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JURASSIC OIL 2/2-1

REPORT ON CARBON ISOTOPIC DISTRIBUTION BETWEEN
HYDROCARBON GASES (METHANE, ETHANE, PROPANE, I-BUTANE
AND N-BUTANE).

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Date: 24th March, 1983

Our ref.: ARÅ/TJ

Your ref.:

REPORT ON CARBON ISOTOPIC DISTRIBUTION BETWEEN HYDROCARBON GASES (METHANE, ETHANE, PROPANE, I-BUTANE AND N-BUTANE)

The gas has been separated into the different hydrocarbons by a Carlo Erba 4200 instrument. We have not yet calibrated the instrument properly for quantitative analysis, but Methane, Ethane and Propane is approximately 60%, 20%, 10%, respectively. A copy of the gaschromatogramme is enclosed.

The different hydrocarbon gases were oxydized in separate ovens. The burning products CO_2 and H_2O were frozen down in liquid N_2 . CO_2 and H_2O were then separated. We have taken care of the water from the Methane and the Ethane burnings. This enables us to do the H/D ratios later. (At the moment we can not do this). The clean CO_2 from the different Hydrocarbon gas burnings were run on a Finnigan Mat 251 mass-spectrometer.

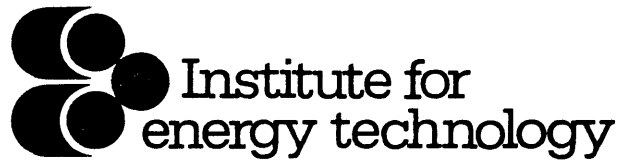
The $\delta^{13}\text{C}$ -values in o/oo vs. PDB are given in the table below :

| | |
|----------|---------|
| Methane | - 48.60 |
| Ethane | - 35.69 |
| Propane | - 31.29 |
| i-Butane | - 29.34 |
| n-Butane | - 29.44 |

The CO_2 -gas from the sample has also been measured. The $\delta^{13}\text{C}$ -value is -7.43. Copies of the computer printouts are enclosed.

The data have been plotted on the maturity diagram (A.T. James, 1983 AAPG in press). A source LOM of 8.7 is indicated for the gas. Methane does not seem to be quite in isotopic equilibrium with the other hydrocarbon gases measured. This may result from mixing early-formed Methane, perhaps of bacterial origin, with the thermally generated natural gas formed at a LOM of about 8-9. At any rate the maturity level of 8.7 is determined by the natural gas components Ethane, Propane and n-Butane.

Saga Petroleum A/S
24th March, 1983



The gas bottles will be sent as soon as transport is available.

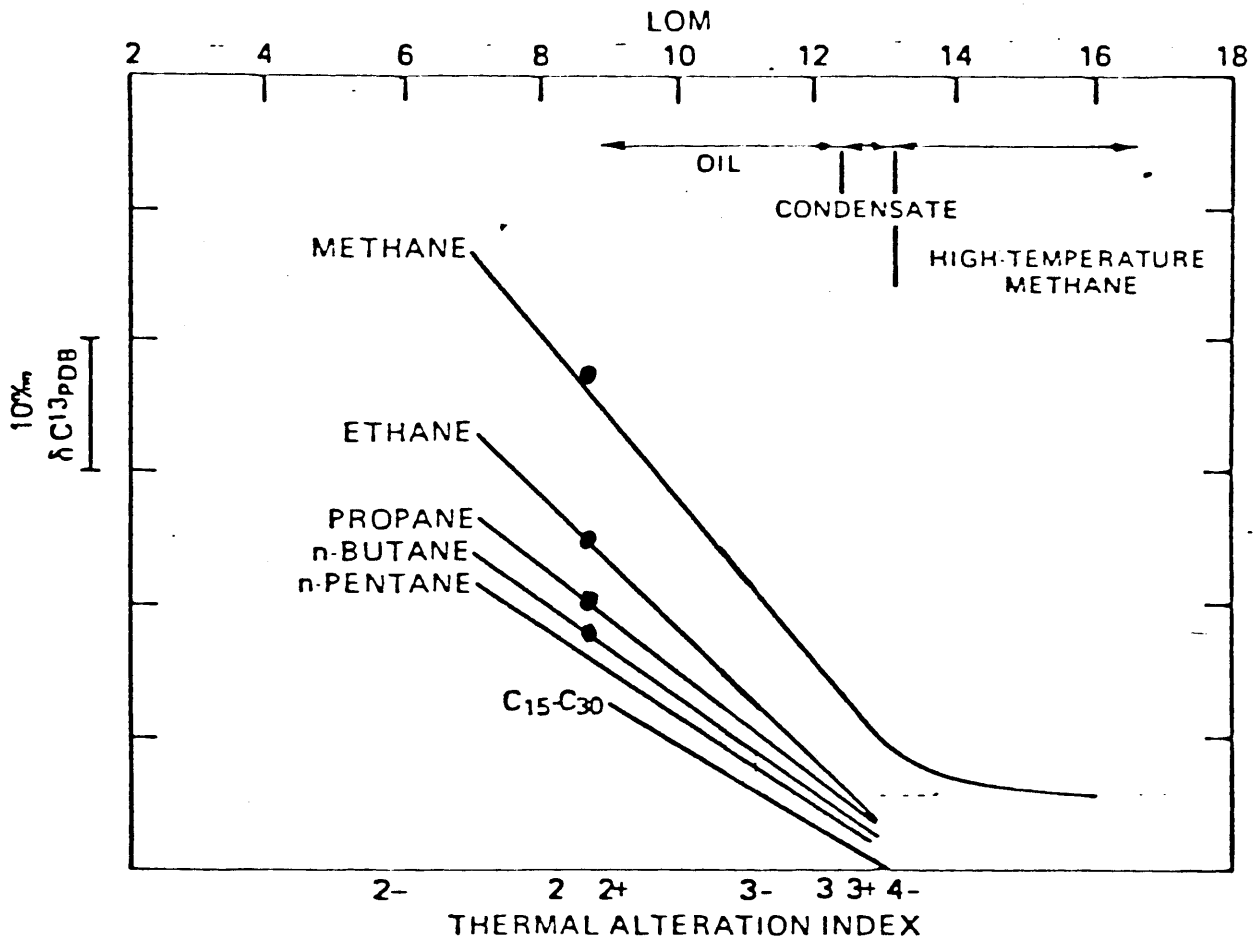
Med hilsen
for INSTITUTT FOR ENERGITEKNIKK

