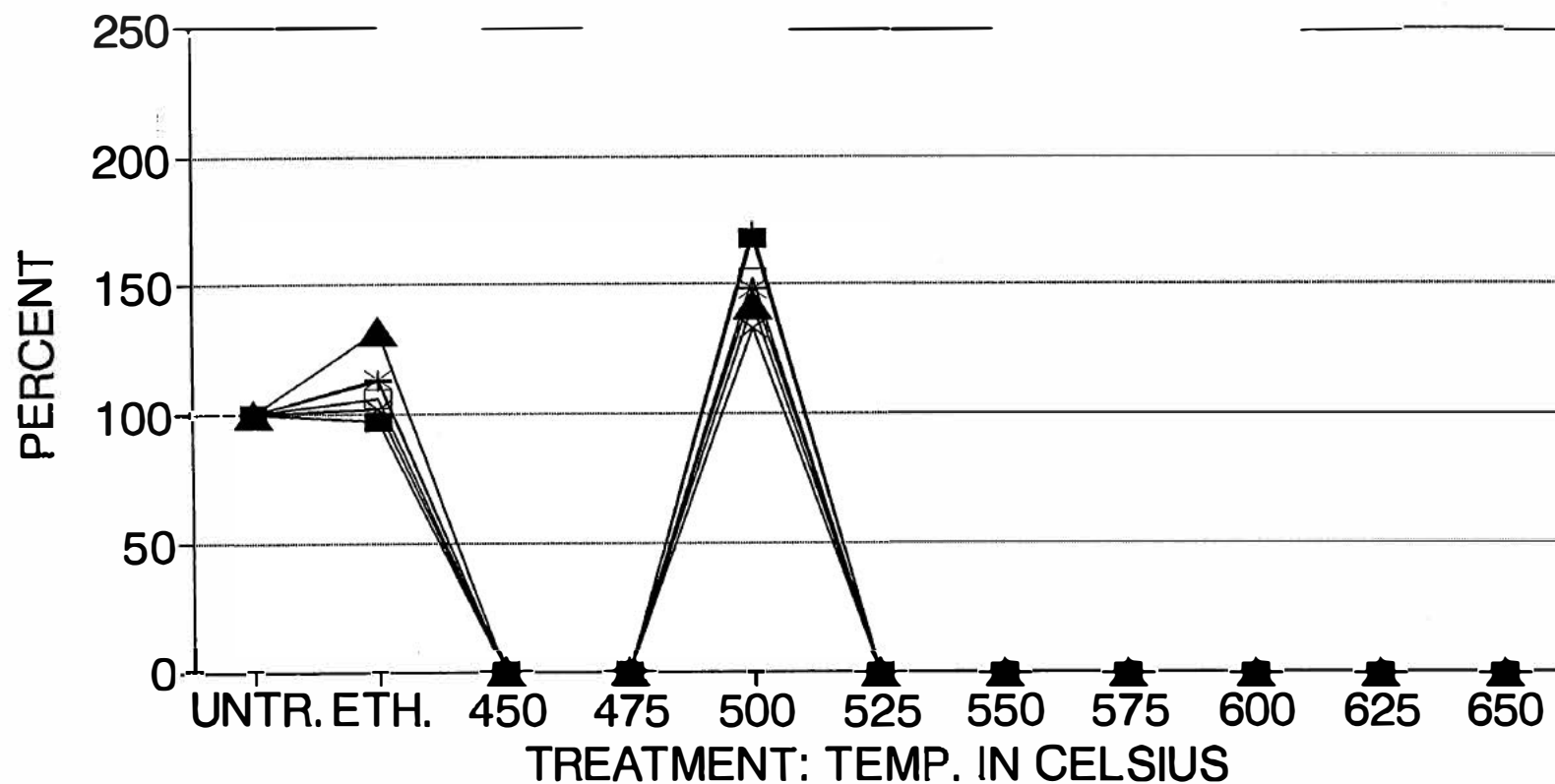
SIZE OF 10Å ILLITE XRD-REFLECTION



—■— 13805 FEET BEL. K —+— 13905 FEET BEL. K —*— 14015 FEET BEL. K
 —□— 14720 FEET BEL. K —x— 15135 FEET BEL. K —▲— 15170 FEET BEL. K

WELL: JEPPE-1

SIZE OF 10Å ILLITE XRD-REFLECTION



—■— 4582 M BEL. KB. —+— 4617 M BEL. KB. —*— 4647 M BEL. KB.
 —□— 4660 M BEL. KB. —x— 4675 M BEL. KB. —▲— 4747 M BEL. KB.

Fig. 26

WELL: ELIN-1

QLAY/QUARTZ RATIO

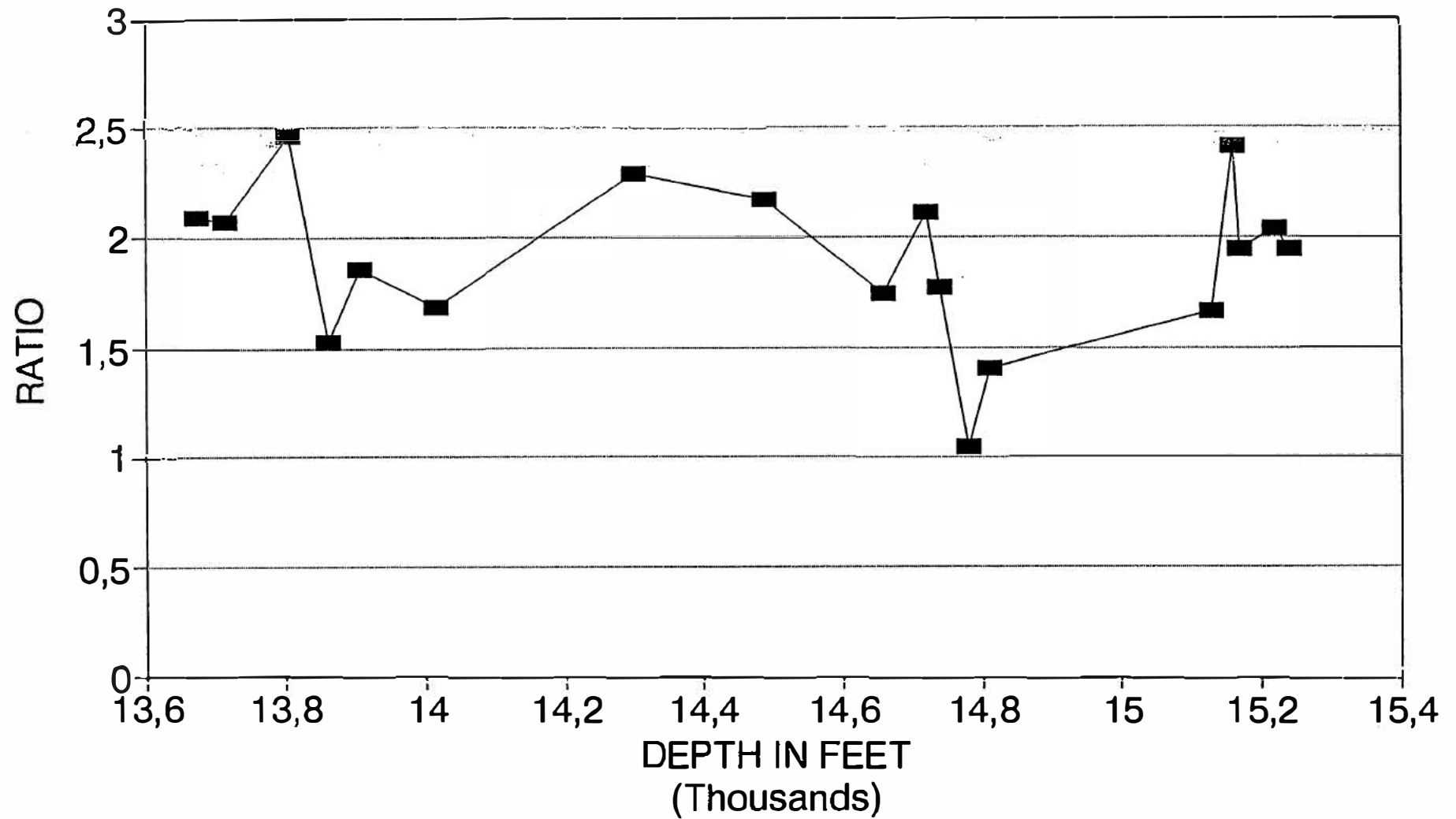


Fig. 27

WELL: JEPPE-1

CLAY/QUARTZ RATIO

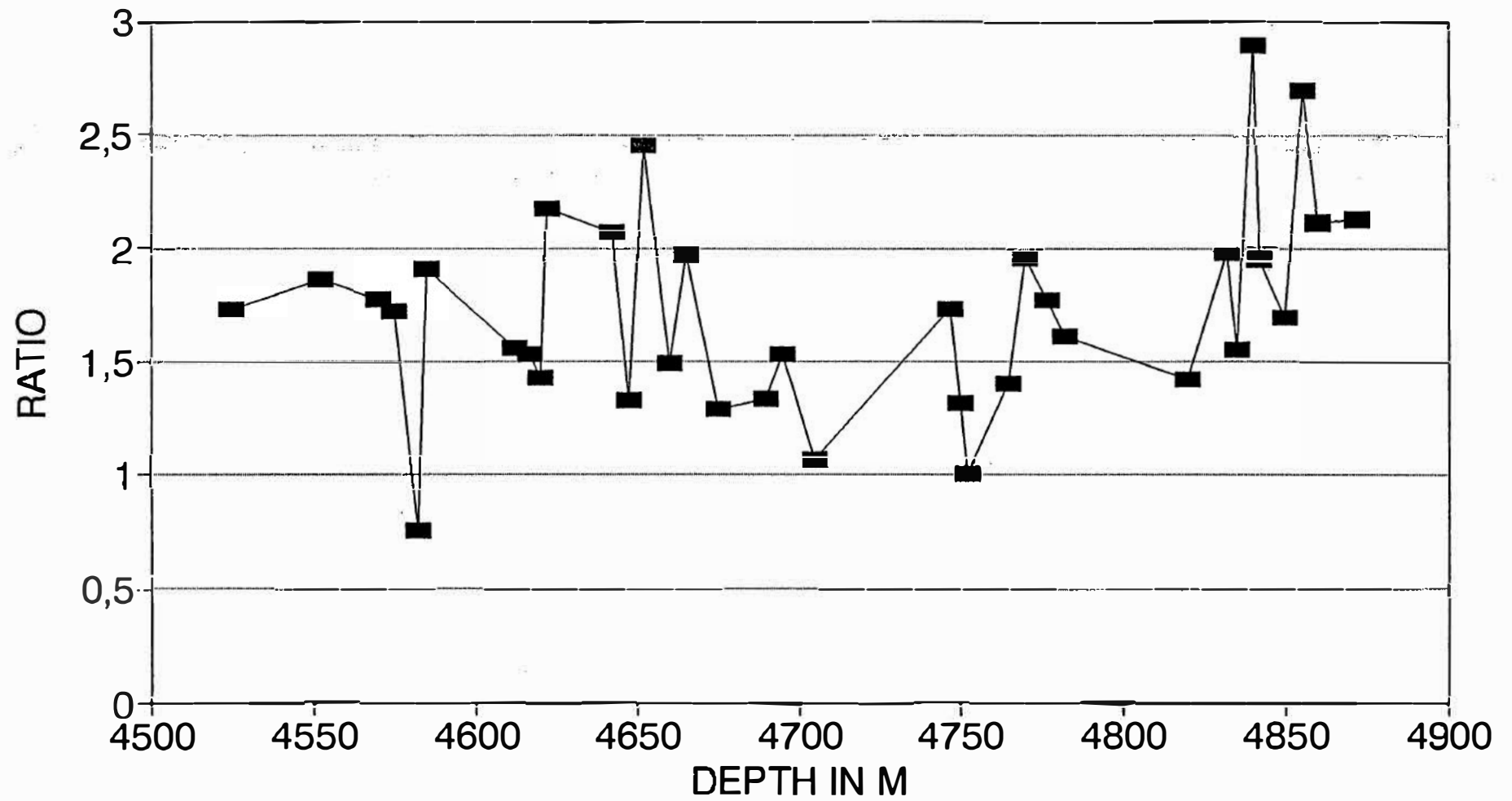
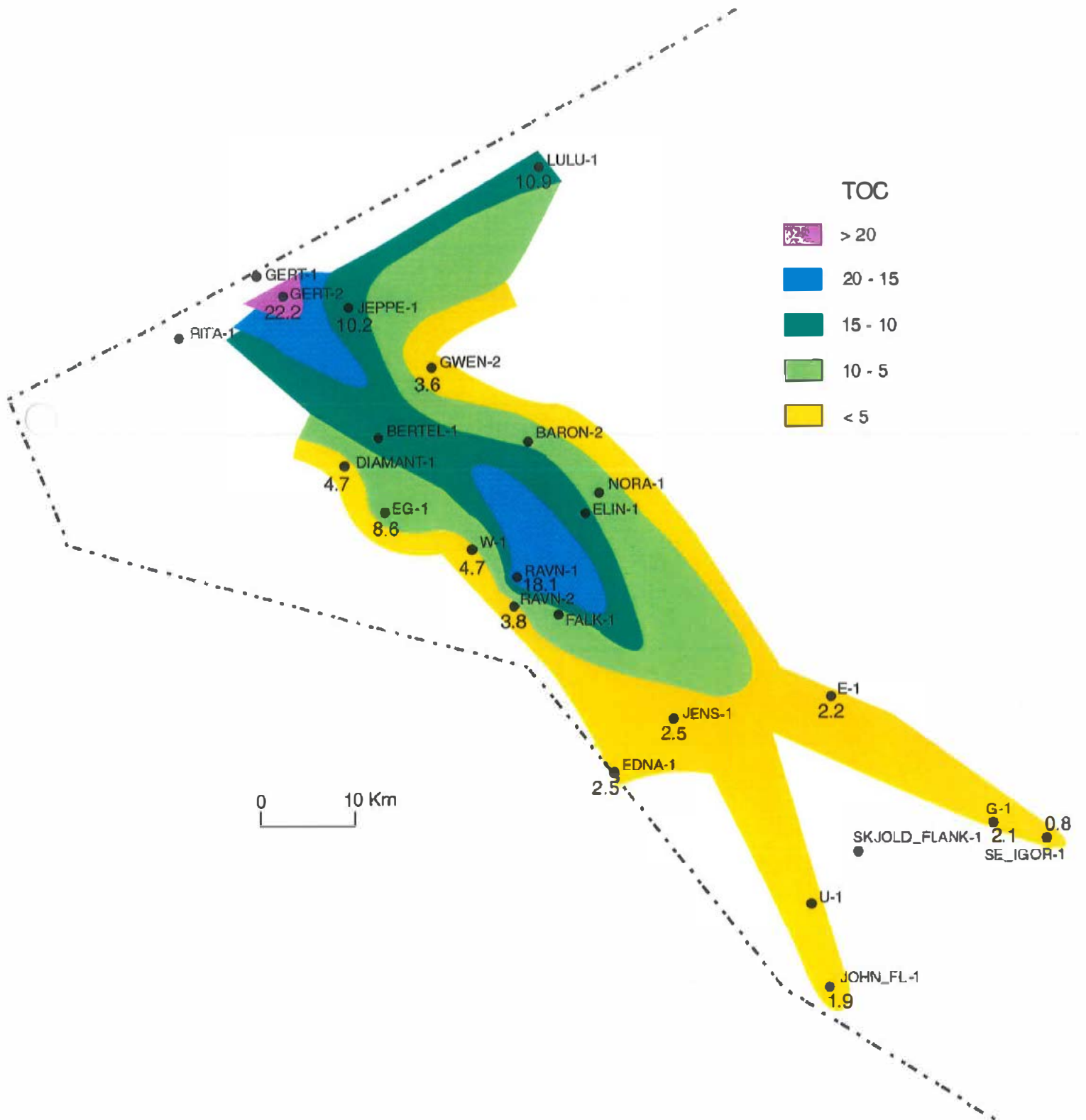
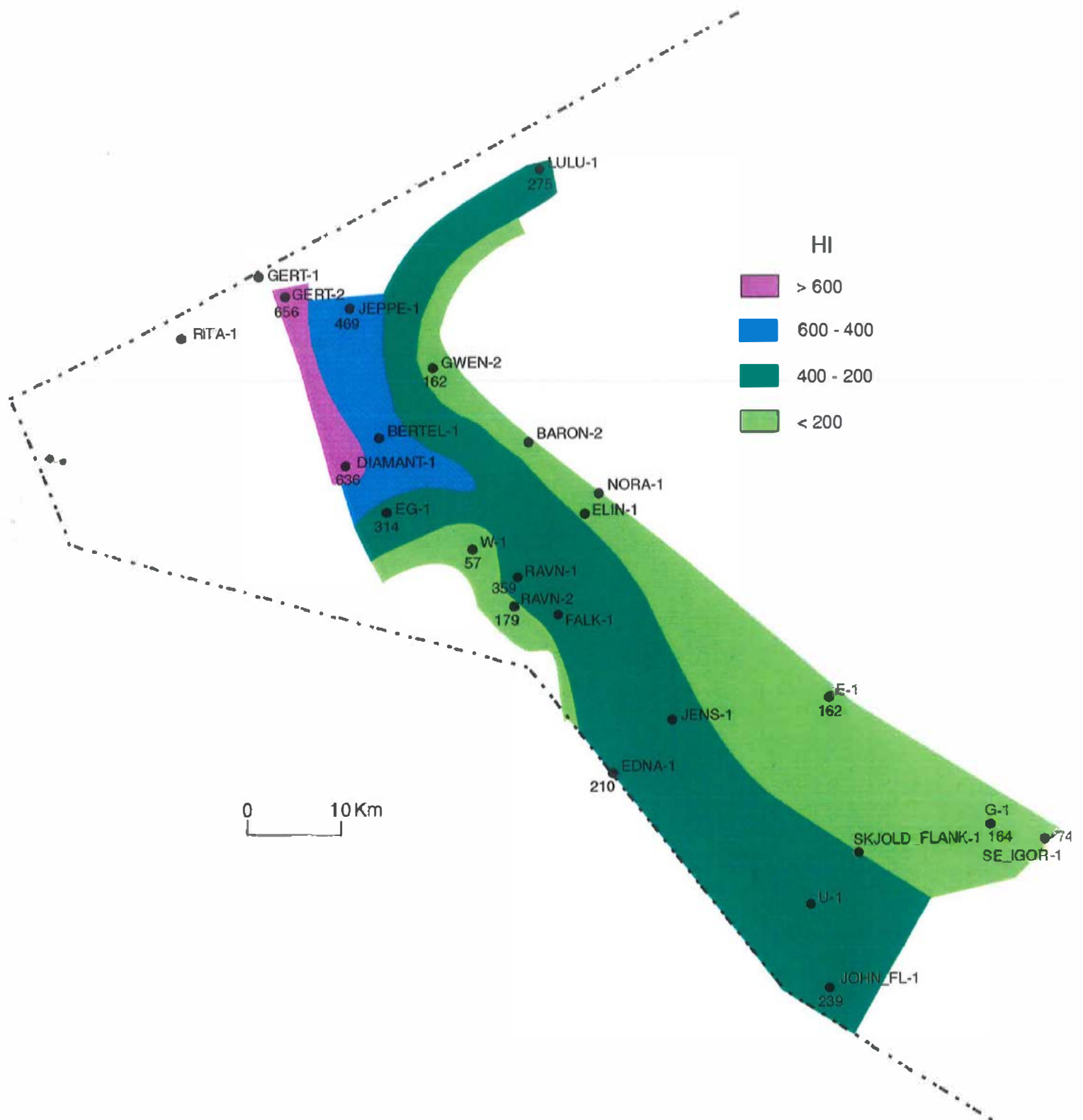


