DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 1997/42

Conventional Core Analysis

For Mærsk Olie og Gas AS
Well: Harald West-7
Spectral core gamma log

GEUS Core Laboratory

Christian Høier

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MINISTRY OF ENVIRONMENT AND ENERGY

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1. Introduction

By request of Mærsk Olie og Gas AS GEUS Core Laboratory has measured a spectral core gamma log on the well Harald West - 7.

The analytical programme was specified by Mr. John Wham

- Spectral core gamma log

GEUS Core Laboratory received 6 cores from Harald West - 7 on March 21, 1997. A preliminary spectral core gamma log was forwarded to Mærsk Olie og Gas AS after completion of the core scanning.

2. Analytical procedure

The laboratory received six cores from Harald West - 7 taken in the interval 15380'0" - 15680'9" feet measured depth. The 10 cm diameter cores were contained in aluminium sleeves and cut into sections of approximately 1 meter.

2.1 Spectral core gamma log

A spectral gamma log of the cores was recorded using a scanning speed of 1 cm per minute. The cores were retained in the aluminium sleeves. All data were later adjusted for an average activity from the sleeve and background.

Incomplete filling of the aluminium sleeves occasionally leads to erroneously low gamma activity at the junction between adjacent boxes. This effect has not been corrected on the core gamma log. However the extent of boxes are indicated as bars on the gamma log display to allow for evaluation.

2.2 List of core boxes for Harald West - 7

Core no. 1: 15380'0" - 15384'4" feet.

Box	Depth [Feet]
A	15380'0" - 15383'6"
AA	15383'6" - 15384'4"

Core no. 2: 15388'0" - 15403'4" feet.

Box	Depth [Feet]
A	15388'0" - 15390'6"
B	15390'6" - 15393'6"
C	15393'6" - 15396'6"
D	15396'6" - 15399'6"
E	15399'6" - 15402'6"
F	15402'6" - 15403'4"

Core no. 3: 15405'0" - 15462'0" feet.

Box	Depth [Feet]
A	15405'0" - 15407'6"
B	15407'6" - 15410'6"
C	15410'6" - 15413'6"
D	15413'6" - 15416'6"
E	15416'6" - 15419'6"
F	15419'6" - 15422'6"
G	15422'6" - 15425'6"
H	15425'6" - 15428'6"
I	15428'6" - 15431'3"
J	15431'3" - 15433'6"
K	15433'6" - 15436'6"
L	15436'6" - 15439'6"
M	15439'6" - 15442'6"
N	15442'6" - 15445'6"
O	15445'6" - 15448'6"
P	15448'6" - 15451'6"
Q	15451'6" - 15454'6"
R	15454'6" - 15457'6"
S	15457'6" - 15460'6"
T	15460'6" - 15462'0"

Core no. 4: 15529'0" - 15589'0" feet.

Box	Depth [Feet]
A	15529'0" - 15531'6"
B	15531'6" - 15534'6"
C	15534'6" - 15537'6"
D	15537'6" - 15540'6"
E	15540'6" - 15543'6"
F	15543'6" - 15546'6"

Core no. 4: 15529'0" - 15589'0" feet (continued).

Box	Depth [Feet]
G	15546'6" - 15549'6"
H	15549'6" - 15552'6"
I	15552'6" - 15555'6"
J	15555'6" - 15558'6"
K	15558'6" - 15561'6"
L	15561'6" - 15564'6"
M	15564'6" - 15567'6"
N	15567'6" - 15570'6"
O	15570'6" - 15573'6"
P	15573'6" - 15576'6"
Q	15576'6" - 15579'6"
R	15579'6" - 15582'6"
S	15582'6" - 15585'6"
T	15585'6" - 15588'2"
U	15588'2" - 15589'0"

Core no. 5: 15598'0" - 15635'0" Feet.

