ГЕОЛОГІЧНІ НАУКИ

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PERSPECTIVE RESOURCES OF THE BLACK SEA

Hydrogen sulfide in the Black Sea is one of the features of the Black Sea. The deep water layers of the Black Sea are saturated with hydrogen sulfide, which causes, in particular, the absence of life in it at depths of more than 150-200 m.

About 9,000 years ago, due to the warming of the climate and the rise of the ocean, the penetration of the sea water of the Bosphorus into the Black Sea basin began [1]. This led to the stable salinity of the lower layers of water, the displacement and lifting of deep water, rich in nutrients, into the euphotic zone to a significant increase in the biological productivity of the basin, accompanied by the concentration of organic matter in water and sediments. Simultaneous development of stratification by density sharply limited the flow of oxygen in the deep water, where it was intensively spent on the oxidation of a large amount of deposited organic matter. As a result of these processes 7000-8000 years ago in the deep layers of the sea a permanent zone with anaerobic conditions was formed, which then, after consistent transformations, reached the modern physical and chemical state.

The analysis of the literary information at the present time suggests that there are three main sources of H_2S in the reservoir of the Earth that differ in their significance. They can be conditionally separated by the way of hydrogen sulfide flows into water. The first source supply is a result of the restoration of waterborne sulfates that arise during decomposition of organic matter. The second source of hydrogen sulfide is the decay of organic matter. The third source supplies hydrogen sulfide from cracks in the earth’s crust, i.e. it has volcanic origin (hydrogen sulfide hydrothermal waters or oil beds).

The huge influence of the thickness of the water layer on the total productivity of hydrogen sulfide is manifested in the laws of the distribution of H2S in the Black Sea. On the horizons of 800-1500 m, the concentration of hydrogen sulfide in water over the slope and on the periphery of the deep water depression is greater than in the central regions of the sea. This is due to the fact that the intensity of sulfate reduction in water above the slope is higher than in the central regions, due to the greater amount of fresh organic matter that is formed and comes in here. In

addition, in the area of the slope, hydrogen sulfide is transferred into the water from the sediments [2].

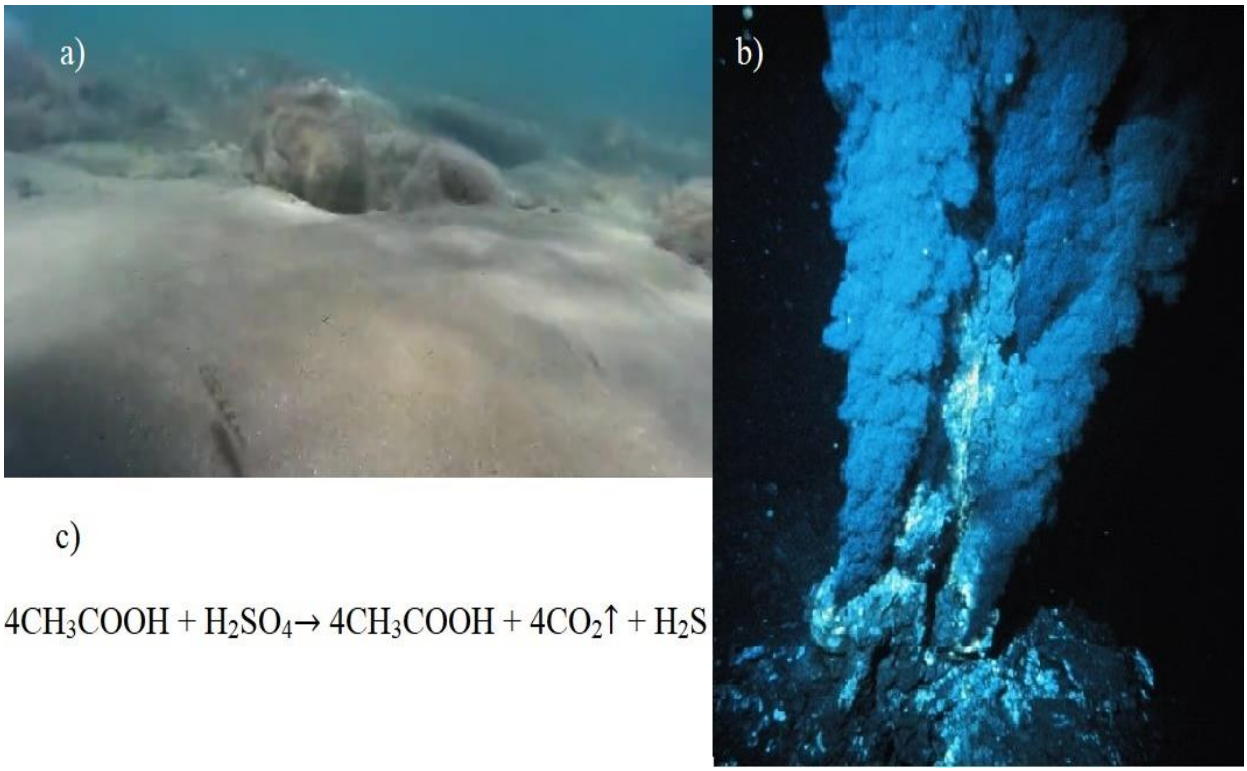

Fig. 1. Sources of hydrogen sulfide: a) decay of organic matter; b) volcanic income; c) the restoration of sulfates.