Karen Garder

Karen Garder
Overingeniør

Arne Råheim
Arne Råheim
Geolog

4 Vedlegg



Carbon isotopic separations of Ex well. 2-2-1-gas plotted on the maturity diagram (A.T. James 1983, AAPG in press). A source LOM of 8.7 is indicated for the gas. The best fit of the data is found by sliding the measured isotopic values horizontally (and vertically) until they fit the calculated lines on the diagram.

Column : 12' x 1/4" SS packed with Porapak QS
50/80 mesh

Col. temp. : 50°C to 160°C, 2 min. hold prog.,
20°C/min, and hold at 160°C

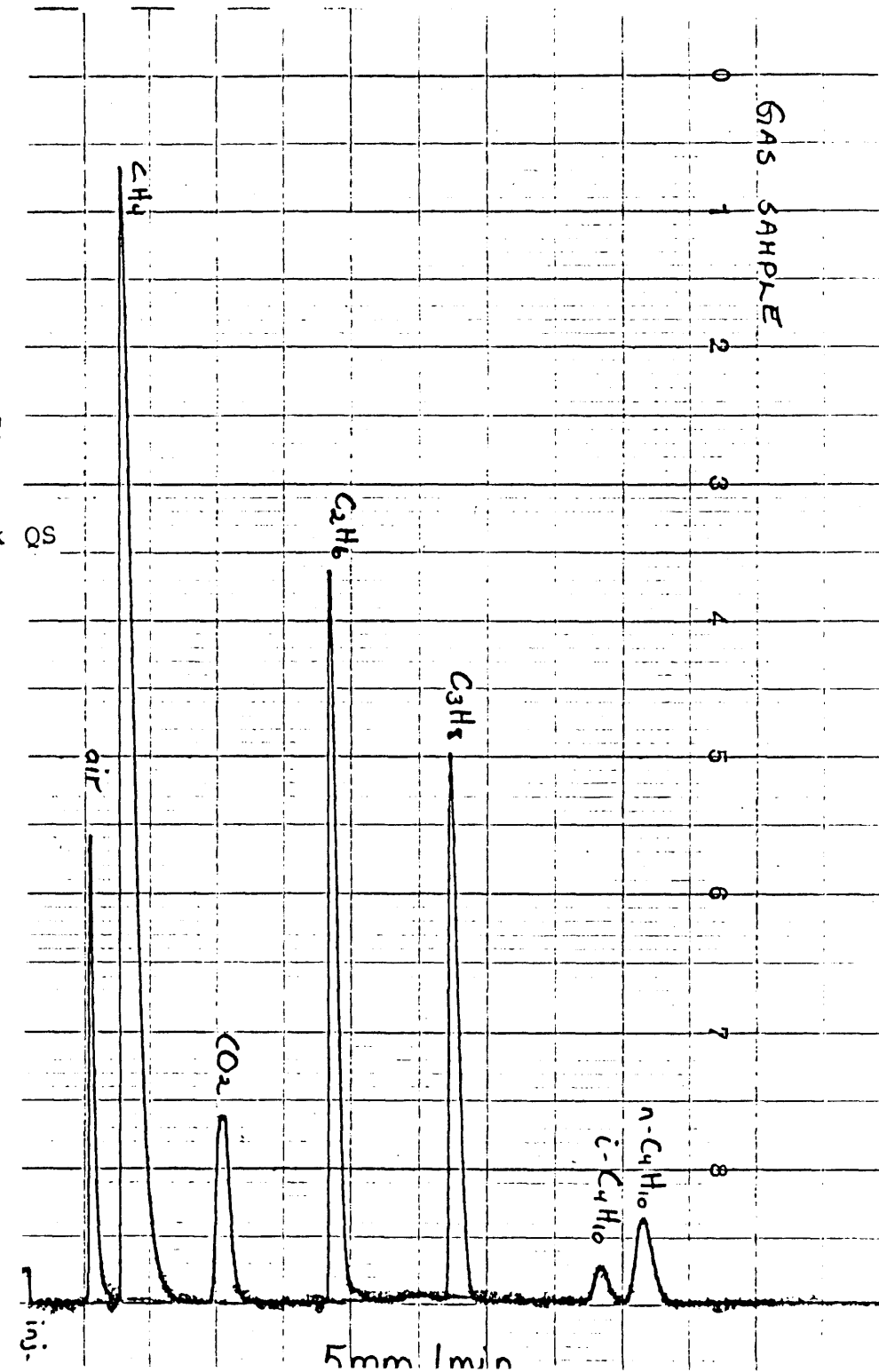
Flow rate : 30 ml/min. helium

Det. : Thermal Conductivity,

Instrument : Carlo Erba 4200

Sample size : 3 ml

Cart drive speed : 5 mm/min.



| | I-GAUGE | CHQ2 | CHQ3 | CHQ4 | TIME |
|-------|---------|-------|-------|-------|----------|
| ST(U) | 3.675 | 6.846 | 8.140 | 9.437 | 00/03/29 |
| SA(U) | 3.673 | 6.829 | 7.784 | 9.482 | 00/09/08 |

| | | | | | |
|--------------------|--|--|----------|--|----------|
| MASS/MASS | | | 45/44 | | 46/44 |
| ST-MEAN | | | 1.188916 | | 1.307187 |
| SA-MEAN | | | 1.139812 | | 1.388489 |