Fig. 28

Max.Toc of units HIV-1A and HIV-1B



Max.HI of units HIV-1A and HIV-1B



Appendices

Appendix 1: Results from the Geochemical analysis

Appendix 2: Results from the Palynological analysis

Appendix 3: Results from the Mineralogical analysis

Appendix 1

GERT-2

D (m)	D (feet)	TOC	Tmax	S1	S2	PI	HI
3993	13100	0.66	432	0.15	0.64	0.19	97
3996	13110	3.34	431	0.45	2.23	0.17	67
3999	13120	3.12	427	2.73	6.21	0.31	199
4002	13130	1.89	425	1.03	2.59	0.28	137
4005	13140	4.31	424	6.11	14.32	0.3	332
4008	13150	5.61	427	6.63	26.41	0.2	471
4011	13160	7.36	427	8.37	36.96	0.18	502
4014	13170	5.97	423	5.77	28.57	0.17	479
4017	13180	9.23	426	5.29	49.02	0.1	531
4020	13190	9.68	425	8.66	47.66	0.15	492
4023	13200	5.57	428	3.31	26.37	0.11	473
4026	13210	9.46	429	18.35	53.08	0.26	561
4029	13220	4.27	430	6.67	20.12	0.25	471
4033	13230	2.45	430	3.77	10.69	0.26	436
4036	13240	2.26	432	3.18	9.18	0.26	406
4039	13250	3.67	433	3.18	14.05	0.18	383
4042	13260	6.4	430	9.65	30.22	0.24	472
4045	13270	4.47	428	6.51	20.93	0.24	468
4048	13280	3.92	431	2.51	14.56	0.15	371
4051	13290	3.25	432	2.39	10.9	0.18	335
4054	13300	2.36	431	1.95	7.43	0.21	315
4057	13310	4.72	430	5.02	19.7	0.2	417
4060	13320	4.67	430	6.66	21.73	0.23	465
4063	13330	2.74	434	1.54	8.73	0.15	319
4066	13340	4.46	431	4	17.35	0.19	389
4069	13350	2.79	433	0.92	5.95	0.13	213
4072	13360	4.53	432	2.85	13.36	0.18	295
4075	13370	3.5	432	1.69	9.29	0.15	265
4078	13380	1.54	434	0.48	3.22	0.13	209
4081	13390	4.52	430	4.47	10.17	0.31	225
4084	13400	2.76	433	1.38	7.65	0.15	277
4087	13410	3.35	431	3.08	11.26	0.21	336
4090	13420	8.04	431	14	40.24	0.26	500
4093	13430	5.35	431	7.96	23.13	0.26	432
4218	13840	2.33	435	2.02	6.34	0.24	272
4221	13850	2.38	433	1.16	5.68	0.17	239
4225	13860	2.19	433	1.64	5.68	0.22	259
4228	13870	2.55	431	2.05	6.78	0.23	266
4231	13880	2.43	433	1.61	6.29	0.2	259
4234	13890	6.11	429	8.09	27.35	0.23	448
4237	13900	3.84	431	4.78	13.58	0.26	354
4240	13910	4.16	433	4.76	18.36	0.21	441
4243	13920	4.39	430	5.61	17.58	0.24	400
4246	13930	4.79	429	7.58	20.98	0.27	438
4249	13940	3.67	432	4.19	14.8	0.22	403
4252	13950	4.69	427	6.42	18.56	0.26	396
4255	13960	3.25	433	2.79	11	0.2	338
4258	13970	3.75	432	3.09	12.76	0.19	340
4261	13980	7.45	430	12.5	36.28	0.26	487
4264	13990	4.47	431	5.5	17.31	0.24	387
4267	14000	4.35	430	6.64	18.48	0.26	425
4270	14010	10.12	428	20.58	52.88	0.28	523

Appendix 1

4273	14020	4.9	429	7.89	22.33	0.26	456
4276	14030	4.25	430	5.46	18.59	0.23	437
4279	14040	4.66	431	6.81	19.55	0.26	420
4282	14050	2.89	432	2.85	8.4	0.25	291
4285	14060	3.45	431	2.67	11.6	0.19	336
4289	14070	4.24	430	6.18	15.57	0.28	367
4292	14080	3.37	433	3.19	10.89	0.23	323
4295	14090	5.52	429	9.25	23.42	0.28	424
4298	14100	7.3	426	11.76	32.13	0.27	440
4301	14110	4.93	428	7.14	20.49	0.26	416
4304	14120	3.41	431	3.01	10.78	0.22	316
4307	14130	8.23	428	9.76	36.6	0.21	445
4310	14140	4.34	430	2.06	9.91	0.17	228
4313	14150	5.68	428	4.58	19.56	0.19	344
4316	14160	12.93	430	22	79.65	0.22	616
4319	14170	10.25	429	15.05	50.11	0.23	489
4322	14180	5.72	430	8.02	24.87	0.24	435
4325	14190	5.86	431	10.5	24.74	0.3	422
4328	14200	11.98	430	20.86	65.37	0.24	546
4331	14210	9.02	429	14.74	46.81	0.24	519
4334	14220	1.5	431	1.68	3.63	0.32	242
4337	14230	7.3	429	11.16	34.72	0.24	476
4340	14240	4.13	432	5.13	13.14	0.28	318
4343	14250	10.78	427	19.29	57.29	0.25	531
4346	14260	13.72	430	25.69	76.7	0.25	559
4349	14270	4.37	431	6.29	15.43	0.29	353
4353	14280	9.29	431	15.27	47.53	0.24	512
4356	14290	5.91	429	9.84	25.33	0.28	429
4359	14300	3.41	425	4.44	10.86	0.29	318
4362	14310	2.63	433	2.22	7.22	0.24	275
4365	14320	2.81	434	1.98	7.73	0.2	275
4368	14330	2.51	434	1.67	5.92	0.22	236
4371	14340	1.02	435	0.65	2.36	0.22	231
4374	14350	6.24	428	4.41	18.39	0.19	295
4377	14360	6.17	427	2.78	16.23	0.15	263
4380	14370	4.17	430	1.46	7.29	0.17	175
4383	14380	4.97	433	1.41	8.09	0.15	163
4386	14390	2.62	432	1.23	6.06	0.17	231
4389	14400	2.91	433	1.55	7.54	0.17	259
4392	14410	2.52	433	1.26	6.14	0.17	244
4395	14420	2.68	434	1.32	7.7	0.15	287
4398	14430	2.91	428	1.86	9.6	0.16	330
4401	14440	2.28	432	1	6.05	0.14	265
4404	14450	2.22	433	1.15	5.69	0.17	256
4407	14460	2.82	433	1.55	8.21	0.16	291
4410	14470	3.6	432	3.05	14.59	0.17	405
4414	14480	5.16	430	5.91	23.92	0.2	464
4417	14490	20.16	434	41.56	123.09	0.25	611
4420	14500	2.72	434	1.68	8.15	0.17	300
4423	14510	5.98	430	7.79	28.97	0.21	484
4426	14520	8.6	428	14.66	44.52	0.25	518
4429	14530	6.24	428	9.65	31.72	0.23	508
4432	14540	7.91	431	12.39	40.2	0.24	508
4435	14550	2.88	432	1.58	7.77	0.17	270
4438	14560	5.37	431	1.63	9.53	0.15	177
4441	14570	3.19	432	1.48	7.14	0.17	224

Appendix 1

4444	14580	2.69	431	1.53	6.38	0.19	237
4447	14590	20.54	434	45	134.67	0.25	656
4450	14600	11.3	432	18.67	63.41	0.23	561
4453	14610	22.15	433	46.28	135.57	0.25	612
4456	14620	15.21	429	31.64	86.44	0.27	568
4459	14630	4.73	431	5.4	18.33	0.23	388
4462	14640	3.5	433	3.88	11.36	0.25	325
4465	14650	3.59	430	4.11	12.79	0.24	356
4468	14660	3.09	432	3.16	10.21	0.24	330
4471	14670	3.28	433	3.25	9.49	0.26	289
4474	14680	4.95	429	6.39	19.97	0.24	403
4478	14690	2.46	433	1.81	6.18	0.23	251
4481	14700	3.03	433	2.54	8.93	0.22	295
4484	14710	3.27	433	2.83	10.64	0.21	325
4487	14720	3.87	431	3.76	13.92	0.21	360
4490	14730	2.13	433	1.19	4.75	0.2	223
4493	14740	2.38	433	1.8	5.88	0.23	247
4496	14750	2.87	429	2.68	8.93	0.23	311
4499	14760	2.93	434	2.84	8.06	0.26	275
4502	14770	3.06	432	3.18	9.13	0.26	298
4505	14780	2.24	435	1.44	6.16	0.19	275
4508	14790	3.17	431	2.55	10.9	0.19	344
4511	14800	2.21	436	1.72	5.32	0.24	241
4514	14810	2.35	433	1.62	6.51	0.2	277
4517	14820	1.99	434	1.57	5.52	0.22	277
4520	14830	2.38	435	1.41	5.77	0.2	242
4523	14840	2.77	433	2.03	7.25	0.22	262
4526	14850	2.24	434	1.37	5.24	0.21	234
4529	14860	2.53	434	1.57	5.49	0.22	217
4532	14870	1.28	436	0.88	2.97	0.23	232
4535	14880	4.32	434	3.54	13.06	0.21	302
4538	14890	8.27	435	6.43	27.75	0.19	336
4542	14900	6.06	435	4.72	19.36	0.2	319
4545	14910	3.31	435	2.3	8.04	0.22	243
4548	14920	2.78	434	1.93	7.03	0.22	253
4551	14930	3.57	435	2.15	8.29	0.21	232
4554	14940	3.3	433	2.27	7.02	0.24	213
4557	14950	3.25	434	1.98	9.02	0.18	278
4560	14960	2.37	434	1.36	5.25	0.21	222
4563	14970	2.03	434	1.29	4.78	0.21	235
4566	14980	2.31	436	1.15	4.75	0.19	206
4569	14990	2.84	432	2.16	7.63	0.22	269
4572	15000	2.33	436	1.17	4.91	0.19	211
4575	15010	2.75	434	1.65	7.5	0.18	273
4578	15020	2.45	434	1.41	5.37	0.21	219
4581	15030	2.51	435	1.31	5.43	0.19	216
4584	15040	2.42	432	1.13	5.2	0.18	215
4587	15050	1.88	432	0.99	3.87	0.2	206
4590	15060	2.15	436	1.15	4.3	0.21	200
4593	15070	2.2	435	0.97	4.32	0.18	196
4596	15080	2.1	434	1.01	4.52	0.18	215
4599	15090	2.18	434	1.13	3.98	0.22	183
4602	15100	2.66	435	1.5	5.2	0.22	195
4606	15110	3.17	436	2.22	7.59	0.23	239
4609	15120	2.33	432	1.45	5.39	0.21	231
4612	15130	2.32	435	1.38	5.01	0.22	216

Appendix 1

4615	15140	2.91	437	1.66	5.69	0.23	196
4618	15150	2.72	434	2.01	6.73	0.23	247
4621	15160	6.2	434	5.75	15.19	0.27	245
4624	15170	3.95	434	3.19	10.12	0.24	256
4627	15180	5.47	431	5.22	17.59	0.23	322
4630	15190	3.55	435	2.66	8	0.25	225
4633	15200	2.9	435	2	7.7	0.21	266
4636	15210	2.62	433	1.62	5.97	0.21	228
4639	15220	7.71	435	7.04	23.47	0.23	304
4642	15230	4.25	434	2.85	11.5	0.2	271
4645	15240	3.32	432	2.22	9.3	0.19	280
4648	15250	4.95	428	4.96	14.1	0.26	285
4651	15260	5.67	432	5.62	15.68	0.26	277
4654	15270	8	433	7.78	23.52	0.25	294
4657	15280	3.81	433	3.38	9.93	0.25	261
4660	15290	3.85	434	3	9.21	0.25	239
4663	15300	2.58	434	1.65	5.88	0.22	228
4666	15310	3.96	434	3.54	11.12	0.24	281
4670	15320	2.96	434	1.95	6.55	0.23	221
4673	15330	3.2	435	1.89	6.82	0.22	213
4676	15340	2.19	434	1.25	4.93	0.2	225
4679	15350	2.55	434	1.23	5.39	0.19	211
4682	15360	2.12	436	1.01	4.51	0.18	213
4685	15370	2.34	433	1.22	5.96	0.17	255
4688	15380	3.25	433	2.25	8	0.22	246
4691	15390	2.15	434	1.03	4.52	0.19	210
4694	15400	2.52	432	1.81	5.82	0.24	231
4697	15410	2.3	434	1.18	5.45	0.18	237
4700	15420	2.42	435	1.09	5.15	0.17	213
4703	15430	3.02	433	1.62	6.13	0.21	203
4706	15440	5.37	433	4.04	11.45	0.26	213
4709	15450	4.25	431	2.77	8.42	0.25	198
4712	15460	5.98	431	5.37	13.43	0.29	225
4715	15470	5.71	432	4.96	13.4	0.27	235
4718	15480	6.72	433	7.23	17.87	0.29	266
4721	15490	6.52	435	7.32	17.2	0.3	264
4724	15500	8.45	437	11.51	27.6	0.29	327
4727	15510	7.61	435	9.79	20.7	0.32	272
4730	15520	6.15	436	6.36	16.44	0.28	267
4734	15530	6.56	433	7.47	17.17	0.3	262
4737	15540	3.45	429	2.82	7.96	0.26	231
4740	15550	3.79	434	3.37	9.21	0.27	243
4743	15560	4.06	436	3.4	9.58	0.26	236
4746	15570	3.58	435	3.19	8.7	0.27	243
4749	15580	3.01	435	2.39	6.47	0.27	215
4752	15590	2.61	437	1.7	6.29	0.21	241
4755	15600	3.2	435	2.46	10.95	0.18	342
4758	15610	2.43	435	1.48	5.53	0.21	228
4761	15620	2.7	437	2.07	6.58	0.24	244
4764	15630	2.2	433	1.47	4.61	0.24	210
4767	15640	2.44	437	1.6	5.45	0.23	223
4770	15650	2.39	436	1.63	5.28	0.24	221
4773	15660	2.82	435	2.07	7.24	0.22	257
4776	15670	2.26	436	1.45	5.41	0.21	239
4779	15680	2	434	1	4.39	0.19	219
4782	15690	2.18	435	1.27	4.55	0.22	209

Appendix 1

4785	15700	2.15	435	1.27	5.22	0.2	243
4788	15710	2.46	435	1.3	5.7	0.19	232
4791	15720	2.55	435	1.52	6.26	0.2	245
4795	15730	2.01	431	1.05	4.37	0.19	217
4798	15740	2.12	435	1.16	5.55	0.17	262
4801	15750	2.09	438	1.04	5.52	0.16	264
4804	15760	2.37	437	1.12	5.74	0.16	242
4807	15770	2.28	433	1.43	4.66	0.23	204
4810	15780	2.38	437	1.21	5.85	0.17	246
4813	15790	2.17	432	1.09	4.74	0.19	218
4816	15800	2.41	437	1.47	6.77	0.18	281
4837	15870	2.92	436	2.48	9.75	0.2	334
4840	15880	3.12	434	3.04	11.73	0.21	376
4843	15890	2.13	435	1.52	6.8	0.18	319
4846	15900	2.59	435	1.94	7.02	0.22	271
4849	15910	1.99	431	1.45	5.25	0.22	264
4852	15920	1.25	437	0.76	2.59	0.23	207
4855	15930	0.94	438	0.46	1.67	0.22	178
4859	15940	1.93	438	1.43	5.95	0.19	308
4862	15950	2.18	433	1.25	5.74	0.18	263
4865	15960	1.79	435	1.16	4.34	0.21	242
4868	15970	2.3	437	1.75	6.48	0.21	282

