Short communication

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The formation of the physical and chemical condition along the continuum «land waters – Azov Sea» in the context of iron geochemistry studies

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ABSTRACT. The authors studied the formation of the chemical type and class of water, the isotopic composition of sulfur and oxygen of sulfate ions, the content of Fetotal along the continuum «land waters – Azov Sea», i.e. from the moment of iron «resurgence» in mine workings before its partial deposition in the bottom sediments of the Sea of Azov.

Keywords: Water types, iron geochemistry, small rivers, Don River, Sea of Azov.

The uniqueness profile for the study of iron geochemistry consists of the fact that from the North, West, and South on the shores of the Sea of Azov there are reserves of iron ores of the Northern Azov region, Prisivashya, Kerch and Taman peninsulas. From the North - East, the Don River flows into the Taganrog Bay. Its waters receive iron compounds that were formed as a result of natural and man-made processes. The waters directly formed during coal mining in lavas, which, like the host rocks, contain pyrite, are represented by an acidic type of water (by Valyashko, 1955). The chemical composition of these waters is represented by the predominant ions H^+ and SO^{2-}_4 (i.e. sulfuric acid) and iron. For the first time, we have proposed the formation of an image of the class, type, and group (S_{IV}^{Fe}) of acidic solutions, which is interpreted as the sulfate class, the fourth type, of the iron group. This corresponds to the scheme (Fig.) of the metamorphization of natural waters. Further, using the classification of O.A. Alekin (1970), which E.V. Posokhov (1965) adapted with the classification of M.G. Valyashko (1955), the evolution of the type of acidic water originating in lavas was traced (S_{IV}^{Fe}). When they pass through the mining system and subsequent drainage in the surface environment, the acidic water type changes to a more stable sulfate (type II) and chloride (type III) types. Using data (Fedorov, 1999) on the chemical and isotopic composition of sulfur and oxygen of sulfate ions in the "background" reservoir and mine waters, we described the origin of acidic waters (S_{IV}^{Fe}) with a high content of dissolved total iron. We also described their effect on the waters of settling ponds, small rivers in coal mining areas, the Don River, and the Sea of Azov (Fedorov et al., 2017). Moreover, we defined a natural evolution of changing chemical types, classes, and groups, and isotopic composition of sulfur and oxygen of sulfate ions, the content of dissolved total iron (Fe_{total}) in water objects for Azov Sea basins mega profile «land waters – sea». This is caused by the participation of both natural and anthropogenic factors and processes (Dmitrik et al., 2019). Acidic waters of the "pure genetic type" were characterized by the lightest isotopic composition of sulfur and oxygen sulfate ions, and a high content of Fe_{total} (S_{IV}^{Fe}). In mine waters and pond aerators, water was characterized as Cl_{II}^{Na}, S_{II}^{Na}, S_{II}^{Mg}, and Cl_{II}^{Na}, S_{II}^{Na}, S_{II}^{Mg}, and there was a decrease in the total iron content and an increase in the $\delta^{34}S$, and $\delta^{18}O$ values.

In small rivers after the passage of water through biological treatment stations, we observed an increase in the $\delta^{34}S$ and $\delta^{18}O$ values as well as a change of chemical type, class, and group to (S_{III}^{Na}, S_{III}^{Mg}, and S_{II}^{Na}). During the mixing of the waters of small rivers and the Don River, there was a decrease in the content Fe_{total} and the $\delta^{34}S$ values. There was also a transition of chemical composition, type, and group in ($S_{I}^{Na,Ca}$). Notably, in 1938, before regulation of the Don River discharge, the chemical composition of the river water was described by the formula C_{I}^{Ca}. In the Sea of Azov, there was a decrease in the content of Fe_{total}, transformation of the salt composition of river waters and its transition to water (Cl_{III}^{Na}) as well as an increase in the value of the isotopic composition of sulfur sulfate ions.

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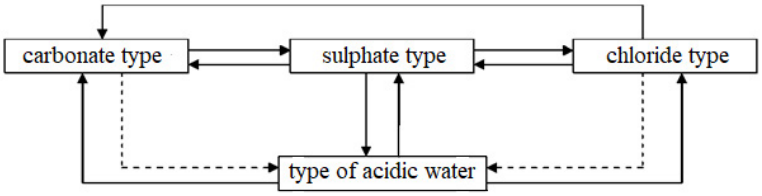

Fig. Mutual transitions of natural water types, by M.G. Valyashko (1955) with additions (by Nikanorov et al., 1989)

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