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Fe-Mn substance in ocean as reason of regulation radionuclide pollution

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Distribution of radionuclide in marine sediments as yet little studied [Choppin & Wong 1998]. The work mainly focused on effects of nuclear test fallout. In the works are examined isotopes of Pu - 238; Th - 232; U -234;238; Pu - 239,240,241; Am - 241; Np - 237; Cm -244 [Holm 1995].

It has been shown that seems to accumulate radionuclides in marine sediments. In particular, the importance attached to carbonate complexes (corals, etc.).

But questions about the possibility of re-mobilization of radionuclide, forms their concentration, their participation in global geochemical cycles in the ocean, remain open. We believe a major factor controlling the distribution of heavy metals is the formation of ocean ferromanganese crusts and nodules hydrogenic at the bottom of the ocean and seamounts. It is likely that the process of formation of Fe-manganese hydrogenic can play a major role in the control of radioactive contamination in the oceanic sediment. At least for the U number of works on the subject [Sherman et al. 2008]. The high sensitivity of the Fe-manganese crust is known to the isotopic composition of lead [Loranger & Zayed 1994, Collen et al 2011]. Recent work [Wilkins etal 2006, Renshaw etal 2009] show a large role; Fe (III)-and Mn (IV)-reducing organisms that anaerobic bacteria in oxidation and therefore changes in mobility systems U and Pu.

So much interest is data for sorption of radionuclide on hydroxides Fe and Mn. Unfortunately we are not aware of works on the subject. We have therefore taken their own experimental studies on sorption of radionuclide on natural Fe-Mn crusts (sample from Magellan seamount Pacific ocean) [Martynov et al 2012].

The results showed high sorption ability of material crusts for fixation of radionuclides: U-233, Np-237, Pu-238, Am-241. For all radionuclide experiment absorption has been reached already in the first hour it was 96.0% of total substance radionuclide absorbed from the solution, and after the first day it was reached the level closed to the ultimate extraction 99.0%. The relative number of increasing absorption of radionuclide Np<U<Pu<Am (Fig1). Also revealed some difference for crusts with a different ages. Younger crust are the more reactive.

Thus, our work for the first time showed a natural self-cleaning of the ocean from radioactive contamination. In that regard, the results of natural observation the effects of radioactive contamination as a result of Fukushima Daiichi Nuclear Power Plant (FDNPP) accident published by [Sakaguchi et al 2012] are very interesting.

Detected traces of pollution in ocean water is negligible and most clearly denoted in the ratio of the U-236/Cs-137. It is precisely those elements that are full of contrast in relation to sorption processes of Fe-Mn material.

Of great interest is the study of variations in the distribution of radionuclide in sediment and especially in the areas of development of ferromanganese crusts wherever you different distances from the center of FDNPP. This would help clarify the kinetic process of self-protection of ocean against pollution

Fig. 1. The degree of radionuclides extraction from the working solution by samples **RT** (ancient) and **T2** (young) in 10 days of contact

Fig. 2. The dependence of Fe and Mn concentrations in solution vs. pH on leaching of the sample T2 for 1 day

An important question is the problem of resistance in the attached in Fe-Mn crust radionuclide to diagenetic processes and subsequent conversion of sediment. This problem requires further detailed studies. As a first step, we implemented a simple experiment on dissolution of crusts acid solutions (Fig 2). The results of the experiment showed that a slight acidification (quite possible in slime sediments for Fe-Mn nodule) will lead to a transition Fe in a solution and it is likely that relation radionuclide may again engage in geochemical cycle of ocean water. At the same time our understanding of the processes of formation of Fe-Mn crust on seamounts talks about sustainable multimillion history stable existence and growth of these entities as on the seamount and on the sea bottom.

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