

Transport of Fukushima-derived radiocesium into the coastal ocean via submarine groundwater discharge: an approach from geochemical character of pore water

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Submarine groundwater discharge (SGD) has been recognized as a route of Fukushima-derived radiocesium (Cs) from land to the ocean together with rivers. However, it is difficult to take large volume SGD samples compared with river water, which can be collected more easily. Therefore, quantitative evaluation of its impact as a source of Cs has not been carried out. In this study, we analyzed Cs activity and chemical component in pore water in Matsukawa-ura Lagoon to explore the transport and flux from land to ocean including SGD.

The measured ¹³⁷Cs activity in pore water samples and the overlying water were 1,398 mBq/L and 117.7 mBq/L, respectively. This indicates that a significant amount of Cs in sediment has been desorbed into pore water. The ¹³⁷Cs flux between the sediment and overlying water was calculated to be 11.3 mBq/cm²/h, using Fick's First Law of diffusion. Moreover, the ¹³⁷Cs flux from the bottom to overlying water of the lagoon was estimated to be 0.08 GBq/day based on the weighted average of ¹³⁷Cs activity in bottom sediment of the lagoon and the K_d value between the sediment and the pore water. This value accounts of the majority of ¹³⁷Cs which supplies the lagoon. Thus, it can be expected that large quantities of Cs have been supplying the coastal area by pore water exchange, that is to say, recycled SGD (RSGD). In the coastal area and the open ocean, it is suggested that SGD is vitally important as a source of Cs to assess it.

Keywords: Fukushima-derived radiocesium, Submarine Groundwater discharge, Pore water, Matsukawa-ura Lagoon