Appendix 1

GERT-2 (extracted samples)

D (m)	D (feet)	TOC	Tmax	S1	S2	PI	HI
4097	13440	1.83	436	0.04	4.37	0.01	239
4100	13450	1.90	435	0.04	4.94	0.01	260
4103	13460	2.53	436	0.05	6.2	0.01	245
4106	13470	1.91	434	0.04	4.26	0.01	223
4109	13480	2.46	434	0.05	6.12	0.01	249
4112	13490	1.87	436	0.03	4.27	0.01	228
4115	13500	2.14	435	0.05	5.19	0.01	243
4118	13510	2.04	436	0.05	4.65	0.01	228
4121	13520	1.72	436	0.03	3.61	0.01	210
4124	13530	2.04	434	0.05	4.98	0.01	244
4127	13540	1.75	436	0.03	4.02	0.01	230
4130	13550	2.03	435	0.08	4.33	0.02	213
4133	13560	2.26	435	0.09	5.38	0.02	238
4136	13570	2.29	435	0.11	4.65	0.02	203
4139	13580	1.88	435	0.05	3.71	0.01	197
4142	13590	1.97	432	0.09	4.14	0.02	210
4145	13600	5.77	435	0.27	7.76	0.03	134
4148	13610	6.68	431	0.47	10.45	0.04	156
4151	13620	5.45	432	0.18	10.38	0.02	190
4154	13630	1.88	436	0.08	4.05	0.02	215
4157	13640	2.55	434	0.09	4.78	0.02	187
4161	13650	1.94	435	0.07	4.05	0.02	209
4164	13660	2.01	434	0.08	4.55	0.02	226
4167	13670	1.89	435	0.05	4.17	0.01	221
4170	13680	1.75	436	0.05	3.57	0.01	204
4173	13690	2.37	432	0.07	5.49	0.01	232
4176	13700	2.35	435	0.09	5.03	0.02	214
4179	13710	2.52	435	0.1	6.18	0.02	245
4182	13720	1.00	441	0.07	2.05	0.03	205
4185	13730	2.84	434	0.1	4.94	0.02	174
4188	13740	2.57	435	0.1	7.17	0.01	279
4191	13750	2.94	436	0.14	8.74	0.02	297
4194	13760	2.46	436	0.1	6.23	0.02	253
4197	13770	2.97	436	0.14	7.48	0.02	252
4200	13780	2.37	436	0.12	5.99	0.02	253
4203	13790	1.87	436	0.09	4.28	0.02	229
4206	13800	2.63	434	0.11	7.14	0.02	271
4209	13810	1.89	435	0.08	4.04	0.02	214
4212	13820	1.20	435	0.06	2.27	0.03	189
4215	13830	2.95	436	0.15	8.53	0.02	289

Appendix 1

JEPPE-1

D (m)	D (feet)	TOC	Tmax	S1	S2	PI	HI
4401.36	14440	5.50	445	4.48	27.95	0.14	508
4401.37	14440	7.27	446	3.61	33.02	0.10	454
4402.67	14444	8.35	445	4.51	39.54	0.10	473
4402.69	14445	6.81	444	4.01	31.22	0.11	458
4402.71	14445	7.06	444	5.16	37.66	0.12	533
4403.45	14447	5.40	441	5.30	30.02	0.15	556
4404.18	14449	5.19	443	4.12	24.74	0.14	477
4404.97	14452	6.57	441	5.49	35.69	0.13	543
4404.97	14452	6.80	441	7.71	40.46	0.16	595
4406.98	14459	5.89	443	3.56	28.72	0.11	488
4407.19	14459	5.61	444	3.01	27.87	0.10	497
4407.41	14460	3.40	441	3.42	16.69	0.17	491
4408.02	14462	1.50	441	0.90	7.29	0.11	486
4408.09	14462	4.68	441	2.45	20.75	0.11	443
4409.24	14466	1.10	440	1.71	3.99	0.30	363
4409.35	14466	3.84	441	2.62	14.51	0.15	378
4410.46	14470	0.20	442	0.22	0.36	0.38	181
4410.86	14471	5.26	443	2.60	22.35	0.10	425
4411.07	14472	4.60	442	2.64	23.74	0.10	516
4411.12	14472	0.49	434	2.02	0.83	0.71	169
4411.36	14473	0.03	438	0.04	0.16	0.20	533
4411.98	14475	4.60	441	3.21	25.99	0.11	565
4412.94	14478	7.13	433	5.42	36.92	0.13	518
4414.11	14482	3.90	443	3.34	18.92	0.15	485
4414.72	14484	5.25	445	3.10	22.61	0.12	431
4414.97	14485	0.15	440	0.10	0.26	0.28	173
4415.03	14485	1.00	441	1.65	3.50	0.32	350
4415.49	14487	4.68	445	2.57	19.30	0.12	412
4416.86	14491	3.40	441	2.70	16.59	0.14	488
4417.33	14493	4.51	442	2.86	18.25	0.14	405
4417.47	14493	2.28	443	2.25	6.29	0.26	276
4418.08	14495	2.70	440	2.78	13.58	0.17	503
4418.73	14497	1.23	442	1.71	3.46	0.33	281
4419.3	14499	6.10	442	4.97	30.50	0.14	500
4419.36	14499	4.73	445	2.69	22.04	0.11	466
4440	14567	0.10	416	0.09	0.12	0.43	120
4452	14606	0.79	436	0.12	0.39	0.24	49
4455	14616	0.10	436	0.06	0.32	0.16	320
4457	14623	0.29	438	0.05	0.13	0.28	45
4460	14633	0.34	-999	-999	-999	-999	-999
4460	14633	1.50	439	0.50	0.69	0.42	46
4462	14639	0.10	-999	-999	-999	-999	-999
4465	14649	0.98	-999	-999	-999	-999	-999
4467	14656	1.01	-999	-999	-999	-999	-999
4470	14665	0.81	-999	-999	-999	-999	-999
4470	14665	1.40	439	0.39	0.39	0.50	28
4472	14672	1.19	-999	-999	-999	-999	-999
4475	14682	0.72	439	0.06	0.04	0.60	6
4477	14688	1.42	436	0.11	0.09	0.55	6
4480	14698	0.01	-999	-999	-999	-999	-999
4480	14698	1.50	450	0.38	0.29	0.57	19
4482	14705	1.19	437	0.15	0.33	0.31	28
4485	14715	0.88	439	0.06	0.14	0.30	16

Appendix 1

4487	14721	0.89	438	0.08	0.02	0.80	2
4490	14731	1.22	440	0.11	0.11	0.50	9
4490	14731	1.10	440	0.45	0.48	0.48	44
4492	14738	1.47	434	0.15	0.01	0.94	1
4495	14747	1.58	436	0.15	0.09	0.63	6
4497	14754	1.02	439	0.09	0.11	0.45	11
4500	14764	1.04	446	0.07	0.11	0.39	11
4500	14764	1.40	442	0.42	0.63	0.40	45
4502	14770	1.37	438	0.16	0.26	0.38	19
4505	14780	1.17	438	0.14	0.18	0.44	15
4507	14787	0.97	-999	-999	-999	-999	-999
4510	14797	0.05	435	0.14	0.02	0.88	40
4510	14797	1.10	439	0.33	0.34	0.49	31
4512	14803	0.78	438	0.08	0.08	0.50	10
4515	14813	0.93	439	0.10	0.06	0.63	6
4517	14820	1.42	437	0.13	0.05	0.72	4
4520	14829	1.05	439	0.08	0.08	0.50	8
4520	14829	1.05	443	0.53	0.95	0.36	63
4522	14836	0.03	428	0.14	0.06	0.70	0
4525	14846	0.88	437	0.09	0.05	0.64	6
4527	14852	0.93	440	0.16	0.12	0.57	13
4530	14862	1.05	436	0.28	0.18	0.61	17
4530	14862	1.10	434	0.31	0.23	0.57	21
4532	14869	0.96	435	0.12	0.04	0.75	4
4537	14885	1.56	437	0.25	0.62	0.29	40
4540	14895	1.04	437	0.13	0.23	0.36	22
4540	14895	1.00	443	0.65	1.11	0.37	111
4542	14902	0.84	439	0.13	0.25	0.34	30
4545	14911	0.54	437	0.08	0.08	0.50	15
4547	14918	0.80	436	0.09	0.03	0.75	4
4550	14928	1.16	435	0.13	0.01	0.93	1
4550	14928	1.20	439	0.36	0.24	0.60	20
4552	14934	1.33	435	0.19	0.23	0.45	17
4555	14944	0.80	436	0.24	0.16	0.60	20
4557	14951	1.23	439	0.16	0.26	0.38	21
4560	14961	1.53	429	0.18	0.08	0.69	5
4560	14961	0.60	442	0.47	0.70	0.40	117
4562	14967	1.38	438	0.24	0.38	0.39	28
4565	14977	1.61	439	0.18	0.14	0.56	9
4567	14984	1.86	438	0.31	0.35	0.47	19
4570	14993	1.91	438	0.26	0.30	0.46	16
4570	14993	1.90	443	0.76	1.14	0.40	60
4572	15000	2.14	438	0.37	0.74	0.33	35
4575	15010	1.90	438	0.32	0.57	0.36	30
4575	15010	2.50	442	1.09	2.03	0.35	81
4577	15016	2.39	439	0.42	0.77	0.35	32
4580	15026	1.06	440	0.24	0.60	0.29	57
4580	15026	3.00	443	2.03	5.49	0.27	183
4582	15033	1.30	437	0.13	0.13	0.50	10
4585	15043	1.43	440	0.23	0.33	0.41	23
4587	15049	1.72	436	0.28	0.46	0.38	27
4590	15059	1.25	440	0.23	0.46	0.33	37
4590	15059	1.70	440	0.78	1.07	0.42	63
4592	15066	2.14	439	0.33	0.53	0.38	25
4595	15075	0.90	436	0.22	0.16	0.58	18
4600	15092	1.55	434	0.80	1.60	0.33	103

Appendix 1

4600	15092	2.00	440	0.78	0.84	0.48	42
4602	15098	2.27	436	0.78	1.75	0.31	77
4605	15108	1.47	439	0.26	0.54	0.33	37
4607	15115	1.63	415	0.29	0.27	0.52	17
4607	15115	1.70	439	0.59	0.43	0.58	25
4610	15125	1.43	440	0.28	0.52	0.35	36
4612	15131	1.82	439	0.24	0.22	0.52	12
4615	15141	1.92	439	0.28	0.22	0.56	11
4617	15148	2.43	439	0.47	0.61	0.44	25
4620	15157	1.86	437	0.30	0.28	0.52	15
4620	15157	1.40	436	0.55	0.45	0.55	32
4622	15164	1.04	440	0.16	0.33	0.33	32
4625	15174	1.53	437	0.30	0.16	0.65	10
4627	15180	1.03	441	0.14	0.06	0.70	6
4630	15190	1.95	435	0.84	2.16	0.28	111
4630	15190	2.20	442	0.65	0.90	0.42	41
4632	15197	1.52	439	0.25	0.41	0.38	27
4635	15207	1.82	439	0.26	0.44	0.37	24
4637	15213	2.06	438	0.57	1.40	0.29	68
4640	15223	1.40	434	0.30	0.38	0.44	27
4640	15223	2.50	439	1.16	1.90	0.38	76
4642	15230	1.51	438	0.30	0.44	0.41	29
4645	15240	1.81	437	0.59	1.07	0.36	59
4647	15246	1.50	439	0.34	0.65	0.34	43
4650	15256	1.30	439	0.26	0.34	0.43	26
4650	15256	1.60	430	1.22	1.38	0.47	86
4652	15262	1.45	433	0.22	0.22	0.50	15
4655	15272	1.69	437	0.48	0.79	0.38	47
4657	15279	2.44	434	1.78	3.66	0.33	150
4660	15289	1.36	441	0.44	0.83	0.35	61
4660	15289	1.80	440	0.57	0.72	0.44	40
4662	15295	1.96	438	0.43	0.54	0.44	28
4665	15305	1.25	437	0.54	1.32	0.29	106
4667	15312	1.34	439	0.32	0.40	0.44	30
4670	15322	0.15	435	0.21	0.17	0.55	113
4670	15322	1.10	440	0.49	0.59	0.45	54
4672	15328	1.33	438	0.33	0.37	0.47	28
4675	15338	1.55	443	0.32	0.52	0.38	34
4677	15344	1.27	438	0.20	0.12	0.63	9
4677	15344	1.10	438	0.36	0.30	0.55	27
4680	15354	1.07	438	0.13	0.15	0.46	14
4682	15361	1.27	438	0.20	0.34	0.37	27
4685	15371	0.94	440	0.19	0.15	0.56	16
4687	15377	1.41	437	0.42	0.69	0.38	49
4690	15387	0.45	-999	0.07	0.01	0.88	2
4690	15387	0.80	458	0.18	0.14	0.56	18
4692	15394	1.19	440	0.17	0.26	0.40	22
4695	15404	1.11	436	0.16	0.14	0.53	13
4697	15410	1.24	439	0.14	0.14	0.50	11
4700	15420	1.04	437	0.11	0.09	0.55	9
4700	15420	0.80	999	0.23	0.08	0.74	10
4702	15427	1.13	406	0.17	0.05	0.77	4
4705	15436	0.93	439	0.18	0.12	0.60	13
4707	15443	1.06	443	0.13	0.09	0.59	8
4710	15453	0.97	436	0.19	0.13	0.59	13
4710	15453	1.00	442	0.23	0.27	0.46	27

Appendix 1

4712	15459	1.17	437	0.16	0.32	0.33	27
4715	15469	1.55	437	0.69	1.57	0.31	101
4717	15476	1.20	439	0.38	1.16	0.25	97
4720	15486	0.92	443	0.13	0.25	0.34	27
4720	15486	0.90	437	0.26	0.17	0.60	19
4722	15492	1.29	442	0.27	0.63	0.30	49
4725	15502	1.48	441	0.29	0.76	0.28	51
4725	15502	1.50	434	0.56	0.48	0.54	32
4727	15509	1.22	441	0.18	0.46	0.28	38
4730	15518	1.00	443	0.22	0.44	0.33	44
4730	15518	1.60	442	0.87	1.10	0.44	69
4732	15525	2.71	441	0.94	2.66	0.26	98
4735	15535	4.25	439	1.97	5.42	0.27	128
4737	15541	3.53	441	1.46	3.95	0.27	112
4740	15551	3.24	441	1.14	3.36	0.25	104
4740	15551	5.60	441	2.99	5.54	0.35	99
4742	15558	2.44	438	1.47	2.92	0.33	120
4745	15568	8.00	436	5.34	15.66	0.25	196
4747	15574	3.57	440	1.57	2.86	0.35	80
4750	15584	6.37	436	3.63	10.28	0.26	161
4750	15584	7.50	440	6.77	17.40	0.28	232
4752	15591	2.39	442	0.84	1.67	0.33	70
4755	15600	1.31	440	0.27	0.51	0.35	39
4757	15607	1.40	439	0.27	0.25	0.52	18
4760	15617	1.36	440	0.26	0.24	0.52	18
4760	15617	1.70	435	0.29	0.24	0.55	14
4765	15633	1.73	440	0.47	0.75	0.39	43
4770	15650	1.71	440	0.48	0.80	0.38	47
4770	15650	3.90	439	2.49	4.84	0.34	124
4772	15656	2.16	437	0.48	0.64	0.43	30
4775	15666	3.34	436	1.48	2.00	0.43	60
4775	15666	2.40	439	1.20	1.20	0.50	50
4777	15673	8.62	436	6.77	12.63	0.35	147
4780	15682	7.60	437	5.24	11.55	0.31	152
4780	15682	4.90	445	9.85	22.98	0.30	469
4782	15689	10.24	437	7.39	17.39	0.30	170
4785	15699	4.29	439	2.10	3.55	0.37	83
4787	15705	4.02	438	1.49	2.14	0.41	53
4790	15715	2.65	441	0.66	1.02	0.39	38
4790	15715	3.00	442	1.69	2.76	0.38	92
4792	15722	3.43	440	1.30	1.75	0.43	51
4795	15732	5.69	438	3.45	6.19	0.36	109
4797	15738	5.76	438	3.16	5.53	0.36	96
4800	15748	2.68	440	0.83	1.35	0.38	50
4802	15755	1.71	438	0.30	0.34	0.47	20
4805	15764	2.01	437	0.34	0.23	0.60	11
4807	15771	1.45	438	0.21	0.17	0.55	12
4810	15781	0.09	438	0.29	0.49	0.37	544
4810	15781	2.50	441	2.02	4.10	0.33	164
4812	15787	0.75	444	0.09	0.05	0.64	7
4815	15797	1.80	442	0.31	0.62	0.33	34
4817	15804	1.39	442	0.21	0.29	0.42	21
4820	15814	1.60	440	0.28	0.28	0.50	18
4820	15814	1.20	442	0.55	0.55	0.50	46
4822	15820	1.85	439	0.34	0.36	0.49	19
4825	15830	1.96	441	0.31	0.42	0.42	21

