

Simultaneously, arsenic could accumulate in authigenic pyrite during diagenesis in bottom sediments, so it is, perhaps, not by chance that we observe great affinity between the distribution of As and pyritic sulfur in recent Black Sea sediments.

In conclusion, we would like to mention some indirect evidence about the influence of organic matter on the accumulation of arsenic in recent Black Sea sediments. First, there is clear correlation between organic matter and As in the main sediment types (see Table 1). The Corg content, like that of arsenic, grows continuously from sand to abyssal clayey and calcareous mud. The relationship between Corg and As is reflected, too, on sketch maps for their lateral distribution in the basin in both natural matter and carbonate-free sediment.

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HYDROGEN IN GASES DISSOLVED IN WATER OF THE WEST SIBERIAN PLAIN¹

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Until recently the prevalent view in the literature was that hydrogen could not occur with hydrocarbon gases owing to their special mode of origin [1]. Each year, however, more and more information is being published about the discovery of molecular hydrogen in natural gases in various fields.

There is no unanimous view about the origin of free hydrogen in the earth's interior or even about the possibility of its existing there. Some think that the hydrogen in natural gas is of technical origin, being due solely to the special conditions of well testing and sample collection and degasification. Others recognize the considerable abundance of hydrogen in sedimentary rocks and believe that the hydrogen concentration now observed can be considered to have avoided

hydrogenation reactions [3]. In the opinion of most scientists, the most likely sources of the hydrogen found in sediments are the chemical and radiochemical dissociation of water and the bacterial, thermal and radiochemical alteration of organic matter. Some authors admit the possibility of hydrogen entering sedimentary rocks from depth.

In western Siberia hydrogen has been detected in a fairly large number of samples (in roughly 15% of all available analyses). Its contents ranges from zero and tenths of a percent to several tens of a percent in individual cases. But its percentage does not usually exceed 1 (in 80 out of 134 analyses). In order to ascertain the trend in the variation of hydrogen in profile, we have calculated the arithmetic mean percentage of this gaseous element and the number of areas and analyses in which it was detected in various stratigraphic units and depth intervals.

The data presented in Tables 1 and 2 show convincingly that for the West Siberian Plain as a whole there is a fairly clear pattern of an

¹Translated from: *K voprosu o vodorode v gazakh, rastvorenykh v vodakh Zapadno-Sibirskoy nizmenosti*. *Doklady Akademii Nauk SSSR*, 1968, Vol. 179, No. 4, pp. 961-962.

Table 1

Content and Frequency of Hydrogen as a Function of the Age of Host Sediments

Age of sediments	H ₂ content, percentage	Number of areas		Number of analyses*	
		in all	with H ₂	in all	with H ₂
Cr ₂ cm + Cr ₁ alb + Cr ₁ apt	—	83	3 (3.6)	147	3 (2.04)
Cr ₁ h — b	0.05	98	14 (14.3)	243	23 (9.45)
Cr ₁ v	0.13	81	15 (18.5)	177	28 (15.8)
J ₃	0.17	80	21 (26.2)	174	34 (19.5)
J ₁₋₂	0.76	66	22 (33.0)	136	33 (24.2)
Basement	0.31	38	11 (28.0)	63	13 (20.6)

* Here and in Tables 2 and 3 the percentages are given in parentheses.

Table 2

Content and Frequency of Hydrogen as a Function of the Depth of Sediments

Depth interval, m	H ₂ content, %	Number of areas		Number of analyses	
		in all	with H ₂	in all	with H ₂
0—500	—	13	—	22	—
500—1000	0.02	72	9 (12.5)	144	9 (6.25)
1000—1500	0.02	112	7 (6.3)	211	9 (4.25)
1500—2000	0.14	102	27 (26.4)	230	39 (16.9)
2000—2500	0.24	101	30 (29.7)	193	52 (26.2)
2500—3000	1.59	23	13 (56.5)	44	18 (40.9)
3000	1.04	4	2 (50.0)	8	4 (50.0)

Table 3

Distribution of Hydrogen in Sediments from Different Kinds of Fields

Age	Oil fields		Eastern gas-condensate fields		Western gas fields	
Cr ₂ cm + Cr ₁ alb + Cr ₁ apt	4	1 (25.0)	3	—	29	1 (3.5)
Cr ₁ h — b	18	6 (33.0)	10	1 (10)	21	1 (4.8)
Cr ₁ v	21	8 (38.0)	14	2 (14)	9	2 (22.2)
J ₃	9	7 (78.0)	6	3 (50)	31	8 (25.8)
J ₁₋₂	9	5 (55.6)	13	6 (46)	20	7 (35.0)
Basement	6	4 (67.0)	2	1 (50)	14	3 (21.4)
In all	67	31 46.3	48	13 27.1	124	22 17.7

increase in the percentage and frequency of hydrogen toward older (Jurassic) and deeper sediments.