| DELTA-MEAN(RUN)(%) | | | -42.166 | | 0.945 |
| -STD.DEV.(%) | | | 0.010 | | 0.014 |
| -STD.ERR.(RUN)(%) | | | 0.002 | | 0.002 |

| | | | | | |
|-------------------|--|--|---------|--|---------|
| MASS/MASS | | | 13/12 | | 18/16 |
| DELTA-ION-CORR(%) | | | -44.962 | | 1.029 |
| DELTA-PDB(%) | | | -48.600 | | -22.184 |
| DELTA-ALPHA(%) | | | | | -22.184 |

C₄H₄

| | I-GAUGE | CHQ2 | CHQ3 | CHQ4 | TIME |
|-------|---------|-------|-------|-------|----------|
| ST(U) | 3.676 | 6.824 | 8.122 | 9.467 | 00/03/29 |
| SA(U) | 3.677 | 6.838 | 7.894 | 9.501 | 00/09/08 |

| | | | | | |
|--------------------|--|--|----------|--|----------|
| MASS/MASS | | | 45/44 | | 46/44 |
| ST-MEAN | | | 1.188007 | | 1.387236 |
| SA-MEAN | | | 1.154450 | | 1.389358 |
| DELTA-MEAN(RUN)(%) | | | -28.944 | | 1.523 |
| -STD.DEV.(%) | | | 0.007 | | 0.018 |
| -STD.ERR.(RUN)(%) | | | 0.001 | | 0.004 |

| | | | | | |
|-------------------|--|--|---------|--|---------|
| MASS/MASS | | | 13/12 | | 18/16 |
| DELTA-ION-CORR(%) | | | -32.804 | | 1.591 |
| DELTA-PDB(%) | | | -35.692 | | -21.645 |
| DELTA-ALPHA(%) | | | | | -21.645 |