Appendix 1

4825	15830	2.60	443	1.05	1.51	0.41	58
4827	15837	1.12	440	0.22	0.22	0.50	20
4830	15846	6.88	437	5.48	8.31	0.40	121
4832	15853	9.33	437	10.99	19.79	0.36	212
4832	15853	10.40	445	13.10	24.34	0.35	234
4835	15863	8.51	439	9.03	15.27	0.37	179
4837	15869	7.63	440	6.31	10.12	0.38	133
4840	15879	4.20	440	2.36	3.43	0.41	82
4840	15879	5.20	446	6.14	10.92	0.36	210
4842	15886	6.28	441	3.86	6.29	0.38	100
4845	15896	4.54	440	2.42	3.29	0.42	72
4847	15902	2.22	443	0.92	1.06	0.46	48
4850	15912	1.46	441	0.37	0.53	0.41	36
4850	15912	3.90	441	1.92	2.89	0.40	74
4852	15919	1.14	441	0.27	0.36	0.43	32
4855	15928	4.42	441	2.50	4.02	0.38	91
4857	15935	2.46	444	0.77	1.08	0.42	44
4860	15945	4.49	438	2.72	4.18	0.39	93
4860	15945	2.10	442	6.38	8.46	0.43	403
4862	15951	5.21	440	3.76	5.02	0.43	96
4865	15961	6.85	439	5.46	7.47	0.42	109
4867	15968	5.59	435	3.07	4.22	0.42	75
4870	15978	7.56	440	5.34	8.32	0.39	110
4870	15978	6.90	441	8.34	12.01	0.41	174
4872	15984	10.70	439	9.38	17.05	0.35	159
4875	15994	8.73	437	6.77	10.13	0.40	116
4875	15994	5.20	442	10.71	16.07	0.40	309
4877	16001	9.55	437	8.00	12.67	0.39	133
4880	16010	8.39	438	6.85	10.62	0.39	127
4880	16010	8.90	444	11.84	19.31	0.38	217
4882	16017	5.57	438	3.13	4.53	0.41	81
4885	16027	5.13	438	3.01	4.84	0.38	94
4887	16033	5.33	439	3.02	4.56	0.40	86
4890	16043	5.91	438	2.94	3.92	0.43	66
4890	16043	3.20	439	4.37	4.74	0.48	148
4892	16050	5.79	438	3.16	4.64	0.41	80
4895	16060	2.74	439	0.43	0.25	0.63	9
4897	16066	2.66	438	0.40	0.30	0.57	11
4900	16076	4.98	439	1.66	2.38	0.41	48
4900	16076	4.20	442	3.09	4.45	0.41	106
4902	16083	2.89	439	0.53	0.45	0.54	16
4905	16093	1.82	431	0.30	0.10	0.75	5
4907	16099	3.32	441	0.73	0.63	0.54	19
4910	16109	3.88	441	0.84	1.04	0.45	27
4910	16109	2.80	441	1.16	1.26	0.48	45
4912	16115	3.66	439	1.07	1.53	0.41	42
4915	16125	2.55	432	0.38	0.19	0.67	7
4917	16132	4.37	440	1.46	2.34	0.38	54
4920	16142	4.25	439	0.91	0.99	0.48	23
4920	16142	4.00	440	1.91	1.76	0.52	44
4925	16158	8.69	437	5.47	8.94	0.38	103
4927	16165	9.20	437	8.50	16.48	0.34	179
4930	16175	8.59	436	5.17	9.45	0.35	110
4932	16181	6.58	438	3.32	5.46	0.38	83
4935	16191	0.63	439	0.09	0.15	0.38	24
4937	16198	1.26	441	0.25	0.62	0.29	49

Appendix 1

4940	16207	1.03	441	0.22	0.66	0.25	64
------	-------	------	-----	------	------	------	----

Appendix 1

JEPPE-1 (extracted samples)

D (m)	D (feet)	TOC	Tmax	S1	S2	PI	HI
4452	14606	1.03	436	0.06	0.22	0.21	21
4455	14616	0.63	436	0.01	0.21	0.05	33
4457	14623	0.65	437	0.01	0.13	0.07	20
4460	14633	0.47	435	0.04	0.02	0.67	4
4462	14639	0.42	434	0.05	0.05	0.5	12
4465	14649	0.91	433	0.04	0.16	0.2	18
4467	14656	1.05	432	0.05	0.05	0.5	5
4470	14665	0.97	437	0.06	0.04	0.6	4
4472	14672	1.41	434	0.09	0.13	0.41	9
4475	14682	0.92	437	0.07	0.21	0.25	23
4477	14688	1.38	436	0.06	0.16	0.27	12
4480	14698	1.05	435	0.08	0.04	0.67	4
4482	14705	1.05	437	0.07	0.25	0.22	24
4485	14715	0.71	437	0.06	0.24	0.2	34
4487	14721	0.77	438	0.08	0.16	0.33	21
4490	14731	0.82	437	0.06	0.18	0.25	22
4492	14738	1.34	436	0.09	0.05	0.64	4
4495	14747	1.31	436	0.09	0.07	0.56	5
4497	14754	1.07	439	0.06	0.12	0.33	11
4500	14764	1.09	437	0.04	0.02	0.67	2
4502	14770	1.23	438	0.1	0.14	0.42	11
4505	14780	1.24	437	0.06	0.12	0.33	10
4507	14787	0.89	439	0.08	0.04	0.67	4
4510	14797	1.22	438	0.07	0.05	0.58	4
4512	14803	0.99	438	0.05	0.11	0.31	11
4515	14813	0.84	442	0.04	0.02	0.67	2
4517	14820	1.17	437	0.11	0.05	0.69	4
4520	14829	0.88	438	0.12	0.1	0.55	11
4522	14836	0.88	436	0.11	0.03	0.79	3
4525	14846	0.93	440	0.1	0.1	0.5	11
4527	14852	1.11	440	0.07	0.03	0.7	3
4530	14862	0.91	440	0.11	0.09	0.55	10
4532	14869	0.93	433	0.11	0.01	0.92	1
4537	14885	1.37	436	0.06	0.42	0.13	31
4540	14895	0.88	437	0.05	0.25	0.17	28
4542	14902	0.81	440	0.05	0.25	0.17	31
4545	14911	0.59	437	0.04	0.06	0.4	10
4547	14918	0.82	446	0.06	0.16	0.27	20
4550	14928	1	999	0.05	0.03	0.63	3
4552	14934	0.02	433	0.04	0.02	0.67	100
4555	14944	1.39	436	0.16	0.1	0.62	7
4557	14951	1.39	436	0.07	0.13	0.35	9
4560	14961	1.56	427	0.06	0.02	0.75	1
4562	14967	1.59	438	0.09	0.21	0.3	13
4565	14977	1.47	439	0.06	0.02	0.75	1
4567	14984	1.91	436	0.08	0.14	0.36	7
4570	14993	1.66	439	0.1	0.12	0.45	7
4572	15000	2	439	0.04	0.44	0.08	22
4575	15010	1.51	440	0.11	0.46	0.19	30
4577	15016	1.88	440	0.16	0.56	0.22	30
4580	15026	0.94	442	0.06	0.26	0.19	28
4582	15033	0.99	438	0.06	0.04	0.6	4
4585	15043	1.5	440	0.07	0.17	0.29	11

Appendix 1

4587	15049	1.5	438	0.06	0.26	0.19	17
4590	15059	1.2	440	0.06	0.24	0.2	20
4592	15066	1.65	441	0.08	0.28	0.22	17
4595	15075	1.01	437	0.04	0.02	0.67	2
4600	15092	0.97	437	0.06	0.22	0.21	23
4602	15098	1.5	439	0.09	0.29	0.24	19
4605	15108	1.24	441	0.06	0.26	0.19	21
4607	15115	1.34	430	0.12	0.12	0.5	9
4610	15125	1.18	441	0.1	0.3	0.25	25
4612	15131	1.47	442	0.18	0.2	0.47	14
4615	15141	1.73	439	0.06	0.08	0.43	5
4617	15148	2.08	441	0.14	0.22	0.39	11
4620	15157	1.62	440	0.09	0.13	0.41	8
4622	15164	0.81	441	0.06	0.14	0.3	17
4625	15174	1.52	439	0.08	0.04	0.67	3
4627	15180	0.92	443	0.06	0.04	0.6	4
4630	15190	1.08	441	0.05	0.23	0.18	21
4632	15197	1.31	442	0.05	0.13	0.27	10
4635	15207	1.54	441	0.09	0.11	0.45	7
4637	15213	1.59	441	0.05	0.45	0.1	28
4640	15223	1.2	442	0.07	0.01	0.88	1
4642	15230	1.38	441	0.05	0.15	0.25	11
4645	15240	1.49	465	0.12	0.26	0.32	17
4647	15246	1.45	440	0.12	0.3	0.29	21
4650	15256	1.28	441	0.08	0.06	0.57	5
4652	15262	1.06	999	0.06	0	-999	-999
4655	15272	1.32	439	0.07	0.11	0.39	8
4657	15279	1.45	440	0.05	0.35	0.13	24
4660	15289	1.86	441	0.09	0.35	0.2	19
4662	15295	1.63	439	0.11	0.15	0.42	9
4665	15305	0.76	439	0.06	0.12	0.33	16
4667	15312	1.1	439	0.08	0.1	0.44	9
4670	15322	0.87	-999	0.04	0	-999	-999
4672	15328	1.12	442	0.06	0.02	0.75	2
4675	15338	1.31	443	0.09	0.33	0.21	25
4677	15344	1.07	-999	0.06	0	-999	-999
4680	15354	0.94	-999	0.04	0	-999	-999
4682	15361	0.99	440	0.04	0.04	0.5	4
4685	15371	0.9	-999	0.02	0	-999	-999
4687	15377	0.97	-999	0.06	0	-999	-999
4690	15387	0.92	-999	0.05	0	-999	-999
4692	15394	1.01	-999	0.06	0	-999	-999
4695	15404	1.03	442	0.08	0.02	0.8	2
4697	15410	1.09	-999	0.02	0	-999	-999
4700	15420	1.1	999	0.07	0	-999	-999
4702	15427	1.06	-999	0.09	0	-999	-999
4705	15436	1.04	999	0.13	0	-999	-999
4707	15443	0.95	-999	0.07	0	-999	-999
4710	15453	1.22	429	0.1	0.04	0.71	3
4712	15459	1.08	440	0.09	0.29	0.24	27
4715	15469	1.33	440	0.06	0.26	0.19	20
4717	15476	1.08	442	0.04	0.28	0.13	26
4720	15486	1.02	443	0.07	0.17	0.29	17
4722	15492	1.59	441	0.13	0.39	0.25	25
4725	15502	1.49	443	0.08	0.39	0.17	26
4727	15509	1.56	442	0.08	0.24	0.25	15

Appendix 1

4730	15518	1.05	443	0.04	0.16	0.2	15
4732	15525	2.31	443	0.1	1.38	0.07	60
4735	15535	3.98	442	0.12	3.19	0.04	80
4737	15541	3.27	443	0.11	2.02	0.05	62
4740	15551	2.86	441	0.07	1.84	0.04	64
4742	15558	1.96	444	0.06	0.9	0.06	46
4745	15568	7.3	437	0.15	11.6	40.01	159
4747	15574	3.26	442	0.12	1.53	0.07	47
4750	15584	6.06	436	0.17	7.85	0.02	130
4752	15591	2.23	442	0.07	0.85	0.08	38
4755	15600	1.15	441	0.09	0.11	0.45	10
4757	15607	1.18	444	0.13	0.15	0.46	13
4760	15617	1.34	439	0.18	0.1	0.64	7
4765	15633	1.64	438	0.3	0.42	0.42	26
4770	15650	1.46	441	0.09	0.31	0.22	21
4772	15656	2.01	440	0.16	0.24	0.4	12
4775	15666	2.92	441	0.14	0.94	0.13	32
4777	15673	7.16	439	0.28	8.46	0.03	118
4780	15682	6.35	440	0.17	7.45	0.02	117
4782	15689	8.54	439	0.34	12.85	0.03	150
4785	15699	3.66	441	0.18	2.23	0.07	61
4787	15705	3.23	440	0.18	1.09	0.14	34
4790	15715	2.34	441	0.15	0.79	0.16	34
4792	15722	3.21	444	0.14	1.16	0.11	36
4795	15732	4.7	440	0.18	3.87	0.04	82
4797	15738	4.86	439	0.17	3.78	0.04	78
4800	15748	2.33	442	0.19	0.97	0.16	42
4802	15755	1.59	440	0.12	0.1	0.55	6
4805	15764	1.89	508	0.14	0.3	0.32	16
4807	15771	1.33	491	0.05	0.03	0.63	2
4810	15781	1.23	443	0.13	0.55	0.19	45
4812	15787	0.78	417	0.06	0.08	0.43	10
4815	15797	1.51	442	0.07	0.37	0.16	25
4817	15804	1.23	441	0.04	0.08	0.33	7
4820	15814	0.28	440	0.08	0.14	0.36	50
4822	15820	1.61	441	0.06	0.16	0.27	10
4825	15830	1.67	439	0.06	0.34	0.15	20
4827	15837	1.29	441	0.06	0.14	0.3	11
4830	15846	5.97	440	0.16	5.19	0.03	87
4832	15853	10.07	440	0.26	14.56	0.02	145
4835	15863	8.61	441	0.1	9.97	0.01	116
4837	15869	6.4	444	0.07	6.1	0.01	95
4840	15879	3.49	445	0.05	1.88	0.03	54
4842	15886	5.18	445	0.14	3.88	0.03	75
4845	15896	3.8	444	0.09	1.74	0.05	46
4847	15902	1.79	445	0.02	0.57	0.03	32
4850	15912	1.21	442	0.01	0.51	0.02	42
4852	15919	1.19	442	0.04	0.31	0.11	26
4855	15928	3.97	445	0.07	2.59	0.03	65
4857	15935	2.22	445	0.08	0.74	0.1	33
4860	15945	3.66	443	0.07	2.13	0.03	58
4862	15951	4.01	443	0.08	2.81	0.03	70
4865	15961	5.44	443	0.09	4.19	0.02	77
4867	15968	4.28	442	0.11	2.12	0.05	50
4870	15978	5.6	442	0.16	5.55	0.03	99
4872	15984	9.48	441	0.23	11.63	0.02	123

Appendix 1

4875	15994	6.9	440	0.14	6.44	0.02	93
4877	16001	7.48	442	0.17	8.43	0.02	113
4880	16010	6.65	441	0.17	6.77	0.02	102
4882	16017	4.8	444	0.09	2.34	0.04	49
4885	16027	4.06	445	0.07	2.42	0.03	60
4887	16033	4.7	445	0.11	2.9	0.04	62
4890	16043	4.42	443	0.11	2.33	0.05	53
4892	16050	5.62	444	0.11	3.07	0.03	55
4895	16060	0.08	444	0.03	0.09	0.25	113
4897	16066	2.21	442	0.07	0.13	0.35	6
4900	16076	3.97	447	0.08	1.36	0.06	34
4902	16083	2.58	442	0.05	0.05	0.5	2
4905	16093	1.69	-999	0.03	0	-999	-999
4907	16099	2.92	447	0.05	0.15	0.25	5
4910	16109	3.36	445	0.07	0.38	0.16	11
4912	16115	3.13	444	0.1	0.74	0.12	24
4915	16125	2.31	444	0.1	0.12	0.45	5
4917	16132	3.79	445	0.08	1.2	0.06	32
4920	16142	3.59	442	0.11	0.53	0.17	15
4925	16158	7.29	442	0.15	5.89	0.02	81
4927	16165	9.18	442	0.12	11.37	0.01	124
4930	16175	7.34	443	0.16	6.14	0.03	84
4932	16181	5.86	443	0.08	3.21	0.02	55
4935	16191	0.47	441	0.02	0.04	0.33	9
4937	16198	0.9	442	0	0.27	0	30
4940	16207	0.86	442	0.2	0.36	0.36	42

Appendix 1

RITA-1

D (m)	D (feet)	TOC	Tmax	S1	S2	PI	HI
3764	12349	0.37	-999	0.33	1.11	0.23	300
3770	12369	6.98	428	6.63	33.73	0.16	483
3776	12388	5.95	426	7.36	26.36	0.22	443
3783	12411	9.85	426	9.37	45.72	0.17	464
3789	12431	8.28	426	9.21	37.14	0.20	449
3795	12451	5.97	421	8.11	28.82	0.22	483
3801	12470	17.42	426	41.90	117.12	0.26	672
3807	12490	15.95	427	35.00	95.71	0.27	600
3813	12510	18.11	426	41.26	103.61	0.28	572
3819	12530	12.87	414	29.39	63.36	0.32	492
3825	12549	14.51	422	29.07	79.81	0.27	550
3831	12569	5.20	428	5.32	18.27	0.23	351
3837	12589	2.98	429	3.15	8.24	0.28	277
3844	12612	3.06	428	2.36	6.79	0.26	222
3847	12621	3.21	427	2.73	6.80	0.29	212
3853	12641	5.25	426	5.60	18.15	0.24	346
3856	12651	5.27	426	7.78	19.34	0.29	367
3862	12671	6.03	428	8.46	24.45	0.26	405
3865	12680	5.96	420	10.72	23.17	0.32	389
3871	12700	3.27	428	4.61	8.65	0.35	265
3874	12710	7.76	425	14.60	33.44	0.30	431
3880	12730	6.81	416	12.60	27.00	0.32	396
3883	12740	3.67	430	3.91	7.87	0.33	214
3889	12759	3.81	431	4.81	10.45	0.32	274
3892	12769	3.04	430	2.96	8.37	0.26	275
3898	12789	1.96	435	1.69	1.77	0.49	90
3901	12799	5.42	429	7.21	18.30	0.28	338
3908	12822	4.95	429	6.58	10.56	0.38	213
3911	12831	4.74	429	6.86	10.27	0.40	217
3917	12851	2.64	427	2.52	4.61	0.35	175
3920	12861	2.89	429	3.86	6.66	0.37	230
3926	12881	0.91	434	0.68	1.06	0.39	116
3929	12890	0.69	423	0.48	0.76	0.39	110
3935	12910	0.58	419	0.28	0.57	0.33	98
3938	12920	1.04	433	0.61	1.18	0.34	113
3944	12940	1.10	436	0.46	1.36	0.25	124
3956	12979	0.96	439	0.57	1.20	0.32	125
3962	12999	0.56	432	0.29	0.46	0.39	82
3965	13009	1.18	437	0.42	0.88	0.32	75
3972	13031	1.24	438	0.46	0.91	0.34	73
3975	13041	1.21	438	0.40	0.87	0.31	72
3981	13061	0.72	435	0.34	0.58	0.37	81
3984	13071	0.80	437	0.41	0.66	0.38	83
3990	13091	1.45	439	0.46	1.15	0.29	79
3993	13100	1.68	438	0.67	1.79	0.27	107
3999	13120	1.60	438	0.49	1.25	0.28	78
4002	13130	2.66	441	1.18	3.91	0.23	147
4008	13150	2.03	442	0.43	1.68	0.20	83
4011	13159	2.34	437	1.04	2.69	0.28	115
4017	13179	1.68	440	0.52	1.43	0.27	85
4020	13189	2.67	436	1.09	3.92	0.22	147
4026	13209	1.53	440	0.60	1.64	0.27	107