Box	Depth [Feet]
A	15589'0" - 15591'6"
B	15591'6" - 15594'6"
C	15594'6" - 15597'6"
D	15597'6" - 15600'6"
E	15600'6" - 15603'6"
F	15603'6" - 15604'10"
G	15604'10" - 15607'6"
H	15607'6" - 15610'6"
I	15610'6" - 15613'6"
J	15613'6" - 15616'6"
K	15616'6" - 15619'6"

Core no. 5: 15598'0" - 15635'0" Feet (continued).

Box	Depth [Feet]
L	15619'6" - 15622'6"
M	15622'6" - 15625'6"
N	15625'6" - 15628'6"
O	15628'6" - 15631'6"
P	15631'6" - 15635'0"

Core no. 6: 15635'0" - 15680'9" Feet

Box	Depth [Feet]
A	15635'0" - 15637'6"
B	15637'6" - 15640'6"
C	15640'6" - 15643'6"
D	15643'6" - 15646'6"
E	15646'6" - 15649'6"
F	15649'6" - 15650'8"
G	15650'8" - 15653'6"
H	15653'6" - 15656'6"
I	15656'6" - 15659'6"
J	15659'6" - 15662'6"
K	15662'6" - 15665'6"
L	15665'6" - 15668'6"
M	15668'6" - 15671'6"
N	15671'6" - 15674'6"
O	15674'6" - 15677'6"
P	15677'6" - 15680'9"

3. Analytical methods

The following is a short description of the methods used by the GEUS Core Laboratory. For a more detailed description of methods, instrumentation and principles of calculation the reader is referred to API recommended practice for core analysis procedure (API RP 40, 1960).

3.1 Spectral core gamma log

The natural gamma radiation of a core is recorded within an energy window of 0.5 - 3.0 MeV, using Tl activated NaI scintillation detectors (Bicron), connected to a multichannel analyzer (Canberra).

The core is passed through a lead shielded tunnel at constant speed, with the gamma activity being continuously recorded. Refer to chapter 2 for the scanning speed used. The integrated gamma activity is recorded at regular intervals, either every 10 cm or every 3". The gamma activity represents the mean activity over a 10 cm or 3" interval, the assigned depth being the middle of the interval. The measured gamma activity is corrected for background activity, and in the case of sleeved core, also for activity of the sleeve. Gamma activity is reported in counts per minute (cpm). The following empirical relationship between cpm and GAPI has been established.

$$cpm = 18.2 * GAPI$$

The relationship should be used as a guideline only. Radiation from decay of potassium and the uranium and thorium decay series are recorded in separate energy windows. Concentrations are calculated using synthetical standards of concrete doped with radioactive minerals in decay equilibrium. Concentrations of K, U and Th are reported as % K, ppm U and ppm Th, respectively. Relevant ratios are given.

3.2 Precision of analytical data

The reproducibility (precision) of the total gamma activity analysis is calculated from counting statistics. The following list shows the dependency of reproducibility on count rate at the 2 standard deviation level.

Count rate (cpm)	Reproducibility (cpm)
125	7.1
250	10.0
500	14.2
1000	20.1
2000	28.4
4000	40.2

Reproducibility (precision) of the amount af uranium, thorium and potassium from gamma radiation is dependent on concentration. Two values for reproducibility are given, one for normal to high concentration range, and one for low concentration range. The latter also defines the detection limit (LLD). The reproducibility values are applicable to total gamma activity above and below 800 cpm, respectively.

	K(%)	U(ppm)	Th(ppm)
Reproducibility			
Normal to high range	0.07	0.60	1.14
Low range (LLD)	0.02	0.45	0.48
Accuracy	0.02	0.45	0.48

Accuracy is calculated as mean deviation from the accepted concentration of one internal standard. This value is only applicable to low concentrations. For high concentrations the high range reproducibility may serve as an approximation to accuracy. Accuracy is reported as an arithmetic mean.

4. Results of Spectral core gamma log

The spectral core gamma log is included on the last page and present plots of:

- Depth vs. Th/K
- Depth vs. Th/U
- Depth vs. U/K
- Depth vs. Thorium
- Depth vs. Uranium
- Depth vs. Potassium
- Depth vs. Total gamma log

A diskette with the data written in ASCII format is included with the report