Comparison of the extent of hydrogen in oil, gas and gas-condensate fields shows that for absolutely all stratigraphic intervals the oil fields are distinguished by a considerably greater frequency of the given element than are the gas and gas-condensate fields (Table 3).

The percentage of hydrogen also varies in the same way as its frequency for the territories mentioned. Disregarding single analyses for the Sos'va and Salym areas where a much greater amount of hydrogen was found, it can be said that the peak percentage of hydrogen is 0.9 for western and northern gas fields, 6.0 for eastern gas-condensate fields (in 42% of analyses the H₂ percentage exceeds 1) and 11.2 for oil fields

(in 46% of analyses the H_2 percentage is more than 1).

Summing up what has been said, it should be noted that hydrogen is most abundant and frequent in Jurassic sediments rich in organic matter and bitumen [2], in oil fields. The results obtained unwittingly suggest that hydrogen is genetically related to petroleum hydrocarbons. The genesis of both can be attributed to one source or, if not to the same factors, then at least to simultaneously changing ones.

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CONDUCTANCE VARIATION DURING KYANITE-SILLIMANITE (Al_2SiO_5) POLYMORPHISM UNDER HIGH TEMPERATURES AND PRESSURES¹

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Experimental study of the conductance of rocks and minerals under high temperatures and pressures provides the necessary information for interpreting the results of geophysical surveys and can be used, at the same time, as a method of investigating the mode of phase transitions. The need for developing such a method is dictated by the fact that the quenching method normally employed for these purposes is unsuitable in certain cases, for experimentally stable phases will not always survive even when the cooling is rapid. Unlike the quenching method, the conductometric method enables phase transitions to be detected in the actual course of high-pressure experiments and also greatly shortens the number of tests required.

One of the risks in investigating the position of the line of equilibrium of the kyanite-sillimanite transition by the quenching method [1-3], is that owing to the low rate of change and the comparatively short duration of experiments the curves obtained will not represent the equilibrium mode of transition. In order to check this assumption and ascertain the form of variation in electrical properties at the time of transformation, the kyanite-sillimanite transition has been studied by the conductometric method. This method has already been used [4] to determine the influence of pressure on the melting point of single-component (albite) and

multicomponent (basalt) systems. The appearance of liquid phase was thereby clearly revealed by the change in temperature dependence of the logarithm of the specimen conductance and capacitance.

The problem of studying solid phase transitions at high pressures by the conductometric method is greatly complicated by the relatively small variation in electrical properties when one phase changes into another and by the strong slanting influence of conductor insulation resistance when high-resistance specimens are being measured.

The work was performed on original high-pressure equipment to provide information about the electrical properties of rocks and minerals at temperatures of up to 1500° and pressures of up to 35,000 kg/cm². The high precision in the measurement of the temperature and its gradient in the specimen essential for our purposes was ensured by introducing into the high-pressure cell three platinum-platinorhodium thermocouples. In this case the temperature measurement error was 1.5%, allowing for the influence of pressure on the thermocouple e. m. f., and the temperature gradient in the specimen did not exceed 20 to 25°. The cell pressure could be determined to within 4% by allowing for the influence of temperature on the pressure calibration of apparatus normally carried out at room temperature.

The conductance measurement circuit was prepared as a coaxial cylindrical capacitor mounted in a recess in the inner cell heater. The powdered specimen investigated was pressed into a ring gap between the capacitor shells. The conductance was measured on a 1000 c/s frequency by means of an a. c. bridge. The sensitivity

¹Translated from: *Izmeneniye elektroprovodnosti pri polimorfnoy prevrashchenii kyanitsillimanit (Al_2SiO_5) v usloviyakh vysokikh temperatur i davleniy*. *Doklady Akademii Nauk SSSR*, 1968, Vol. 179, No. 4, pp. 963-965.