Appendix 1

4029	13219	1.70	438	0.68	1.64	0.29	96
4036	13241	2.31	438	1.19	3.53	0.25	153
4039	13251	2.31	440	0.93	2.43	0.28	105
4045	13271	6.50	437	4.10	16.12	0.20	248
4048	13281	2.31	436	1.40	4.69	0.23	203
4054	13301	4.66	435	2.71	7.87	0.26	169
4057	13310	1.83	438	0.59	2.20	0.21	120
4063	13330	4.85	435	4.32	12.64	0.25	261
4066	13340	3.01	438	1.60	4.13	0.28	137
4072	13360	11.21	433	13.31	43.44	0.23	388
4075	13369	8.48	429	10.55	29.86	0.26	352
4081	13389	7.65	429	11.28	24.46	0.32	320
4084	13399	0.27	375	0.35	0.17	0.67	63
4093	13428	6.61	431	4.44	25.24	0.15	382
4100	13451	8.70	435	7.42	33.44	0.18	384
4103	13461	10.19	434	8.66	40.31	0.18	396
4109	13481	6.80	431	5.04	20.95	0.19	308
4112	13491	5.55	430	3.07	13.27	0.19	239
4118	13510	4.84	436	2.29	8.88	0.21	183
4121	13520	3.12	436	1.99	3.82	0.34	122
4127	13540	2.52	438	1.35	1.95	0.41	77
4130	13550	2.04	437	0.96	1.37	0.41	67
4136	13570	5.03	430	1.91	10.93	0.15	217
4139	13579	5.13	429	3.44	10.42	0.25	203
4142	13589	4.25	430	2.69	8.00	0.25	188
4145	13599	2.23	439	0.84	1.88	0.31	84
4148	13609	5.73	434	3.44	15.31	0.18	267
4154	13629	3.80	435	1.78	4.79	0.27	126
4157	13638	9.22	433	9.25	29.65	0.24	322
4164	13661	8.24	431	8.24	21.73	0.27	264
4167	13671	7.80	432	8.32	20.60	0.29	264
4173	13691	7.56	432	7.26	19.70	0.27	261
4176	13701	7.96	430	8.02	20.56	0.28	258
4182	13720	3.60	437	1.72	4.79	0.26	133
4185	13730	5.96	433	5.31	11.69	0.31	196
4191	13750	10.07	433	11.18	31.40	0.26	312
4194	13760	9.99	433	13.03	31.44	0.29	315
4200	13780	11.38	434	12.17	37.82	0.24	332
4203	13789	10.06	436	11.99	38.41	0.24	382
4212	13819	10.71	434	12.13	30.67	0.28	286
4218	13839	4.78	436	3.57	10.26	0.26	215
4221	13848	6.28	438	3.76	11.25	0.25	179
4225	13862	5.26	429	13.30	9.28	0.59	176
4231	13881	6.98	429	9.00	14.97	0.38	214
4237	13901	6.58	437	4.62	12.23	0.27	186
4243	13921	11.96	440	15.14	39.81	0.28	333
4246	13930	8.47	435	10.63	20.82	0.34	246
4249	13940	5.66	435	5.21	11.31	0.32	200
4255	13960	4.99	439	3.98	9.37	0.30	188
4258	13970	7.02	439	5.59	15.20	0.27	217
4264	13990	3.14	446	1.28	3.17	0.29	101
4267	13999	2.80	446	1.15	3.34	0.26	119
4273	14019	3.87	438	3.10	5.70	0.35	147
4276	14029	4.56	439	3.41	6.58	0.34	144
4282	14049	3.49	443	1.80	3.50	0.34	100
4285	14058	4.40	443	2.61	5.41	0.33	123

Appendix 1

4292	14081	3.53	444	1.72	3.66	0.32	104
4295	14091	1.95	447	0.82	1.29	0.39	66
4301	14111	1.90	443	0.70	0.86	0.45	45
4304	14121	5.11	440	3.61	6.96	0.34	136
4310	14140	4.56	442	2.99	5.48	0.35	120
4313	14150	3.66	443	2.03	3.70	0.35	101
4319	14170	3.54	441	2.39	4.00	0.37	113
4322	14180	7.69	440	8.71	16.30	0.35	212
4328	14199	5.54	437	5.77	8.17	0.41	147
4331	14209	6.15	436	7.27	10.80	0.40	176
4340	14239	6.22	437	6.63	11.15	0.37	179
4346	14259	6.94	438	8.19	13.20	0.38	190
4349	14268	8.71	439	11.33	21.29	0.35	244
4356	14291	7.26	439	8.87	14.35	0.38	198
4362	14311	5.38	438	4.56	7.88	0.37	146
4365	14321	5.64	436	5.60	9.15	0.38	162
4371	14341	7.33	437	7.12	14.11	0.34	192
4374	14350	4.43	443	2.89	5.28	0.35	119
4380	14370	5.22	441	3.91	7.10	0.36	136
4383	14380	5.72	433	6.60	9.38	0.41	164
4389	14400	6.93	435	8.07	13.05	0.38	188
4392	14409	7.69	442	10.92	22.13	0.33	288
4398	14429	8.24	440	10.13	18.01	0.36	219
4401	14439	7.86	438	9.65	15.56	0.38	198
4407	14459	7.49	438	8.28	15.11	0.35	202
4410	14469	7.43	441	7.94	15.49	0.34	208
4417	14491	8.34	443	8.26	18.58	0.31	223
4423	14511	4.50	440	2.50	5.97	0.30	133
4426	14521	4.76	443	2.70	5.54	0.33	116
4429	14531	5.45	439	3.75	7.27	0.34	133
4432	14541	4.27	441	2.72	4.17	0.39	98
4438	14560	4.15	437	2.49	4.17	0.37	100
4444	14580	6.55	435	6.80	11.78	0.37	180
4447	14590	3.07	433	1.63	2.47	0.40	80
4450	14600	2.06	416	0.94	1.87	0.33	91
4456	14619	4.56	436	3.43	7.23	0.32	159
4459	14629	3.20	435	1.51	2.22	0.40	69
4462	14639	4.26	442	2.45	5.28	0.32	124
4465	14649	3.35	446	2.59	3.11	0.45	93
4471	14669	7.44	439	8.20	14.26	0.37	192
4478	14692	5.52	442	4.22	7.64	0.36	138
4481	14701	2.82	446	1.48	2.60	0.36	92
4484	14711	2.11	440	0.94	0.90	0.51	43
4487	14721	3.11	443	1.37	2.43	0.36	78
4490	14731	5.24	442	3.81	6.76	0.36	129
4493	14741	2.93	445	1.03	1.80	0.36	61
4499	14760	1.72	443	0.54	0.33	0.62	19
4502	14770	1.29	436	0.45	0.29	0.61	22
4508	14790	1.38	411	0.45	0.26	0.63	19
4514	14810	1.18	440	0.39	0.37	0.51	31
4517	14820	0.99	374	0.56	0.59	0.49	60
4523	14839	0.93	443	0.39	0.39	0.50	42
4529	14859	1.33	441	0.65	1.40	0.32	105
4532	14869	3.79	408	4.80	8.89	0.35	235
4548	14921	1.17	447	0.66	0.92	0.42	79
4551	14931	1.18	444	0.65	1.06	0.38	90

Appendix 1

4557	14951	0.97	435	0.60	0.76	0.44	78
4566	14980	1.71	443	0.98	1.91	0.34	112
4569	14990	2.15	440	0.92	2.10	0.30	98
4575	15010	1.14	429	0.82	0.92	0.47	81
4587	15049	1.69	442	0.76	1.20	0.39	71
4593	15069	0.96	443	0.59	0.67	0.47	70
4596	15079	1.33	449	0.60	0.98	0.38	74
4602	15098	0.64	443	0.25	0.35	0.42	55
4606	15112	1.00	448	0.59	0.98	0.38	98
4609	15121	0.73	437	0.37	0.47	0.44	64
4612	15131	0.59	447	0.21	0.13	0.62	22
4618	15151	0.44	420	0.21	0.21	0.50	48
4621	15161	0.45	452	0.20	0.32	0.38	71
4624	15171	0.65	416	0.25	0.19	0.57	29
4627	15180	0.30	457	0.21	0.27	0.44	90
4630	15190	0.50	451	0.29	0.27	0.52	54
4633	15200	0.58	428	0.25	0.35	0.42	60
4636	15210	1.11	405	0.57	1.44	0.28	130
4642	15230	1.83	451	0.63	1.17	0.35	64
4645	15240	2.52	452	0.86	2.20	0.28	87
4651	15259	2.46	460	0.65	1.48	0.31	60
4654	15269	0.83	426	0.52	0.58	0.47	70
4657	15279	1.12	450	0.51	0.70	0.42	63
4663	15299	0.96	442	1.06	0.82	0.56	85
4666	15308	0.92	441	0.43	0.62	0.41	67
4670	15322	0.68	449	0.33	0.55	0.38	81
4673	15331	2.05	447	0.65	1.22	0.35	60

Appendix 1

Gwen-2

D (m)	D (feet)	TOC	Tmax	S1	S2	PI	HI
3965	13010	0.47	-999	0.11	0.48	0.18	102
3972	13030	0.31	-999	0.02	0.15	0.11	50
3978	13050	0.26	-999	0.01	0.07	0.13	26
3984	13070	0.32	-999	0.02	0.15	0.11	48
3990	13090	0.33	-999	0.04	0.19	0.17	58
3996	13110	0.77	422	0.87	3.27	0.21	425
4002	13130	0.38	-999	0.02	0.16	0.11	43
4008	13150	0.45	419	0.04	0.21	0.15	47
4014	13170	0.34	-999	0.05	0.13	0.26	40
4020	13190	0.39	-999	0.02	0.16	0.11	42
4026	13210	0.30	-999	0.02	0.09	0.18	29
4033	13230	0.34	-999	0.03	0.15	0.16	45
4039	13250	0.27	-999	0.03	0.10	0.23	36
4045	13270	0.23	-999	0.02	0.01	-999	4
4051	13290	0.50	420	0.12	0.22	0.34	44
4057	13310	0.31	-999	0.05	0.10	0.33	31
4063	13330	0.73	434	0.16	0.77	0.18	106
4069	13350	3.31	433	3.03	10.11	0.23	305
4072	13360	1.44	439	0.60	2.13	0.22	148
4075	13370	3.05	433	2.22	8.40	0.21	275
4075	13370	2.67	434	1.50	5.64	0.21	211
4078	13380	1.76	439	0.90	3.19	0.22	181
4081	13390	2.53	436	1.69	6.29	0.21	249
4084	13400	3.41	441	1.07	8.22	0.12	241
4087	13410	3.56	434	3.07	8.12	0.27	228
4087	13410	3.66	439	1.62	7.30	0.18	199
4090	13420	3.88	440	2.36	7.14	0.25	184
4093	13430	3.04	435	2.13	6.33	0.25	208
4097	13440	2.86	438	1.81	4.65	0.28	163
4100	13450	2.01	434	1.47	3.83	0.28	191
4100	13450	2.03	442	1.06	3.77	0.22	186
4103	13460	2.62	442	2.39	5.43	0.31	207
4106	13470	2.03	436	1.88	3.60	0.34	177
4109	13480	2.75	442	2.74	5.58	0.33	203
4112	13490	2.50	438	1.98	4.37	0.31	175
4115	13500	2.52	444	1.69	3.11	0.35	123
4118	13510	2.18	437	1.08	1.20	0.47	55
4121	13520	2.48	441	1.07	1.28	0.46	52
4124	13530	2.75	437	1.28	2.06	0.38	75
4127	13540	2.42	444	0.78	0.98	0.44	40
4130	13550	3.06	433	1.56	2.90	0.35	95
4133	13560	2.40	445	0.86	1.11	0.44	46
4136	13570	2.26	435	1.11	1.78	0.38	79
4139	13580	1.87	444	0.87	1.31	0.4	70
4142	13590	1.46	437	0.54	0.83	0.39	57
4145	13600	2.00	442	0.59	0.68	0.46	34
4148	13610	2.48	435	1.48	1.89	0.44	76
4151	13620	3.64	440	1.27	2.10	0.38	58
4154	13630	3.29	436	2.36	5.33	0.31	162
4157	13640	3.60	438	1.95	3.61	0.35	100
4161	13650	2.58	436	1.30	2.14	0.38	83
4164	13660	2.29	443	1.11	1.66	0.4	72
4167	13670	2.38	436	1.52	2.68	0.36	112

Appendix 1

4170	13680	6.66	436	5.94	12.03	0.33	181
4173	13690	5.34	430	6.58	10.52	0.38	197
4176	13700	3.96	439	2.41	4.13	0.37	104
4179	13710	3.83	436	2.68	2.93	0.48	76
4182	13720	3.13	444	1.00	0.94	0.52	30
4185	13730	3.95	434	3.05	4.31	0.41	109
4188	13740	3.10	445	1.04	1.19	0.47	38
4191	13750	3.22	438	2.07	2.43	0.46	75
4191	13750	2.63	440	0.57	0.48	0.54	18
4194	13760	3.60	442	1.10	1.32	0.45	37
4197	13770	5.34	435	4.99	7.57	0.4	142
4200	13780	5.28	438	3.05	5.63	0.35	107
4203	13790	5.30	434	4.99	6.12	0.45	116
4206	13800	4.04	444	1.50	2.55	0.37	63
4209	13810	4.88	434	2.96	4.92	0.38	101
4212	13820	2.53	446	1.03	1.78	0.37	70
4215	13830	3.96	436	1.81	3.09	0.37	78
4218	13840	2.97	443	0.98	1.76	0.36	59
4221	13850	4.50	432	2.70	4.13	0.4	92
4225	13860	2.23	441	1.48	3.15	0.32	141
4228	13870	2.73	442	2.21	4.80	0.31	176
4231	13880	1.79	444	1.17	2.55	0.31	142
4234	13890	2.79	444	2.18	4.86	0.31	174
4234	13890	2.65	444	2.25	4.43	0.34	167
4240	13910	3.20	442	2.28	6.29	0.27	196
4258	13970	2.76	440	1.58	5.78	0.21	209
4270	14010	1.65	441	0.88	1.72	0.29	129
4276	14030	2.50	443	2.34	5.58	0.3	223
4279	14040	2.80	444	2.20	4.62	0.32	165
4282	14050	2.34	443	2.28	4.17	0.35	178
4285	14060	2.57	445	2.25	4.45	0.34	173
4295	14090	1.54	443	1.22	2.22	0.35	144
4298	14100	1.89	444	1.23	2.50	0.33	132
4301	14110	1.44	443	1.09	2.09	0.34	145
4304	14120	1.47	447	0.76	1.56	0.33	106
4307	14130	1.18	442	0.70	1.21	0.37	102
4310	14140	2.33	444	1.73	4.01	0.3	172
4313	14150	3.52	440	1.44	3.92	0.27	111
4316	14160	2.41	443	1.49	3.20	0.32	133
4319	14170	1.80	439	0.76	1.91	0.29	106
4322	14180	2.33	444	1.51	3.34	0.31	143
4325	14190	2.04	440	1.03	2.25	0.31	110
4328	14200	1.93	445	1.21	2.30	0.34	119
4331	14210	1.12	439	0.54	1.00	0.35	89
4334	14220	2.10	445	1.41	2.92	0.33	139
4337	14230	1.55	438	0.61	1.38	0.31	89
4340	14240	2.85	443	1.88	4.13	0.31	145
4343	14250	1.70	440	0.99	2.27	0.3	134
4346	14260	2.80	442	1.45	3.19	0.31	114
4349	14270	2.07	442	1.14	2.84	0.29	137
4353	14280	1.94	441	1.19	2.71	0.31	140
4356	14290	0.92	442	0.61	1.15	0.35	125
4359	14300	0.97	441	0.54	1.72	0.24	177
4362	14310	1.11	443	0.87	1.81	0.33	163
4365	14320	1.89	445	1.38	3.02	0.31	160
4368	14330	0.53	443	0.42	0.62	0.39	122

Appendix 1

4371	14340	1.33	441	0.91	1.84	0.33	138
4374	14350	1.12	443	0.82	1.60	0.34	143
4377	14360	0.95	437	0.63	1.32	0.32	139
4380	14370	1.26	442	0.71	1.61	0.31	128
4383	14380	1.80	442	1.40	3.18	0.31	177
4386	14390	0.84	442	0.42	0.87	0.33	104
4389	14400	0.69	440	0.40	0.75	0.35	109
4392	14410	0.66	443	0.30	0.84	0.26	127
4395	14420	1.19	443	0.90	2.00	0.31	168
4398	14430	0.99	441	0.42	0.98	0.3	99
4401	14440	1.62	443	1.30	2.71	0.32	167

