

7.7 Geochemistry of hydrocarbon gases in Kara Sea sediments

G.S. Korobeinik, V.G. Tokarev, T.I. Waisman

Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Moscow, Russia

Detailed gasometrical investigations in the Kara Sea were continued during the expedition of R/V "Academic Boris Petrov" (August - September, 2001). In this short paper we present preliminary results of a detailed study on the concentrations and distribution of hydrocarbon gases in the Kara Sea deposits. Sediments from four cores sampled at the stations BP01-26, BP01-55, BP01-47, BP01-34 were analyzed.

Methods

The analytical procedures used for this work have been described previously (Korobeinik et al. 2001).

Results and Discussion

The concentrations of the individual hydrocarbon gases (C_1 - C_5) and the ratios of $(C_{2=}-C_{4=})/(C_2-C_4)$ and $\sum(C_4-C_5)/\sum(C_2-C_3)$ are shown in Table 7.9. Geochemical indices and methane distribution within the cores and along the Yenisei-Kara Sea profile are presented in Figures 7.12-7.15.

C_1 concentration in the sediments of the cores BP01-26, BP01-55 varies within a wide range from 56×10^{-4} ml/l in the subsurface layer to 10 ml/l at the core bottoms. C_1 distribution within the sediments of the core BP01-26 is shown in Figure 7.12. Deposits are characterized by a down core increase of methane content and in the low parts of the cores a high concentration gradient is observed. Sediments taken at the stations BP01-26 and BP01-55 contain less $C_{2=}$, $C_{3=}$, $C_{4=}$ hydrocarbons than $C_2, C_3, i-C_4, n-C_4$ ($(C_{2=}-C_{4=})/(C_2-C_4) < 1$). However, in the uppermost layer an oxidized layer as indicated by $(C_{2=}-C_{4=})/(C_2-C_4)$ ratio of 4.99 can be distinguished (Fig. 7.13, curve A). In the upper layers (75 – 146 cm), higher homologues of hydrocarbon gases ($i-C_4, n-C_4, i-C_5, n-C_5$) were observed in higher concentrations than C_2+C_3 homologues, resulting in a $\sum(C_4-C_5)/\sum(C_2-C_3)$ ratio of 7.02-7.20 (Fig. 7.13, curve B).

Hydrocarbon gases concentration and the distribution of the higher homologues within the sediments of cores BP01-26 and BP01-55 indicate active processes of gas generation and consumption in the deposits. The authigenic mineral ikaite as well as carbonate concretions were also described in these sediments (Kodina et al. 2001). The same regularities were revealed earlier in the sediments of the core BP00-37 (Korobeinik et al. 2001).

Sediments of the cores BP01-34 and BP01-37 show low methane concentrations and vary from 300×10^{-4} to 660×10^{-4} ml/l in the core BP01-47 (Fig. 7.14) and from 150×10^{-4} to 974×10^{-4} ml/l in the core BP01-34. Geochemical indices show $(C_{2=}-C_{4=})/(C_2-C_4) > 1$ in the oxidized layer and $\sum(C_4-C_5)/\sum(C_2-C_3) > 1$. Hydrocarbon content and distribution pattern of these cores in the northern part of the Kara Sea (78°N) indicate that

Table 7.9: Methane and Other Hydrocarbon Gases in Sediment Cores of Kara Sea.