At present, there is a promising way of clearing natural reservoirs from hydrogen sulfide [3], which proposes to use a vertical channel with rigid walls in the sea. Pumping once the water from this channel, we can get a gas fountain due to the difference in hydrostatic pressure in the sea at the level of the lower cut of the channel and the pressure of the gas mixture at the same level inside the channel. At the same time, according to the authors, there is almost no need to spend energy on the pumping of the deep layers to the surface for the rise of hydrogen sulfide aqueous masses from the depth due to the use of the so-called airlift effect (gas lift). That is, this method is as follows. To ensure the flow of water up the tube, vertical plates are placed in the lower part of the pipe (channel) made, for example, from activated aluminum. When interacting with sea water, such an alloy partially decomposes water, releasing hydrogen. Hydrogen, rising up, lifts water in the pipe (primary airlift). With the movement to the surface of water, a hydrogen-water mixture, due to the pressure drop begins to provide dissolved hydrogen sulfide, thereby enhancing the effect of airlift. The advantages of hydrogen as fuel compared to gas are briefly as follows:

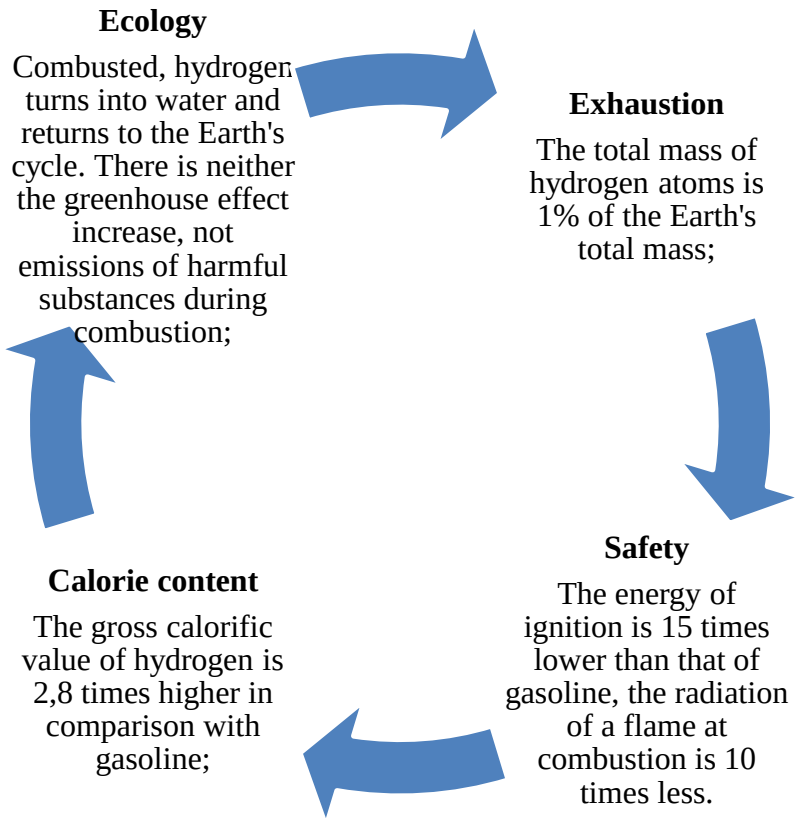

Fig. 2. Advantages of hydrogen fuel

It is known that the Black Sea contains not less than one billion tons of hydrogen sulfide. And one ton of hydrogen sulfide contains 58 kg of hydrogen, thus:

$$\text{The amount of hydrogen} = 1\,000\,000\,000 \cdot 0{,}058 = 58\,000\,000 \text{ tones}$$

When burning 1 ton of hydrogen the same amount of energy, is released as when burning 3 828 liters of gasoline. Thus you can calculate the equivalent of gasoline extracted from the seabed:

$$E_{\text{gasoline}} = 58\,000\,000 \cdot 3\,828 = 222\,024\,000\,000 \text{ litres}$$

Taking into account the price of 1 liter of gasoline at UAH 33.00 and possible costs (up to 20%), the profit from the sale of hydrogen will be:

$$P = 222\,024\,000\,000 \text{ litres} \cdot 33{,}00 \text{ UAH} - 20\% = 5\,861\,433\,600\,000 \text{ UAH}$$

Thus, the energy resources of the Black Sea are enormous and in terms of the energy crisis, they are a promising source of energy and an object for studying geological science.

References:

1. Eremeyev V.N. Features of paleohydrology of the Black Sea in various geological epochs / V.N. Yeremeyev, S.G. Boguslavsky, V.A. Zhorov // Sea hydrophysical journal. – 1994. – № 4. – P. 28-36.

2. Kravets V.N. Perennial variability and assessment of hydrogen sulfide balance in the Black Sea / V.N. Kravets // Scientific works of UkrNDHMI. – 2002. – № 250. – P. 354-363.

3. A.S. RF № 2123476. The method of purification of natural water from hydrogen sulfide / Varshavskyi I.L., Maksimenko A.I., Tereshchuk V.S. Description of the invention to the patent of the Russian Federation. 12.20.1998.