Well GWEN-2
Top 13000 ft
Bottom 15000 ft

DEPTH, b.kb.		Sample interval (in ft)	Count	Arithmetic mean	Arithmetic std.dev.	Geometric mean	Geometric std.dev.	Shape index	Shape index
feet	metres			AREA-A- MEAN	STD- AREA-A	AREA-G- MEAN	STD- AREA-G	ELLIP	PERI
13380	4077	13360 - 13380	418	496,5086	424,6390	2,6137	0,2517	0,7119	0,7511
13460	4101	13450 - 13460	276	514,2805	565,4523	2,5777	0,3029	0,6204	0,6924
13500	4113	13490 - 13500	255	462,0809	526,5350	2,5435	0,2777	0,6495	0,7128
13540	4126	13530 - 13540	491	447,2278	385,1023	2,5574	0,2627	0,6617	0,7294
13580	4138	13570 - 13580	321	473,5483	430,1550	2,5761	0,2671	0,6448	0,7049
13620	4150	13610 - 13620	491	498,8810	571,9738	2,5668	0,2979	0,6811	0,7393
13660	4162	13650 - 13660	253	438,6126	407,3022	2,5472	0,2604	0,6518	0,7109
13740	4187	13730 - 13740	332	485,8296	421,2283	2,5816	0,2797	0,6873	0,7327
13780	4199	13770 - 13780	491	480,5784	468,9956	2,5720	0,2791	0,6793	0,7387
13820	4211	13810 - 13820	124	549,3751	638,7315	2,5968	0,3132	0,6498	0,7191
13980	4260	13970 - 13980	207	515,0273	502,4054	2,5939	0,2958	0,6446	0,7017
14040	4278	14030 - 14040	250	556,7527	559,2850	2,6209	0,3052	0,6372	0,6959
14060	4284	14050 - 14060	309	479,7194	469,0822	2,5725	0,2784	0,6445	0,7039
14100	4296	14090 - 14100	243	549,5957	568,8252	2,6179	0,2994	0,6374	0,6966
14140	4308	14130 - 14140	261	498,3808	395,9089	2,6060	0,2709	0,6294	0,6889
14160	4315	14150 - 14160	216	602,3688	557,4113	2,6532	0,3161	0,6306	0,6947
14200	4327	14190 - 14200	216	566,8466	559,8196	2,6322	0,3018	0,6636	0,7128
14260	4345	14250 - 14260	201	468,9890	380,5008	2,5756	0,2726	0,6157	0,6813
14280	4351	14270 - 14280	164	550,5733	542,6793	2,6092	0,3177	0,6268	0,6935
14340	4369	14330 - 14340	178	517,8115	515,6332	2,5943	0,2924	0,6281	0,6832
14400	4388	14390 - 14400	141	602,3025	613,0826	2,6238	0,3437	0,6350	0,6999
14420	4394	14410 - 14420	148	518,8266	493,2743	2,5907	0,3109	0,6229	0,6944

Well JEPPE-1

Top 4500 m

Bottom 5000 m

Bottom 5000 m				Arithmetic mean	Arithmetic std.dev.	Geometric mean	Geometric std.dev.	Shape index	Shape index
DEPTH, b.kb.		Sample	Count	AREA-A- MEAN	STD- AREA-A	AREA-G- MEAN	STD- AREA-G	ELLIP	PERI
metres	feet	interval (in m)							
4525	14849	4522,5 - 4525	223	831,8406	985,7450	2,7303	0,3761	0,6728	0,7371
4552	14937	4549,5 - 4552	175	795,1815	877,4524	2,7195	0,3724	0,6982	0,7532
4570	14996	4567,5 - 4570	285	538,6360	603,2682	2,5894	0,3158	0,6987	0,7518
4575	15013	4572,5 - 4575	300	550,5275	593,7393	2,6023	0,3129	0,6986	0,7594
4582	15036	4579,5 - 4582	229	576,6665	516,5816	2,6440	0,3035	0,6827	0,7447
4585	15046	4582,5 - 4585	277	488,8073	543,7719	2,5648	0,2882	0,6985	0,7601
4612	15134	4609,5 - 4612	281	606,7582	588,4786	2,6529	0,3169	0,6973	0,7510
4617	15151	4614,5 - 4617	373	523,6564	555,9498	2,5910	0,3000	0,6886	0,7463
4620	15161	4617,5 - 4620	227	714,9122	762,3984	2,6913	0,3559	0,7107	0,7557
4622	15167	4619,5 - 4622	124	564,8185	479,5551	2,6327	0,3098	0,7028	0,7464
4642	15233	4639,5 - 4642	207	543,4636	526,4712	2,6173	0,2952	0,6699	0,7381
4647	15249	4644,5 - 4647	157	585,5904	627,0557	2,6199	0,3339	0,6907	0,7489
4652	15266	4649,5 - 4652	253	579,1799	671,4039	2,6052	0,3339	0,6905	0,7521
4660	15292	4657,5 - 4660	301	611,5601	712,7003	2,6239	0,3374	0,6697	0,7314
4665	15308	4662,5 - 4665	200	576,4652	570,6834	2,6255	0,3195	0,6943	0,7561
4675	15341	4672,5 - 4675	155	611,8489	710,2927	2,6405	0,3204	0,6671	0,7468
4690	15390	4687,5 - 4690	180	604,4116	667,8882	2,6235	0,3408	0,6771	0,7474
4695	15407	4692,5 - 4695	151	603,6196	673,9663	2,6290	0,3303	0,6970	0,7538
4705	15439	4702,5 - 4705	236	617,7661	663,6902	2,6433	0,3276	0,7049	0,7610
4747	15577	4744,5 - 4747	420	587,2345	650,0867	2,6228	0,3243	0,6772	0,7402
4750	15587	4747,5 - 4750	402	504,5689	510,3794	2,5791	0,2953	0,6597	0,7264
4752	15594	4749,5 - 4752	302	504,4759	561,0957	2,5744	0,2952	0,6754	0,7408
4762	15627	4759,5 - 4765	238	599,3085	554,7183	2,6477	0,3190	0,6990	0,7492
4767	15643	4764,5 - 4770	268	594,8471	640,0351	2,6324	0,3214	0,6639	0,7271
4777	15676	4774,5 - 4777	393	526,8032	525,9379	2,6023	0,2920	0,6721	0,7406
4782	15692	4779,5 - 4782	491	567,3913	509,9836	2,6451	0,2881	0,6580	0,7332
4820	15817	4817,5 - 4820	235	720,0832	811,5748	2,6847	0,3627	0,6961	0,7485
4832	15856	4829,5 - 4832	467	578,9434	526,3641	2,6525	0,2879	0,6822	0,7372
4835	15866	4832,5 - 4835	491	477,1553	410,8462	2,5902	0,2536	0,6599	0,7388
4840	15882	4837,5 - 4840	252	625,6110	665,9975	2,6644	0,3117	0,6635	0,7385
4842	15889	4839,5 - 4842	335	494,2331	483,2749	2,5758	0,2923	0,6702	0,7387
4850	15915	4847,5 - 4850	314	525,2813	519,7225	2,5934	0,3039	0,6867	0,7464
4855	15932	4852,5 - 4855	344	589,1974	578,1821	2,6359	0,3175	0,6560	0,7320
4860	15948	4857,5 - 4860	472	568,5265	518,4164	2,6370	0,3020	0,6657	0,7394
4872	15987	4869,5 - 4872	491	441,6698	340,7808	2,5667	0,2421	0,6571	0,7381

Well ELIN-1
Top 13000 ft
Bottom 15500 ft

DEPTH, b.kb.		Sample interval (In ft)	Count	Arithmetic mean	Arithmetic std.dev.	Geometric mean	Geometric std.dev.	Shape index	Shape index
feet	metres			AREA-A- MEAN	STD- AREA-A	AREA-G- MEAN	STD- AREA-G	ELLIP	PERI
13675	4167	13660 - 13680	255	483,7253	386,9256	2,5949	0,2634	0,6743	0,7447
13715	4179	13700 - 13720	194	539,1899	432,3879	2,6435	0,2618	0,6654	0,7303
13805	4206	13790 - 13810	162	441,8592	361,3724	2,5617	0,2500	0,6495	0,7123
13860	4223	13850 - 13860	296	582,8948	648,5786	2,6186	0,3249	0,6492	0,7343
13905	4237	13890 - 13910	193	565,1280	576,3324	2,6186	0,3142	0,6502	0,7298
14015	4270	14000 - 14020	201	586,9254	525,6350	2,6542	0,2972	0,6724	0,7273
14300	4357	14290 - 14300	114	535,6347	375,2259	2,6445	0,2641	0,6343	0,7124
14490	4415	14480 - 14490	209	532,1751	519,1761	2,6093	0,2922	0,6567	0,7228
14660	4467	14650 - 14660	238	538,2875	494,9814	2,6215	0,2876	0,6458	0,7238
14720	4485	14710 - 14720	210	503,3041	333,6402	2,6252	0,2516	0,6601	0,7258
14740	4491	14730 - 14740	236	603,3648	626,4875	2,6574	0,2984	0,6558	0,7241
14780	4503	14770 - 14780	476	556,7918	491,6443	2,6432	0,2799	0,6727	0,7300
14810	4513	14800 - 14810	298	534,2970	482,2468	2,6246	0,2771	0,6624	0,7265
15135	4612	15120 - 15140	204	617,7749	477,8408	2,6937	0,2820	0,6531	0,7348
15160	4619	15150 - 15160	220	629,9278	495,0939	2,7103	0,2653	0,6572	0,7277
15170	4622	15160 - 15170	246	603,3348	524,2711	2,6800	0,2806	0,6568	0,7193
15220	4638	15210 - 15220	143	584,0223	526,1269	2,6671	0,2716	0,6688	0,7361
15240	4644	15230 - 15240	194	595,3834	501,1646	2,6750	0,2784	0,6478	0,7347

TABLE 1

BULK MINERALOGY

Elin-1 Depth in'	Well Quartz %	K-F.spar %	Elin-1 Plagioc. %	MixDol %	Calcite %	Rhodocr. %	Barite %	Siderite %	Pyrite %	Amphibol %	Clay Min %
13675	21,1	0,0	0,0	6,0	6,8	0,0	12,1	6,5	3,2	0,0	44,2
13715	23,3	0,0	3,1	3,2	6,8	0,0	9,0	3,9	2,4	0,0	48,3
13805	23,2	0,0	1,6	3,2	8,8	0,0	0,0	5,0	1,2	0,0	57,0
13860	28,5	0,0	0,0	0,0	7,1	0,0	10,6	6,5	3,9	0,0	43,5
13905	25,0	0,0	3,7	2,8	5,0	0,0	9,7	4,6	2,7	0,0	46,4
14015	28,4	0,0	3,9	3,4	5,7	0,0	0,0	7,7	3,3	0,0	47,7
14300	22,8	0,0	2,3	3,2	8,8	0,0	0,0	9,1	1,8	0,0	52,1
14490	25,4	0,0	3,7	3,2	6,5	0,0	0,0	3,6	2,3	0,0	55,2
14660	24,6	0,0	3,5	15,4	6,5	0,0	0,0	3,8	3,3	0,0	43,0
14720	26,9	0,0	3,6	2,4	5,4	0,0	0,0	2,9	2,0	0,0	56,8
14740	22,8	0,0	3,9	23,2	6,0	0,0	0,0	1,9	1,8	0,0	40,4
14780	30,8	0,0	5,4	21,0	5,7	0,0	0,0	2,9	1,9	0,0	32,3
14810	32,1	0,0	5,0	6,0	6,6	0,0	0,0	3,1	2,2	0,0	45,1
15135	29,8	0,0	4,3	4,8	6,3	0,0	0,0	3,3	1,9	0,0	49,6
15160	23,6	0,0	3,5	3,4	7,5	0,0	0,0	3,1	1,9	0,0	56,9
15170	27,1	0,0	5,6	3,3	6,0	0,0	0,0	3,6	1,9	0,0	52,6
15220	26,8	0,0	2,7	3,7	6,7	0,0	0,0	3,2	2,3	0,0	54,6
15240	25,9	0,0	3,6	4,8	8,1	0,0	0,0	4,0	3,0	0,0	50,5

TABLE 2		BULK MINERALOGY										
Jeppe-1		Jeppe-1										
Depth in m	Well	Quartz	K-F.spar	Plagioc.	MixDol	Calcite	Rhodocr.	Barite	Siderite	Pyrite	Amphibol	Clay Min
	%	%	%	%	%	%	%	%	%	%	%	%
4525	29,0	0,0	4,4	0,0	10,4	0,0	0,0	3,3	2,8	0,0	50,2	
4552	28,8	0,0	4,5	3,5	7,5	0,0	0,0	2,3	0,0	0,0	53,5	
4570	28,4	0,0	3,9	2,6	8,6	0,0	0,0	3,9	2,0	0,0	50,6	
4575	28,9	0,0	4,2	0,0	11,2	0,0	0,0	3,9	1,9	0,0	49,8	
4582	51,0	0,0	8,1	0,6	0,8	0,0	0,0	1,0	0,0	0,0	38,4	
4585	26,6	0,0	3,4	2,1	10,0	0,0	0,0	4,7	2,4	0,0	50,8	
4612	32,5	0,0	2,7	0,0	9,4	0,0	0,0	3,3	1,3	0,0	50,7	
4617	32,1	0,0	4,3	0,0	7,6	0,0	0,0	4,2	2,7	0,0	49,1	
4620	32,3	0,0	4,2	2,7	8,4	0,0	0,0	4,2	2,1	0,0	46,1	
4622	21,3	0,0	2,5	14,5	9,5	0,0	0,0	4,4	1,6	0,0	46,2	
4642	28,0	0,0	2,2	0,0	5,8	0,0	0,0	4,7	1,2	0,0	58,0	
4647	34,7	0,0	4,4	0,0	9,5	0,0	0,0	3,9	1,5	0,0	46,0	
4652	23,2	0,0	4,4	2,3	6,9	0,0	0,0	4,4	1,9	0,0	57,0	
4660	33,8	0,0	2,7	1,4	4,9	0,0	0,0	5,7	1,1	0,0	50,5	
4665	23,1	0,0	4,0	15,3	7,5	0,0	0,0	3,1	1,4	0,0	45,6	
4675	37,6	0,0	3,9	2,5	7,5	0,0	0,0	0,0	0,0	0,0	48,4	
4690	34,3	0,0	5,4	2,8	7,0	0,0	0,0	2,5	2,1	0,0	45,8	
4695	34,0	0,0	3,5	1,8	5,7	0,0	0,0	2,6	0,6	0,0	51,8	
4705	41,5	0,0	4,7	2,9	4,8	0,0	0,0	1,9	0,0	0,0	44,2	
4747	27,9	0,0	3,3	4,4	11,1	0,0	0,0	3,2	1,7	0,0	48,4	
4750	33,4	0,0	1,8	3,3	13,5	0,0	0,0	1,9	2,2	0,0	43,9	
4752	41,4	0,0	3,7	3,3	6,4	0,0	0,0	1,9	1,6	0,0	41,7	
4765	28,6	0,0	5,0	4,2	15,9	0,0	0,0	4,2	2,1	0,0	40,0	
4770	23,9	0,0	3,4	2,7	16,1	0,0	0,0	5,2	1,8	0,0	46,8	
4777	24,8	0,0	0,0	2,5	23,6	0,0	0,0	0,0	5,2	0,0	43,9	
4782	27,2	0,0	0,9	3,0	18,6	0,0	0,0	1,5	4,9	0,0	43,9	
4820	32,3	0,0	0,0	2,3	15,0	0,0	0,0	2,6	2,0	0,0	45,7	
4832	27,9	0,0	1,7	2,5	5,8	0,0	0,0	2,2	4,9	0,0	55,2	
4835	29,9	0,0	4,0	3,8	6,2	0,0	0,0	3,4	6,5	0,0	46,3	
4840	18,9	0,0	0,0	3,7	13,6	0,0	0,0	6,0	3,2	0,0	54,6	
4842	28,5	0,0	0,0	3,0	6,2	0,0	0,0	3,0	3,8	0,0	55,6	
4850	30,2	0,0	0,0	0,0	12,8	0,0	0,0	4,1	1,8	0,0	51,1	
4855	21,2	0,0	3,4	2,4	8,3	0,0	0,0	4,2	3,3	0,0	57,2	
4860	25,8	0,0	2,6	2,5	5,4	0,0	0,0	5,2	3,9	0,0	54,6	
4872	23,5	0,0	0,0	3,3	6,2	0,0	9,0	2,7	5,4	0,0	50,0	

TABLE 3

Elin-1 Depth in '	Clay fraction untreated									
	Quartz %	K-Fsp. %	Plagi. %	Mixdo. %	Calcite %	Pyrite %	Sider. %	Ka/Chl %	Illite %	Mix.lay. %
13675	4,3	0,0	0,0	0,6	3,1	0,0	0,8	30,6	60,5	0,0
13715	5,2	0,0	0,0	0,0	8,4	0,3	0,0	33,7	45,7	6,7
13805	4,8	0,0	0,0	0,0	5,5	0,0	0,5	29,3	54,4	5,5
13860	2,1	0,0	0,0	0,0	2,0	0,0	0,0	41,0	49,2	5,8
13905	4,3	0,0	0,0	0,5	4,1	0,9	1,1	26,3	56,4	6,5
14015	5,6	0,0	0,0	0,0	5,0	1,8	1,1	24,2	54,3	8,1
14300	4,3	0,0	0,0	0,0	11,0	0,0	0,0	40,5	44,1	0,0
14490	4,0	0,0	0,0	0,0	9,1	0,0	1,1	24,2	53,4	8,1
14660	3,3	0,0	0,0	0,9	2,5	0,0	0,0	31,2	53,4	8,8
14720	5,7	0,0	0,0	0,0	5,0	0,0	1,1	20,5	60,0	7,7
14740	7,0	0,0	0,0	6,3	6,5	1,5	2,2	17,5	50,9	8,2
14780	8,4	0,0	0,0	9,2	7,5	0,0	2,0	16,3	56,6	0,1
14810	2,6	0,0	0,0	0,0	0,5	0,0	0,0	13,5	71,4	12,1
15135	2,5	0,0	0,0	0,0	3,6	0,0	0,4	14,4	36,3	42,9
15160	2,8	0,0	0,0	0,0	4,8	0,0	0,5	26,3	54,5	11,1
15170	5,3	0,0	0,0	0,0	5,6	0,0	1,1	25,1	54,1	8,8
15220	3,0	0,0	0,0	0,0	3,0	0,6	0,5	20,4	61,6	10,7
15240	5,4	0,0	0,0	0,0	3,3	0,0	0,0	27,9	56,0	7,4
	4,5	0,0	0,0	1,0	5,0	0,3	0,7	25,7	54,0	8,8

