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	REPORT TITLE REPORT ON STABLE ISOTOPES ($\delta^{13}\text{C}$, δD , $\delta^{18}\text{O}$) ON NATURAL GAS SAMPLES FROM WELL 34/10-23 AND WELL 34/10-33B.		DATE OF LAST REV. REV. NO.	
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SUMMARY The gas components C ₁ -C ₃ and CO ₂ have been separated from natural gas samples from well 34/10-23, sample A 15257, DST 1 (28.09.85), 4085 - 4095 mRKB and well 34/10-33B, sample K 5122, RFT, 3335 mRKB. The $\delta^{13}\text{C}$ values of methane, ethane, propane, the butanes and CO ₂ have been measured. The isotopic composition of hydrogen from CH ₄ has also been measured. The isotopic composition of the gas samples from well 34/10-23 and well 34/10-33 indicates a mixed gas. The mixed gas is at least derived from two different sources with one source dominating from C ₁ to C ₃ and the other dominating from C ₄ and higher. Gases derived from the same source but at different maturity levels is also a possibility. It is in the present case (because of the mixed gas situation) difficult to use the isotopes to indicate the maturity level of the source rocks, the data however, suggest a high maturity situation.			DISTRIBUTION Statoil (10) Andresen, B. Råheim, A. Throndsen, T. File (2)	
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1 INTRODUCTION

Two gas samples, well 34/10-23, sample A 15257, DST 1 (28.09.85), 4085 - 4095 mRKB and well 34/10-33B, sample K 5122, RFT, 3335 mRKB were received and analysed October/November 1989.

On the samples $C_1 - C_3$ and CO_2 are quantified, and the $\delta^{13}C$ value is measured on methane, ethane, propane, the butanes and CO_2 . The δD value is also measured on methane.

2 ANALYTICAL PROCEDURE

The natural gas have been quantified and separated into the different gas components by a Carlo Erba 4200 instrument.

The hydrocarbon gas components were oxidized in separate CuO-ovens in order to prevent cross contamination. The combustion products CO_2 and H_2O were frozen into collection vessels and separated.

The water was reduced with zinc metal in a sealed tube to prepare hydrogen for isotopic analysis. The isotopic measurements were performed on a Finnigan Mat 251 and Finnigan Delta mass spectrometer. IFE's value on NBS 22 is $-29.77 \pm .06$ ‰ PDB.

3 RESULTS

The volume composition of the gas samples is given in table 1. The results have been normalized to 100%. The stable isotope results are given in table 2.

The uncertainty on the $\delta^{13}C$ value is estimated to be ± 0.3 ‰ PDB and includes all the different analytical steps. The uncertainty on the δD value is likewise estimated to be ± 5 ‰.

Table 1 Volume composition of gas samples from well 34/10-23 and 34/10-33B.

SAMPLE	IFE no.	C ₁ %	C ₂ %	C ₃ %	iC ₄ %	nC ₄ %	iC ₅ %	nC ₅ %	CO ₂ %	Σ C ₁ - C ₅	WET- NESS	iC ₄ / nC ₄
34/10-23, A 15257 (28.09.85) DST 1, 4085 - 4095 mRKB	8519	82.3	7.7	1.5	0.22	0.37	0.07	0.07	7.8	92.2	0.11	0.60
34/10-33B K 5122 RFT, 3335 mRKB	8520	85.3	8.4	2.2	0.29	0.60	0.09	0.14	3.0	97.0	0.12	0.49

Table 2 Isotopic composition of gas samples from well 34/10-23 and 34/10-33B.

SAMPLE	IFE no.	C ₁ δ ¹³ C PDB	C ₁ δ D SMOW	C ₂ δ ¹³ C PDB	C ₃ δ ¹³ C PDB	iC ₄ δ ¹³ C PDB	nC ₄ δ ¹³ C PDB	CO ₂ δ ¹³ C PDB	CO ₂ δ ¹⁸ O PDB
34/10-23 A 15257 (28.09.85) DST 1, 4085 - 4095 mRKB	8519	-38.0	-190	-28.4	-26.0	-25.1	-23.6	-0.9	-12.6
34/10-33B K 5122 RFT, 3335 mRKB	8520	-38.5	-196	-28.8	-26.7	-27.7	-26.0	-8.3	-11.3

4 INTERPRETATION

As seen from table 2 the gas samples are characterized by rather heavy carbon isotopic composition of methane which may indicate a high maturity situation, an isotopically heavy source rock or a biodegraded environment.