Station	Horizon cm	Concentration, ml/*10 ⁻⁴										Gasgeochemical indices	
		C1	C2	C2=	C3	C3=	iC4	nC4	C4=	iC5	nC5	((C2=)-(C4=)) (C2-C4)	Σ(C4-C5) Σ(C2-C3)
26	5-7	56	6	44,8	3	10,76	1	3	5,3	3	3	4,99	1,22
	26-50	1 451	17	5,2	12	0,15	6	10	0,0	22	8	0,18	1,85
	75-95	277	9	0,6	7	0,16	4	77	0,0	14	16	0,04	7,02
	126-146	424	8	1,0	10	0,4	5	10	0,2	23	81	0,05	7,20
	175-195	511	27	1,8	34	0,48	15	29	0,3	34	30	0,02	1,78
	200-220	1 996	6	0,9	11	0,38	5	8	0,8	14	4	0,07	1,88
	226-246	1 939	3	0,4	4	0,03	2	4	0,0	7	4	0,06	2,19
	305-325	42 949	5	0,4	7	0,24	3	6	0,0	12	3	0,05	2,04
	350-370	105 993	16	2,2	12	0,15	5	9	0,0	18	7	0,08	1,37
	400-420	67 734	18	1,5	5	0,4	2	3	0,0	6	7	0,08	0,80
495-515	79 994	31	2,1	4	0,58	2	4	0,0	5	4	0,07	0,42	
55	16-36	1 074	30	0,4	28	0,25	13	23	0,0	30	9	0,01	0,73
	36-60	2 171	21	2,2	28	0,08	16	23	0,0	70	42	0,01	3,20
	105-125	3 153	42	1,6	25	0,2	12	21	0,7	45	20	0,02	1,47
	135-165	43 325	87	1,4	26	0,41	13	22	1,8	40	16	0,02	0,80
	190-217	112 715	227	17,2	17	0,41	11	17	3,0	24	11	0,08	0,26
	270-285	108 400	52	4,1	48	1,56	12	23	0,0	46	22	0,06	1,03
47	0-3	328	24	2	31	1,0	17	31	1,3	86	39	0,04	3,10
	6-10	298	25	2	29	0,5	17	28	0,0	64	59	0,05	3,10
	20-24	94	18	1	21	0,1	14	20	0,0	53	23	0,03	2,79
	34-38	310	7	0,2	18	0,04	9	15	0,0	43	14	0,01	3,64
	97-127	260	23	2	27	0,4	15	24	0,3	65	28	0,03	2,69
	170-192	531	20	1	25	0,6	11	22	0,3	68	26	0,03	2,84
	202-225	659	26	1	31	0,3	18	30	0,4	83	25	0,02	2,74
	230-259											0,03	2,97
34	24-29	4	0,5	0,04	1	0	0,2	0,4	0,0	4	0	0,08	4,20
	55-87	244	30	2	37	1,0	23	47	0,0	49	17	0,04	2,02
	150-180	150	24	1	24	0,02	15	22	0,0	43	15	0,02	2,00
	250-280	284	40	25	50	0,4	29	54	0,0	144	58	0,03	3,18
	280-380	974	28	2	21	0,2	8	12	0,0	42	37	0,04	2,02
	450-480	218	25	2	31	0,4	20	29	0,0	77	133	0,04	4,6

Fig. 7.12 Methane in bottom sediment.
(Kara Sea, BP01-26)

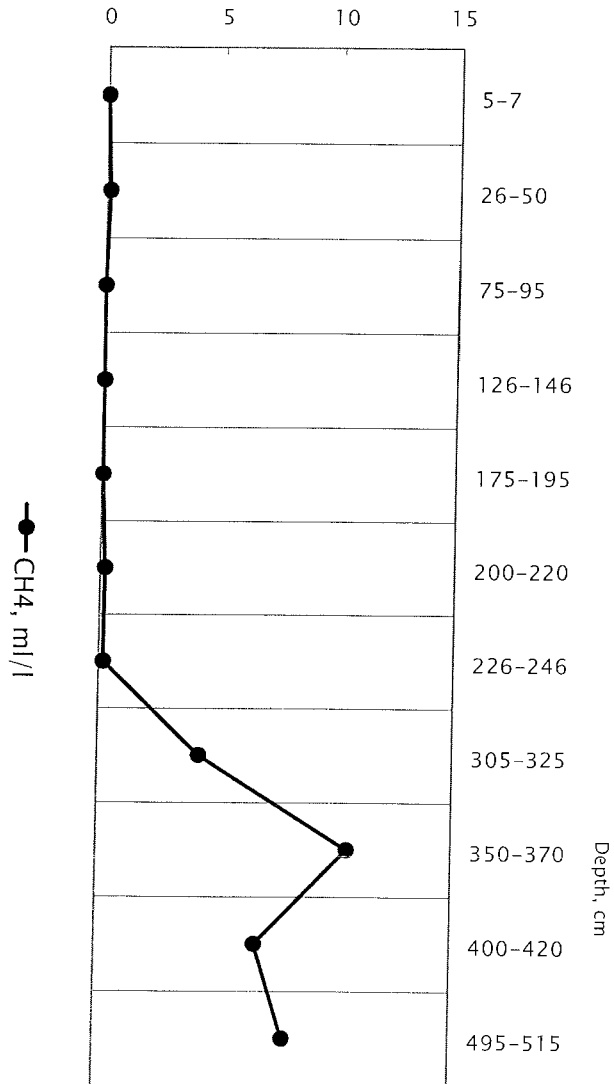


Fig. 7.13 Geochemical indices in bottom sediment, (Kara Sea, BP01-26)