TABLE 4

Jeppe-1 Depth in m	Clay fraction untreated									
	Quartz %	K-Fsp. %	Plagi. %	Mixdo. %	Calcite %	Pyrite %	Sider. %	Ka/Chl %	Illite %	Mix.lay. %
4525	19,3	0,0	0,0	0,5	1,6	2,1	0,0	40,3	36,3	0,0
4552	9,2	0,0	0,0	0,0	10,9	0,0	0,0	38,4	41,4	0,0
4570	5,8	0,0	0,0	0,0	8,3	0,6	0,0	35,6	49,7	0,0
4575	6,3	0,0	0,0	0,0	16,1	0,0	0,0	36,3	41,3	0,0
4582	8,5	0,0	0,0	0,0	24,8	0,0	0,0	31,7	35,0	0,0
4585	4,7	0,0	0,0	0,0	14,0	0,0	0,0	36,6	44,7	0,0
4612	8,2	0,0	0,0	0,0	10,3	0,0	0,0	33,3	48,1	0,0
4617	12,5	0,0	0,0	0,0	16,0	1,6	0,0	32,0	38,0	0,0
4620	8,2	0,0	0,0	0,0	7,6	0,0	0,0	39,4	44,7	0,0
4622	4,9	0,0	0,0	1,3	14,8	0,0	0,0	36,2	42,9	0,0
4642	7,2	0,0	0,0	0,0	1,1	1,4	0,6	40,6	49,1	0,0
4647	6,1	0,0	0,0	0,0	13,3	0,0	0,0	37,2	43,4	0,0
4652	3,7	0,0	0,0	0,0	2,4	0,9	1,1	34,2	57,7	0,0
4660	8,2	0,0	0,0	0,0	8,7	2,1	0,0	39,0	42,0	0,0
4665	4,3	0,0	0,0	2,2	7,6	0,0	0,0	43,0	42,9	0,0
4675	8,6	0,0	0,0	0,0	13,4	0,0	0,0	27,6	50,4	0,0
4690	13,5	0,0	2,9	0,8	1,5	0,0	0,0	23,2	58,0	0,0
4695	9,3	0,0	0,0	0,0	12,9	2,7	0,0	29,4	45,8	0,0
4705	15,4	0,0	4,5	0,0	0,0	0,0	2,3	29,7	48,2	0,0
4747	13,1	0,0	0,0	0,0	19,5	4,6	0,0	24,6	38,1	0,0
4750	15,4	0,0	0,0	1,3	0,0	0,0	0,0	32,4	50,9	0,0
4752	9,0	0,0	0,0	0,0	10,9	2,9	2,3	27,5	47,3	0,0
4765	17,0	0,0	2,7	1,9	10,9	5,2	0,0	23,7	38,6	0,0
4770	3,1	0,0	0,0	0,0	17,9	1,7	1,6	34,8	40,8	0,0
4777	9,1	0,0	0,0	0,0	27,9	3,0	0,0	21,9	38,0	0,0
4782	53,3	0,0	0,0	0,0	11,6	1,8	1,6	11,3	20,4	0,0
4820	8,5	0,0	0,0	0,0	19,7	2,5	2,8	27,0	39,6	0,0
4832	24,2	0,0	0,0	0,0	0,0	4,7	0,0	29,6	41,5	0,0
4835	15,5	0,0	0,0	0,0	4,3	4,3	1,6	29,6	44,8	0,0
4840	5,8	0,0	0,0	0,0	9,1	1,9	1,4	38,8	43,0	0,0
4842	7,0	0,0	0,0	0,0	4,9	2,6	1,6	37,0	47,0	0,0
4850	3,7	0,0	0,0	0,0	14,8	1,6	1,7	36,7	41,6	0,0
4855	6,1	0,0	0,0	0,0	4,7	1,7	0,8	29,9	56,7	0,0
4860	8,9	0,0	0,0	0,0	7,2	2,5	1,7	35,9	43,8	0,0
4872	13,9	0,0	0,0	0,7	0,0	5,7	0,0	36,2	43,5	0,0
	10,8	0,0	0,3	0,2	10,0	1,7	0,6	32,6	43,9	0,0

TABLE 5

Elin-1 Depth in '	Clay min. in % of $<2\mu$			
	Mix. lay.	Illite	Chlorite	Kaolinite
13675	18,4	64,2	1,1	16,3
13715	13,8	64,7	0,0	21,5
13805	13,5	69,7	0,0	16,8
13860	19,1	46,4	0,6	33,8
13905	9,6	68,1	0,8	21,5
14015	11,0	73,8	0,8	14,4
14300	21,6	41,1	0,0	37,3
14490	10,3	73,3	0,5	15,9
14660	26,2	47,5	0,6	25,7
14720	11,4	74,9	0,8	12,8
14740	26,3	60,0	0,0	13,7
14780	5,9	81,1	0,6	12,4
14810	22,1	67,3	0,0	10,6
15135	12,1	71,8	0,5	15,6
15160	25,9	49,2	0,0	24,9
15170	10,3	73,8	0,6	15,3
15220	20,6	67,0	0,0	12,5
15240	8,1	71,8	0,0	20,1

TABLE 6

Jeppe-1 Depth in m	Clay min. in % of $<2\mu$			
	Mix. lay.	Illite	Chlorite	Kaolinite
4525	27,1	36,4	3,2	33,4
4552	5,8	57,2	1,6	35,4
4570	13,1	37,6	0,0	49,3
4575	11,5	50,5	2,1	35,9
4582	10,2	52,3	2,1	35,4
4585	22,5	25,5	1,3	50,7
4612	18,9	31,8	1,5	47,7
4617	6,7	60,1	1,8	31,4
4620	15,4	40,7	1,6	42,3
4622	7,5	50,8	2,3	39,4
4642	31,0	41,5	1,2	26,2
4647	6,2	60,4	1,3	32,1
4652	14,6	40,2	2,1	43,1
4660	7,6	54,2	1,9	36,3
4665	20,1	41,2	1,6	37,2
4675	4,6	62,9	2,6	29,9
4690	15,7	53,1	1,7	29,4
4695	0,0	66,2	1,5	32,3
4705	26,3	35,8	1,5	36,4
4747	4,7	71,4	0,0	23,9
4750	7,4	71,3	0,0	21,2
4752	6,6	63,4	2,3	27,6
4765	28,3	45,5	0,0	26,1
4770	5,9	55,1	2,7	36,2
4777	25,1	45,9	0,0	29,0
4782	2,7	73,4	1,6	22,4
4820	6,6	63,2	2,1	28,2
4832	10,0	54,4	0,0	35,6
4835	2,2	72,5	1,1	24,2
4840	7,6	59,5	1,6	31,3
4842	5,9	59,2	1,6	33,2
4850	12,3	49,9	2,4	35,4
4855	16,4	46,0	1,7	35,8
4860	10,6	61,7	1,3	26,4
4872	16,9	45,0	0,0	38,1

TABLE 7

Elin-1 Depth in '	Clay min. in % of whole rock			
	Mix. lay.	Illite	Kaolinite	Chlorite
13675	8,2	28,4	7,2	0,5
13715	6,7	31,2	10,4	0,0
13805	7,7	39,7	9,6	0,0
13860	8,3	20,2	14,7	0,3
13905	4,4	31,6	10,0	0,4
14015	5,2	35,2	6,9	0,4
14300	11,3	21,4	19,4	0,0
14490	5,7	40,5	8,8	0,3
14660	11,3	20,4	11,0	0,3
14720	6,5	42,5	7,3	0,5
14740	10,6	24,2	5,5	0,0
14780	1,9	26,2	4,0	0,2
14810	10,0	30,3	4,8	0,0
15135	6,0	35,7	7,7	0,3
15160	14,8	28,0	14,2	0,0
15170	5,4	38,8	8,1	0,3
15220	11,2	36,6	6,8	0,0
15240	4,1	36,3	10,2	0,0

TABLE 8

Jeppe-1 Depth in m	Clay min. in % of whole rock			
	Mix. lay.	Illite	Kaolinite	Chlorite
4525	13,6	18,3	16,8	1,6
4552	3,1	30,6	18,9	0,9
4570	6,6	19,0	25,0	0,0
4575	5,7	25,2	17,9	1,1
4582	3,9	20,1	13,6	0,8
4585	11,4	12,9	25,7	0,6
4612	9,6	16,1	24,2	0,8
4617	3,3	29,5	15,4	0,9
4620	7,1	18,7	19,5	0,7
4622	3,5	23,5	18,2	1,1
4642	18,0	24,1	15,2	0,7
4647	2,9	27,8	14,8	0,6
4652	8,3	22,9	24,6	1,2
4660	3,8	27,3	18,3	1,0
4665	9,2	18,8	17,0	0,7
4675	2,2	30,5	14,5	1,3
4690	7,2	24,3	13,5	0,8
4695	0,0	34,3	16,8	0,8
4705	11,6	15,8	16,1	0,7
4747	2,3	34,6	11,6	0,0
4750	3,3	31,3	9,3	0,0
4752	2,8	26,5	11,5	1,0
4765	11,3	18,2	10,5	0,0
4770	2,8	25,8	17,0	1,3
4777	11,0	20,2	12,7	0,0
4782	1,2	32,2	9,8	0,7
4820	3,0	28,9	12,9	1,0
4832	5,5	30,0	19,6	0,0
4835	1,0	33,5	11,2	0,5
4840	4,2	32,5	17,1	0,9
4842	3,3	32,9	18,4	0,9
4850	6,3	25,5	18,1	1,2
4855	9,4	26,4	20,5	1,0
4860	5,8	33,7	14,4	0,7
4872	8,5	22,5	19,1	0,0

TABLE 9

Elin-1 Depth in '	Grain size			Clay/Silt ratio	Bulk Clay/Q ratio
	Sand	Silt	Clay		
13675	16,73	38,42	44,85	1,17	7,4
13715	15,34	30,33	54,33	1,79	2,1
13805	19,24	28,12	52,64	1,87	2,5
13860	37,63	18,53	43,84	2,37	1,5
13905	17,99	30,69	51,32	1,67	1,9
14015	20,64	25,48	53,88	2,11	1,7
14300	37,47	29,03	33,50	1,15	2,3
14490	16,61	28,42	50,94	1,79	2,2
14660	19,80	33,47	46,73	1,40	1,7
14720	12,69	29,71	57,60	1,94	2,1
14740	35,97	25,35	38,68	1,53	1,8
14780	32,99	29,32	37,69	1,29	1,0
14810	21,22	35,70	43,08	1,21	1,4
15135	15,15	31,21	53,64	1,72	1,7
15160	14,62	33,55	51,83	1,54	2,4
15170	13,75	31,09	55,16	1,77	1,9
15220	18,29	36,22	45,49	1,26	2,0
15240	17,22	31,38	51,40	1,64	1,9

TABLE 10

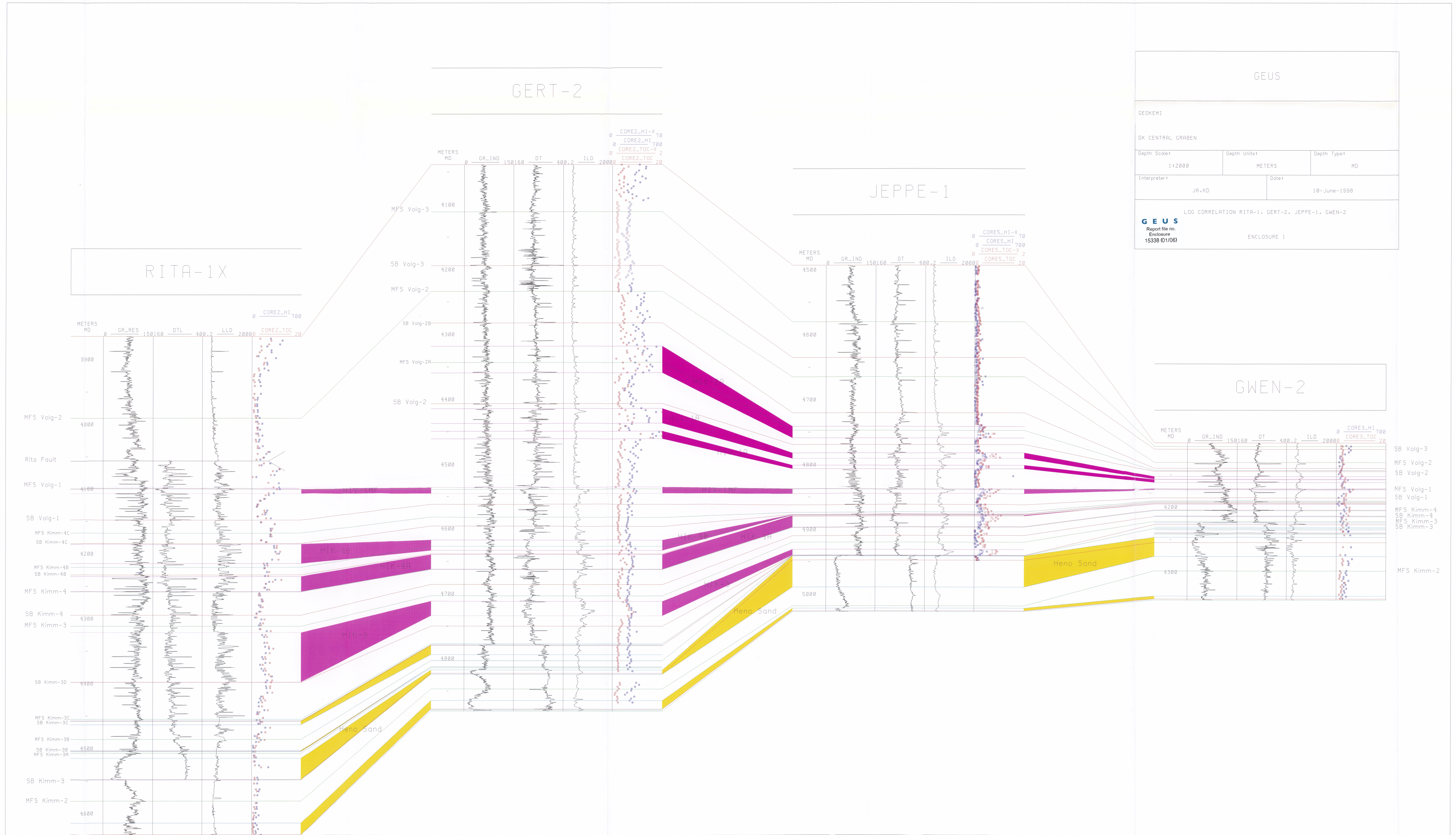
Jeppe-1 Depth in m	Grain size		Clay	Clay/Silt ratio	Bulk Clay/Q ratio
	Sand	Silt			
4525	42,69	17,02	40,29	2,37	1,7
4552	41,96	11,37	46,67	4,10	1,9
4570	46,53	15,06	38,41	2,55	1,8
4575	40,04	18,83	41,12	2,18	1,7
4582	44,49	15,79	39,72	2,52	0,8
4585	36,77	17,99	45,24	2,51	1,9
4612	45,81	14,54	39,65	2,73	1,6
4617	49,85	14,68	35,47	2,42	1,5
4620	52,38	12,54	35,08	2,80	1,4
4622	38,89	17,94	43,17	2,41	2,2
4642	37,31	17,48	45,21	2,59	2,1
4647	40,99	17,24	41,77	2,42	1,3
4652	35,11	17,40	47,49	2,73	2,5
4660	33,94	22,14	43,92	1,98	1,5
4665	37,56	14,78	47,66	3,22	2,0
4675	40,30	11,91	47,79	4,01	1,3
4690	52,69	13,66	33,65	2,46	1,3
4695	53,67	16,22	30,11	1,86	1,5
4705	35,81	7,54	56,65	7,51	1,1
4747	39,71	18,84	41,45	2,20	1,7
4750	26,76	20,55	52,69	2,56	1,3
4752	40,87	19,72	39,41	2,00	1,0
4765	50,02	9,65	40,33	4,18	1,4
4770	25,76	25,10	49,14	1,96	2,0
4777	20,18	15,90	63,92	4,02	1,8
4782	30,73	17,16	52,11	3,04	1,6
4820	49,55	11,31	39,14	3,46	1,4
4832	21,19	24,09	54,72	2,27	2,0
4835	19,89	23,77	56,34	2,37	1,5
4840	15,73	23,65	60,62	2,56	2,9
4842	18,59	22,46	58,95	2,62	1,9
4850	13,85	24,22	61,95	2,56	1,7
4855	13,89	27,25	58,86	2,16	2,7
4860	17,92	23,40	58,68	2,51	2,1
4872	17,09	26,01	56,90	2,19	2,1

TABLE 11

Elin-1 Depth in '	Sulphur in %	Pyrite % normative	Total C	TOC %	Total C -TOC %	Calcite % normative
13675	3,09	5,78	5,01	3,75	1,26	10,50
13715	1,57	2,94	4,44	2,23	2,21	18,42
13805	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
13860	1,10	2,06	n.a.	n.a.	n.a.	0,00
13905	2,15	4,02	4,36	2,35	2,01	16,75
14015	1,30	2,43	4,96	2,83	2,13	17,75
14300	0,73	1,37	4,35	2,32	2,03	16,92
14490	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
14660	0,89	1,67	6,01	3,07	2,94	24,50
14720	0,93	1,74	4,08	2,39	1,69	14,08
14740	0,75	1,40	6,83	3,15	3,68	30,67
14780	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
14810	1,46	2,73	4,64	3,19	1,45	12,08
15135	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
15160	0,97	1,81	3,86	2,57	1,29	10,75
15170	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
15220	1,13	2,11	4,46	2,87	1,59	13,25
15240	1,01	1,89	4,37	2,05	2,32	19,33