C₂H₆

| | I-GAUGE | CHQ2 | CHQ3 | CHQ4 | TIME |
|-------|---------|-------|-------|-------|----------|
| ST(U) | 3.613 | 6.814 | 8.122 | 9.473 | 00/03/37 |
| SA(U) | 3.623 | 6.803 | 7.899 | 9.469 | 00/09/16 |

| | | | | | |
|--------------------|--|--|----------|--|----------|
| MASS/MASS | | | 45/44 | | 46/44 |
| ST-MEAN | | | 1.181882 | | 1.390023 |
| SA-MEAN | | | 1.161120 | | 1.392028 |
| DELTA-MEAN(RUN)(%) | | | -25.869 | | 1.281 |
| -STD.DEV.(%) | | | 0.005 | | 0.020 |
| -STD.ERR.(RUN)(%) | | | 0.002 | | 0.005 |

| | | | | | |
|-------------------|--|--|---------|--|---------|
| MASS/MASS | | | 13/12 | | 18/16 |
| DELTA-ION-CORR(%) | | | -27.583 | | 1.340 |
| DELTA-PDB(%) | | | -31.288 | | -21.891 |
| DELTA-ALPHA(%) | | | | | -21.891 |

C₃H₈

| | I-GAUGE | CHA2 | CHA3 | CHA4 | TIME |
|-------|---------|-------|-------|-------|----------|
| ST(U) | 2.736 | 1.225 | 1.461 | 1.767 | 00/06/30 |
| SA(U) | 2.734 | 1.250 | 1.455 | 1.750 | 00/12/09 |

| | | | | | |
|--------------------|--|--|----------|--|----------|
| MASS/MASS | | | 45/44 | | 46/44 |
| ST-MEAN | | | 1.182158 | | 1.389654 |
| SA-MEAN | | | 1.163835 | | 1.399999 |
| DELTA-MEAN(RUN)(%) | | | -23.750 | | 7.452 |
| -STD.DEV.(%) | | | 0.017 | | 0.042 |
| -STD.ERR.(RUN)(%) | | | 0.004 | | 0.011 |

i-C₄H₁₀

| | | | | | |
|-------------------|--|--|---------|--|---------|
| MASS/MASS | | | 13/12 | | 18/16 |
| DELTA-ION-CORR(%) | | | -25.625 | | 7.512 |
| DELTA-PDB(%) | | | -29.339 | | -15.861 |
| DELTA-ALPHA(%) | | | | | -15.861 |

| | I-GAUGE | CHA2 | CHA3 | CHA4 | TIME |
|-------|---------|-------|-------|-------|----------|
| ST(U) | 3.395 | 4.946 | 5.880 | 6.862 | 00/04/06 |
| SA(U) | 3.387 | 4.954 | 5.757 | 6.907 | 00/09/44 |

| | | | | | |
|--------------------|--|--|----------|--|----------|
| MASS/MASS | | | 45/44 | | 46/44 |
| ST-MEAN | | | 1.189056 | | 1.387384 |
| SA-MEAN | | | 1.162132 | | 1.394256 |
| DELTA-MEAN(RUN)(%) | | | -23.956 | | 4.842 |
| -STD.DEV.(%) | | | 0.022 | | 0.042 |
| -STD.ERR.(RUN)(%) | | | 0.005 | | 0.011 |

n-C₄H₁₀

| | | | | | |
|-------------------|--|--|---------|--|---------|
| MASS/MASS | | | 13/12 | | 18/16 |
| DELTA-ION-CORR(%) | | | -25.728 | | 5.000 |
| DELTA-PDB(%) | | | -29.440 | | -18.315 |
| DELTA-ALPHA(%) | | | | | -18.315 |

| | I-GAUGE | CHA2 | CHA3 | CHA4 | TIME |
|-------|---------|-------|-------|-------|----------|
| ST(U) | 3.083 | 2.482 | 2.965 | 3.452 | 00/03/50 |
| SA(U) | 3.081 | 2.484 | 2.946 | 3.450 | 00/09/29 |

| | | | | | |
|--------------------|--|--|----------|--|----------|
| MASS/MASS | | | 45/44 | | 46/44 |
| ST-MEAN | | | 1.189085 | | 1.385417 |
| SA-MEAN | | | 1.185945 | | 1.386582 |
| DELTA-MEAN(RUN)(%) | | | -3.337 | | 2.284 |
| -STD.DEV.(%) | | | 0.065 | | 0.102 |
| -STD.ERR.(RUN)(%) | | | 0.017 | | 0.027 |

CO₂

| | | | | | |
|-------------------|--|--|--------|--|---------|
| MASS/MASS | | | 13/12 | | 18/16 |
| DELTA-ION-CORR(%) | | | -3.625 | | 2.214 |
| DELTA-PDB(%) | | | -7.431 | | -21.037 |
| DELTA-ALPHA(%) | | | | | -21.037 |