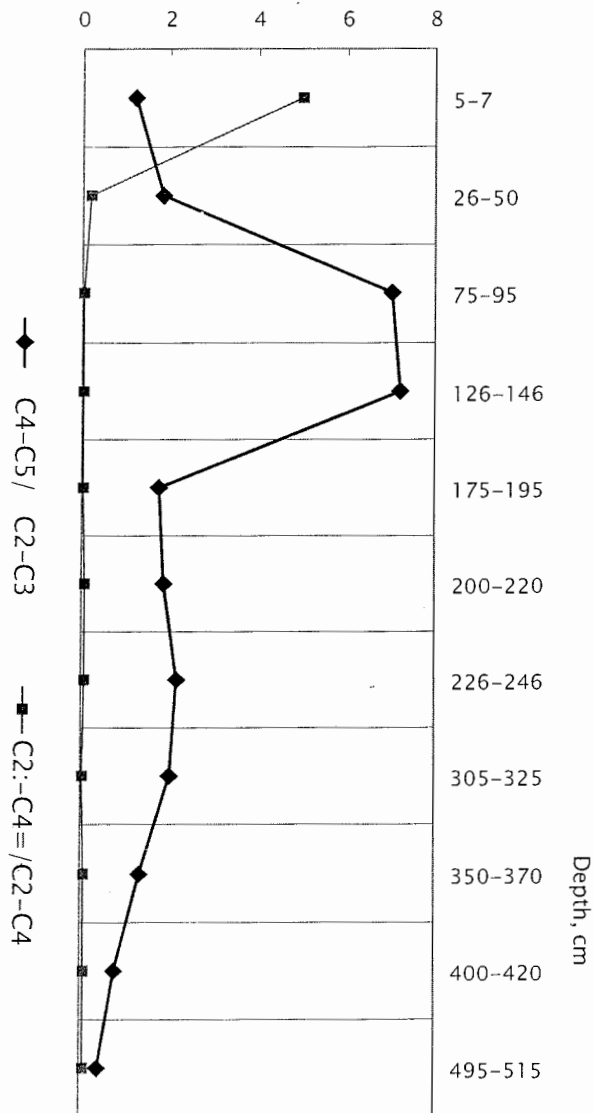


Fig. 7.14 Methane in bottom sediment.
(Kara Sea, BP01-47) .

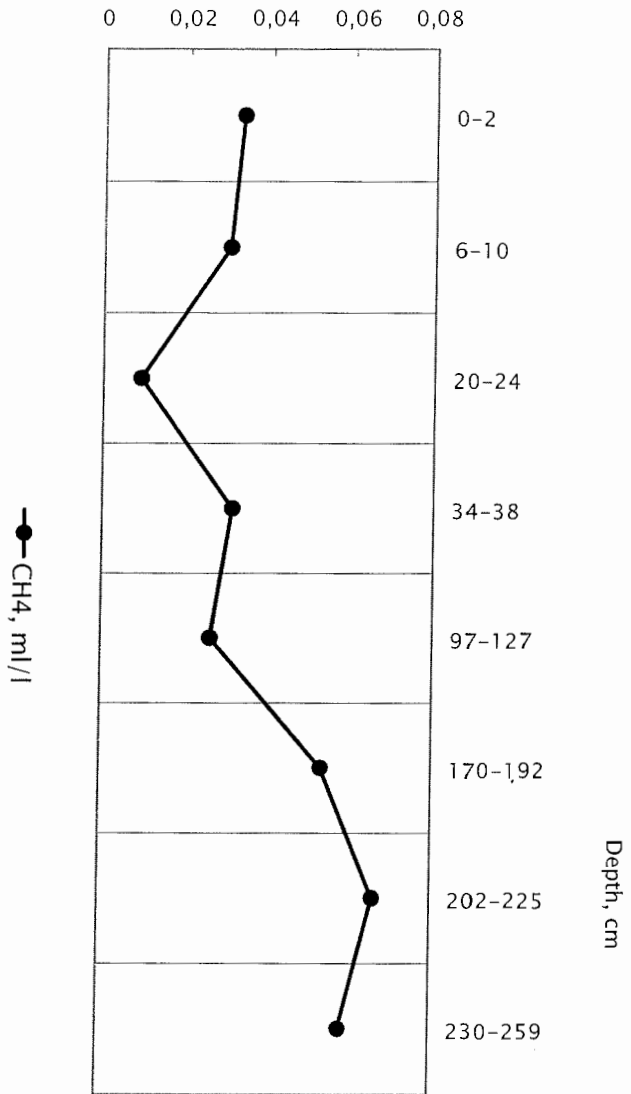


Fig.7.15 Geochemical indices in bottom sediment,
(Kara Sea, BP01-47)