TABLE 12

	Sulphur in %	Pyrite % normative	Total C	TOC %	Total C -TOC %	Calcite % normative
Jeppe-1						
Depth in m						
4525	1,09	2,04	2,94	1,91	1,03	8,58
4552	1,34	2,51	3,03	0,90	2,13	17,75
4570	1,45	2,71	3,61	2,79	0,82	6,83
4575	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4582	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4585	1,23	2,30	3,55	2,49	1,06	8,83
4612	1,72	3,22	3,85	2,92	0,93	7,75
4617	1,83	3,42	3,62	3,15	0,47	3,92
4620	1,56	2,92	3,26	2,88	0,38	3,17
4622	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4642	2,06	3,85	3,03	2,88	0,15	1,25
4647	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4652	1,68	3,14	3,07	2,46	0,61	5,08
4660	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4665	1,08	2,02	4,78	2,62	2,16	18,00
4675	1,07	2,00	3,19	1,83	1,36	11,33
4690	1,26	2,36	2,70	1,78	0,92	7,67
4695	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4705	1,13	2,11	2,75	2,18	0,57	4,75
4747	1,34	2,51	5,79	3,59	2,20	18,33
4750	1,64	3,07	n.a.	n.a.	n.a.	n.a.
4752	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4765	1,10	2,06	n.a.	n.a.	n.a.	n.a.
4770	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4777	2,34	4,38	n.a.	n.a.	n.a.	n.a.
4782	1,92	3,59	10,67	7,13	3,54	29,50
4820	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4832	3,18	5,95	12,49	12,25	0,24	2,00
4835	2,87	5,37	10,48	9,00	1,48	12,33
4840	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4842	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4850	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4855	1,50	2,81	5,24	4,27	0,97	8,08
4860	2,00	3,74	4,81	3,05	1,76	14,67
4872	3,67	6,87	12,09	12,05	0,04	0,37



GEUS		
GEOKEMI		
DK CENTRAL GRABEN		
Depth Scale: 1:2000	Depth Units: METERS	Depth Type: MD
Interpreter: JA,KD		Date: 10-June-1998
LOG CORRELATION RITA-1, GERT-2, JEPPE-1, GWEN-2		
ENCLOSURE 1		

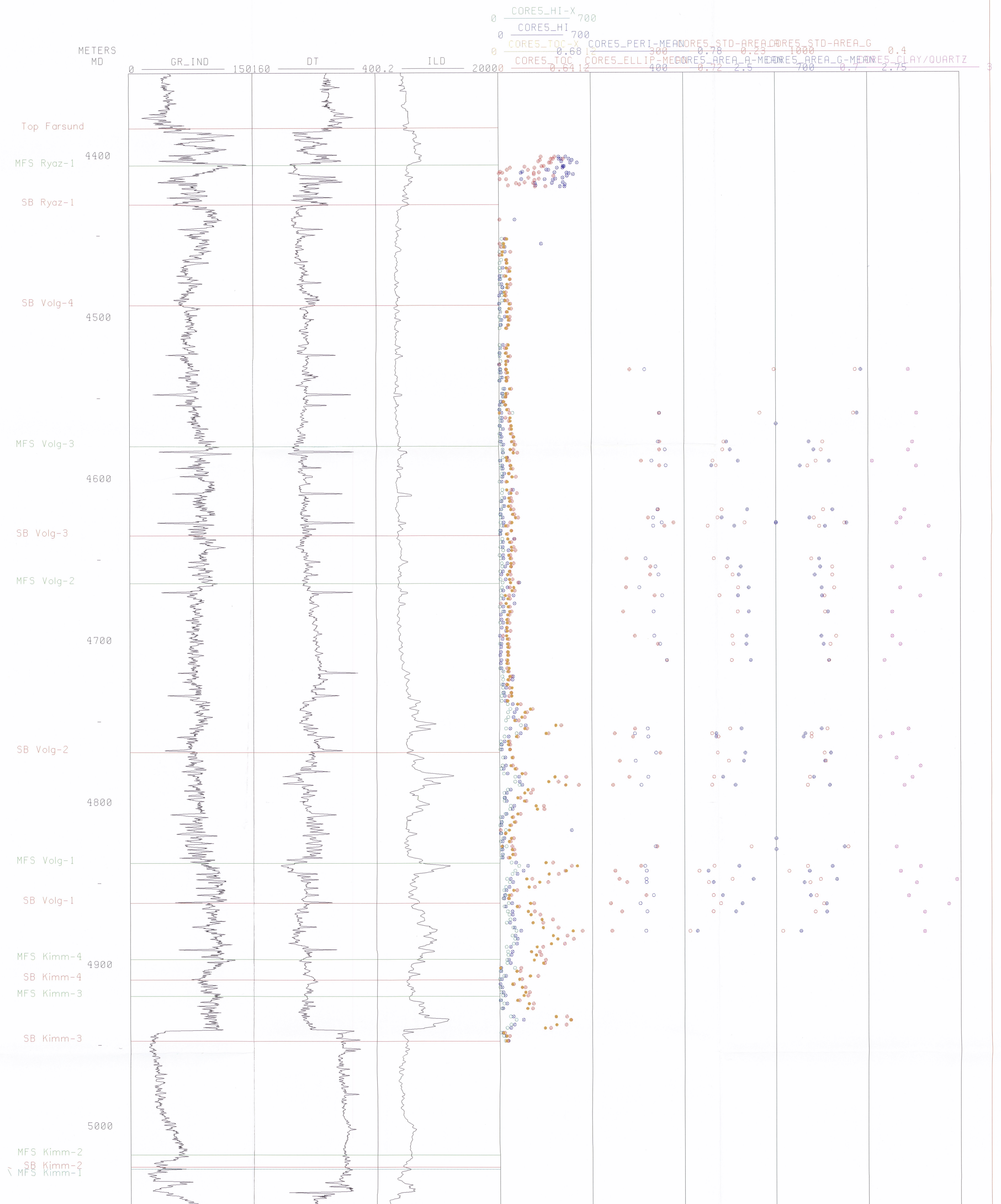
Jeppes-1 1:1500

Gr., Sonic, Resistivity, TOC/HI, peri/ellip., area A/std. area A, area G/std. area G, clay/quartz (TOC-x, HI-x: extracted samples)

JEPPE-1

G E U S

Report file no.
Enclosure
15338 (02/06)



ENCLOSURE 3

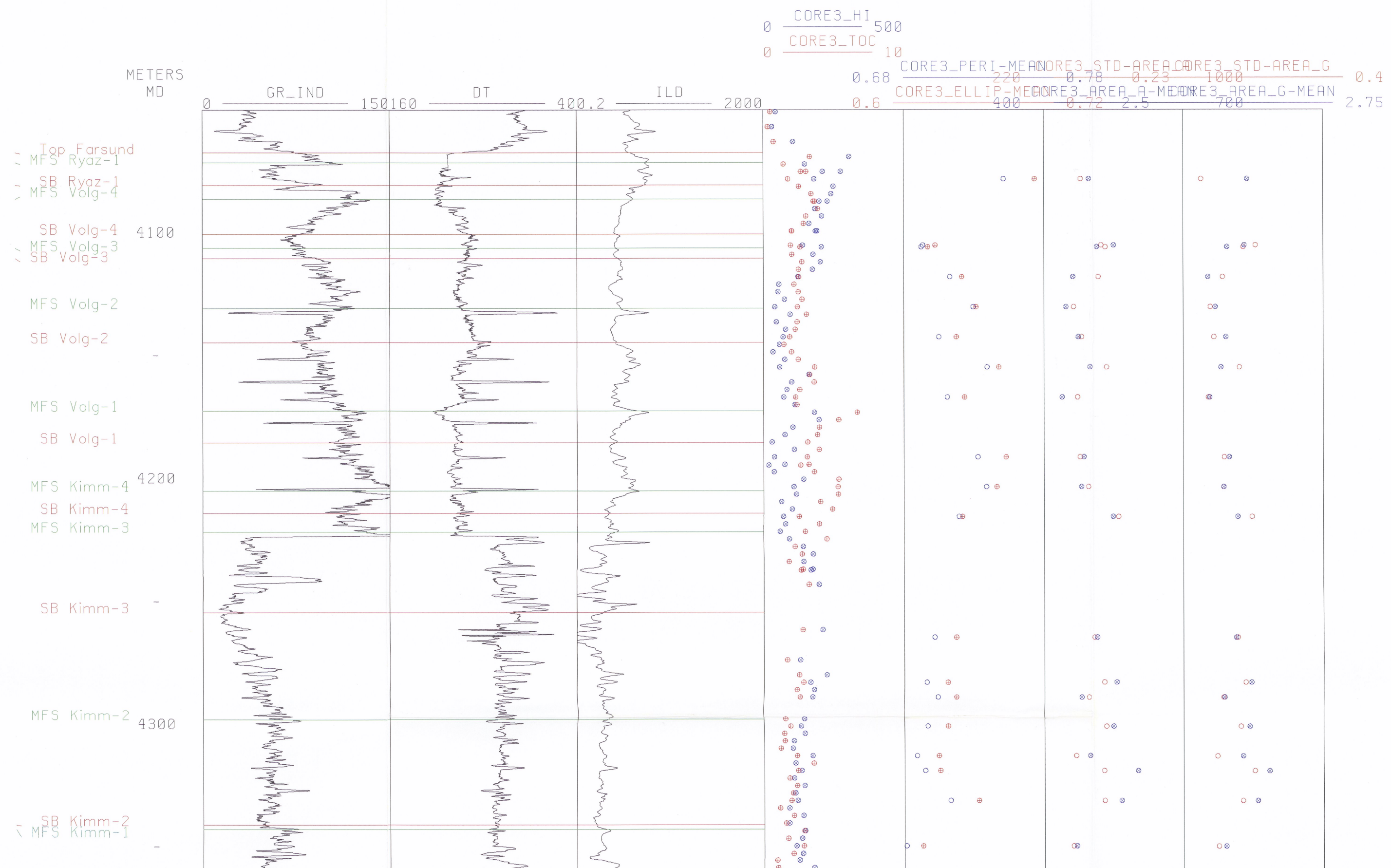
Gwen-2 1:1500

Gr., Sonic, Resistivity, TOC/HI, peri./ellip., area A/std. area A, area G/std. area G (TOC-x, HI-x:extracted samples)

GWEN-2

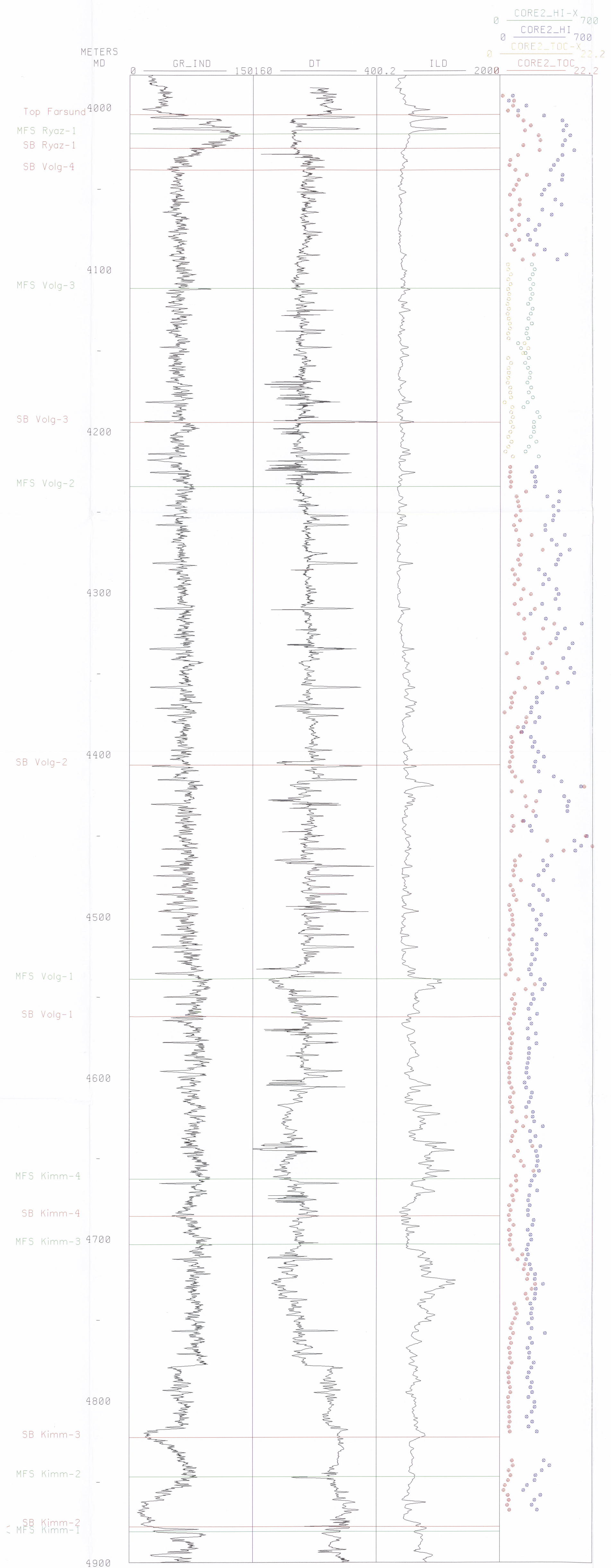
GEUS

Report file no.
Enclosure
15338 (03/06)



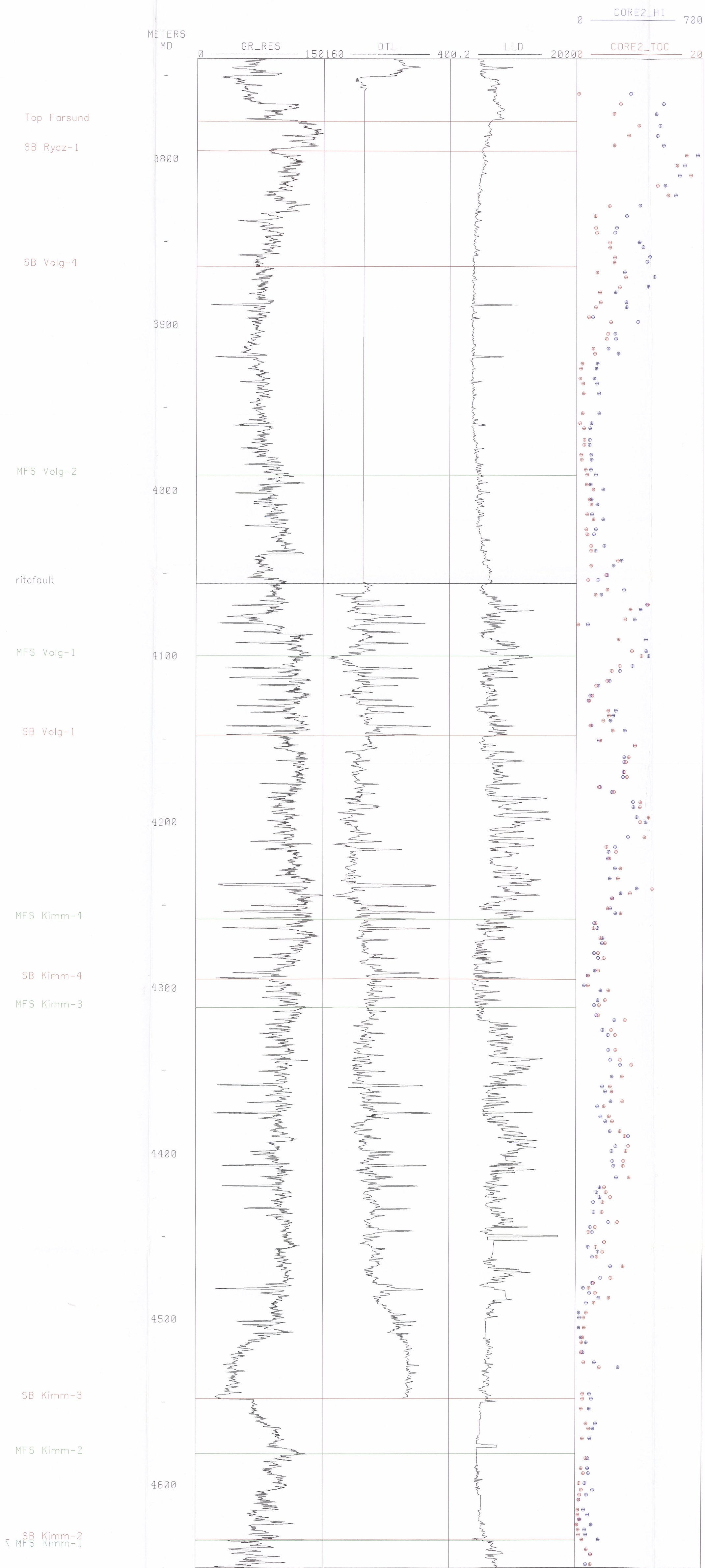
GERT-2

Report file no.
Enclosure
15338 (04/06)



RITA-1X

GEUS
Report file no.
Enclosure
15338 (05/06)



ENCLOSURE 6

Gr., Sonic, Resistivity, clay/quartz, peri./ellip., area A/std. area A, area G/std. area G

Elin-1 1:1500

ELIN-1

GEUS

Report file no.
Enclosure
15338 (06/06)