The gas sample from well 34/10-33B are slightly lighter in the isotopic composition than the gas sample from well 34/10-23. This effect is most pronounced on the carbon isotopic composition of the butanes and CO₂.

Both samples follow a general isotopic trend for unaltered gases with a smooth progression from methane to n-butane, excluding i-butane (James, 1983).

A source LOM of about 12 is indicated when the $\delta^{13}\text{C}$ values of methane, ethane, propane and n-butane from well 34/10-33B are plotted in James maturity diagram, fig.1 (James, 1983), e.g. at a relatively high maturity level in the oil window.

In the sample from well 34/10-23 the carbon isotopic value of n-butane does not fit with the corresponding ethane and propane values when plotted on the maturity diagram. The $\delta^{13}\text{C}$ n-butane value is too heavy. This may indicate a mixed gas situation with gas at least derived from two different sources with one source dominating from C_1 to C_3 and the other dominating from C_4 and higher. Gases derived from the same source but at different maturity levels is also a possibility. A source LOM of about 11 is indicated when the $\delta^{13}\text{C}$ values of methane, ethane and propane are plotted in James maturity diagram, fig.1 (James, 1983), e.g. at a maturity level in the middle of the oil window.

A higher maturity situation equal to the condensate field of the oil window is indicated for both samples with the combined use of the carbon and hydrogen isotopes of methane, fig.2 (Schoell, 1983).

5 CONCLUSION

The isotopic composition of the gas samples from well 34/10-23 and well 34/10-33B may indicate a mixed gas. The mixed gas is at least derived from two different sources with one source dominating from C_1 to C_3 and the other dominating from C_4 and higher. Gases derived from the same source but at different maturity levels is also a possibility.

It is in the present case (because of the mixed gas situation) difficult to use the isotopes to indicate the maturity level of the source rocks, the data however, suggest a high maturity situation.

6 LITERATURE

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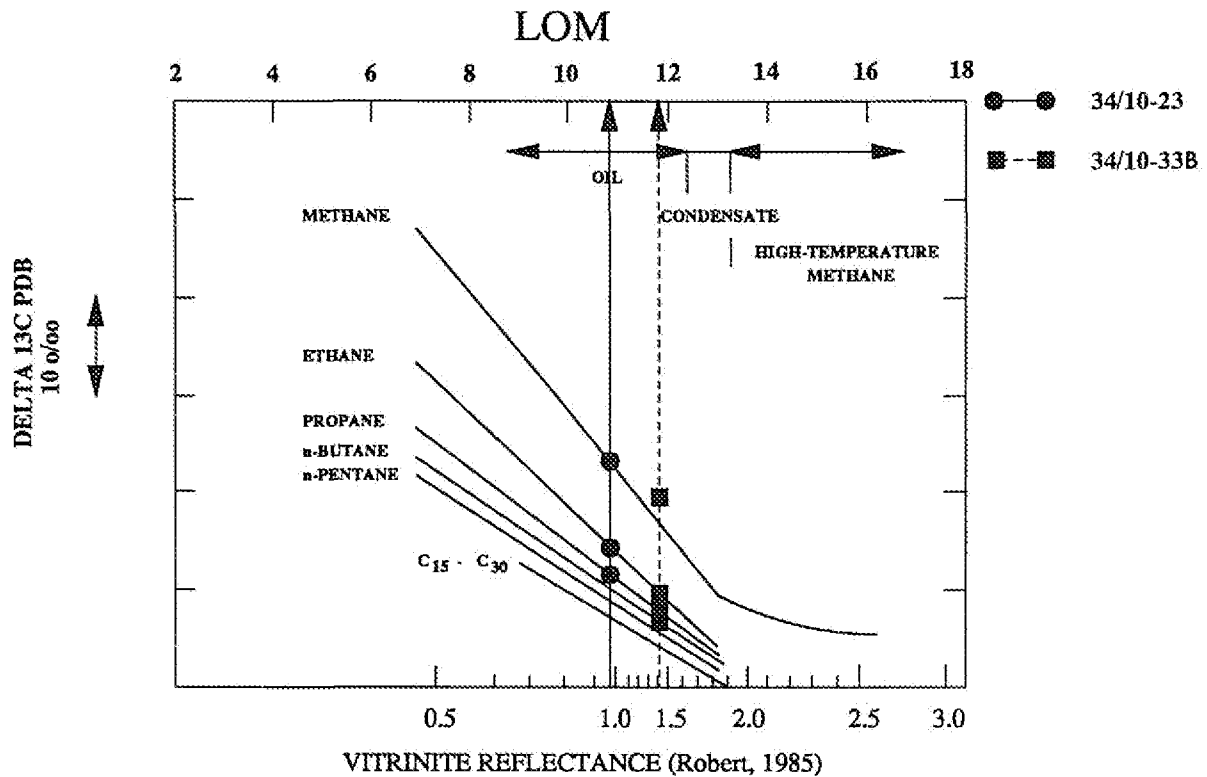


Figure 1

Carbon isotopic separation of gas samples from well 34/10-23 and well 34/10-33B are plotted on the maturity diagram (after James, 1983). A source LOM of about 11 and 12 is indicated for the gas samples.

