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RESERVOIR GAS GEOCHEMISTRY ON SAMPLES FROM WELL 31/6-1

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SUMMARY

A rather heavy $\delta^{13}C$ propane value together with the uncommon relation ships between the $\delta^{13}C$ values of propane and the butanes can in our view only be explained by effects from bacterial degradation in the reservoir.

This in accordance wtih the conclusion given in the reports on well 31/2-1, 31/5-1, 31/5-2, and 31/6-2.

This biodegradation was followed by a period of renewed supply of predominantly dry gas. A crossplot between the $\delta^{13}C$ methane and the δD methane values indicates that this superimposed gas was formed at rather high maturity at the end of the oil window in the condensate field.

DISTRIBUTION

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KEYWORDS

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ANALYTICAL PROCEDURE

The sample were received in two Suppelco 125 ml glass containers, one new with no bacterizides (sample 1), one used and with bacterizides (sample 2). The natural gas has been separated into the different gas components by a Carlo-Erba 4200 instrument. The hydrocarbon gas components were oxydized in separate CuO-ovens, which enables us to collect several times when the concentration of a gas component is low. The combustion products CO_2 and H_2O were frozen into collection vessles and separated. The isotopic measurements were performed on a Finnigan Mat 251 mass spectrometer. Our $\delta^{13}C$-value on NBS-22 is -29.77 +/- .06 $^{0}/oo$.

RESULTS

The stable isotope results of the gas from gas bottle A 8679 DST 1 31/6-1 are given in the following table :

Table 1. Isotopic composition of gas samples from well 31/6-1.

	C_1 $\delta^{13}C$	C_1 δD	C_2	C_3	iC_4	nC_4
DST I (no bacterizides)	- 45.5	- 169.7	- 25.2	- 22.4	- 26.9	- 25.8
DST II (bacterizides)	- 45.2		- 25.4	- 22.0		

The composition in % of the gas samples are given in table 2. The results have not been normalized to 100%, the rest is air.

Table 2. Composition of gas from well 31/6-1 % of C_1-C_4

	Sample 1 no bacterized	Sample 2 with bacterized
C_1	71.0	72.0
C_2	4.1	4.2
C_3	1.0	1.0
iC_4	0.4	0.4
nC_4	0.2	0.2
CO_2	0.2	0.1

INTERPRETATION

The rather heavy $\delta^{13}C$ propane values together with the uncommon relation ships between the $\delta^{13}C$ values of propane and the butanes can in our view only explained by effects from bacterial degradation in the reservoir.

A new, relatively dry gas has migrated into the reservoir after the bacterial degradation had stopped. The new gas mixed with the gas left after the bacterial degradation.

This makes it impossible to use Alan T. James' method * to indicate the maturity of the source.

It is, however, likely that the methane component of the natural gas is representative for the new, relatively dry gas. This assumption is based on our experience on bacterial degradation from laboratory experiments. The carbon and hydrogen isotopic composition of the gas can therefore be plotted in a $\delta^{13}C$ methane vs. δD methane plot (Schoell, 1983)**, figure 1. This indicate that the superimposed gas was formed at a rather high maturity in the condensate field of the oil window.

* James, Alan T. (1983) : Correlation of Natural Gas by Use of Carbon Isotopic Distribution Between Hydrocarbon Components, A.A.P.G. Vol. 67, No. 7, July, 1983.

** Schoell, M. 1983 : Genetic Characertization of Natural Gases. A.A.P.G. December, 1983.

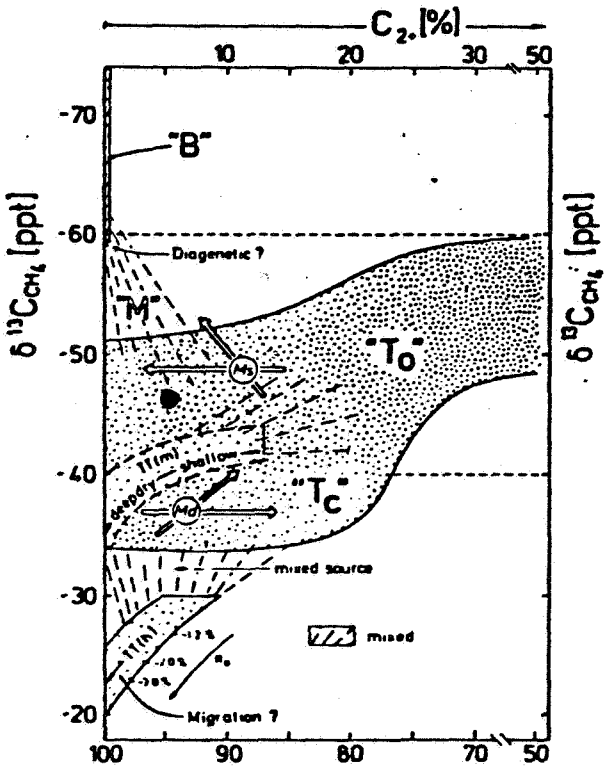

Figure 1 a. Variations of molecular composition in natural gases related to the isotope variations of methane.

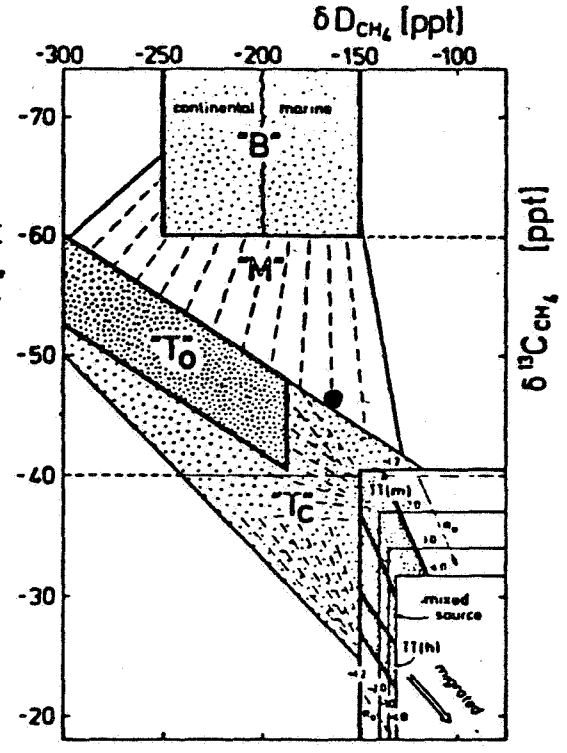

Figure 1 b. Carbon and hydrogen isotope variations in methanes.

The principle for the genetic characterization of natural gases is that the 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. "T" are gases associated with petroleum in an initial phase of formation. "T_C" are gases associated with condensates. (Schoell, 1983).