The calculated carbon isotopic separations between gas components are plotted on the vertical axis using a sliding scale that is simply the algebraic difference, in parts per mil, between the isotopic composition of the natural gas components. The scale does not possess a fixed origin, but is oriented with the more depleted $\delta^{13}\text{C}$ values at the upper end. Use of this sliding scale allows the maturity of a gas to be assessed without prior knowledge of the isotopic composition of the gas source.

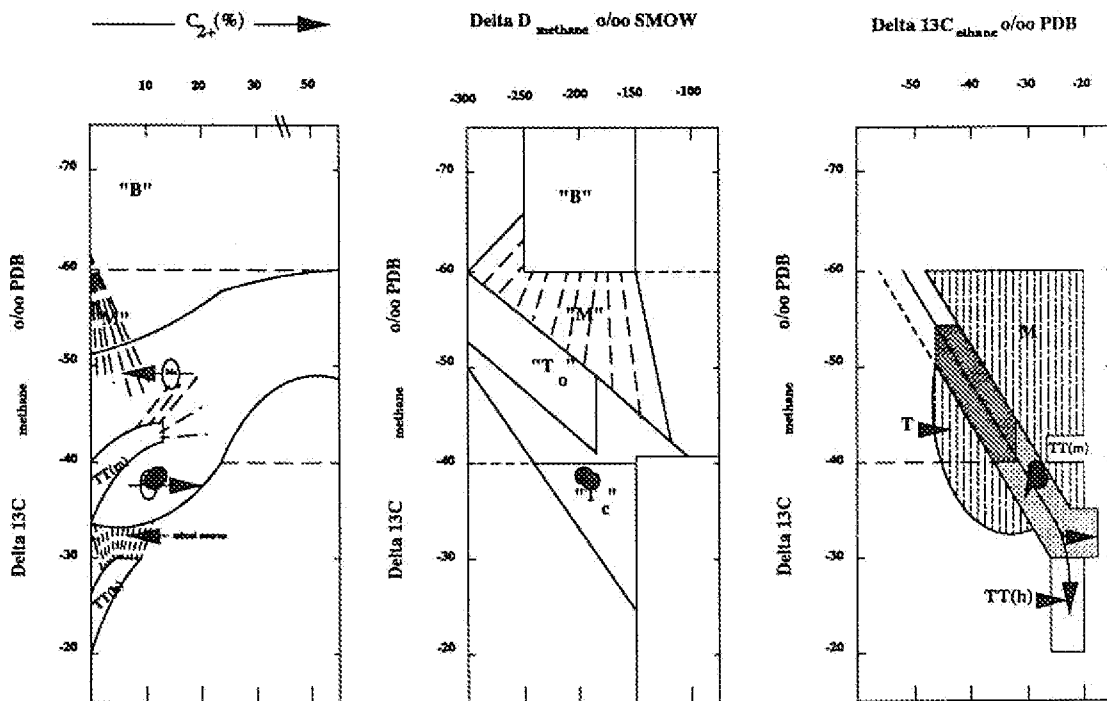


Figure 2A

Variations of molecular composition in natural gases related to the isotope variations of methane.

Figure 2B

Carbon and hydrogen isotope variations in methane.

Figure 2C

Carbon isotope variations in ethane related to carbon isotope variations in methane.

The principle for the genetic characterization of natural gases is that primary gases (B-biogenic gas, T-associated gas, TT-non-associated gas) are defined by fields of compositional variations. These primary gases may become mixed and form various mixtures "M" of intermediate composition. "TT(m)" and "TT(h)" are non-associated gases from marine source rocks and coal gases from N.W. Germany, respectively, compositional shifts due to migration are indicated by arrows Md (deep migration) and Ms (shallow migration), respectively. "T₀" are gases associated with petroleum in an initial phase of formation. "T_c" are gases associated with condensates (Schoell, 1983).