

Efforts to understanding of deep groundwater in Japanese coastal areas

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The coastal area is one of the candidate sites for geological disposal because of the possibility of finding places with extremely slow groundwater flow with low fluidity during a long period and the relatively large number of areas with low uplift rates. On the other hand, hydrogeological data and knowledge in the deep coastal areas, including the seafloor, have not been sufficiently obtained, and some survey methods have not been established. Together with Central Research Institute of Electric Power Industry, Geological survey of Japan, AIST, has been elucidating the flow system including the residence time and developing research methods of deep groundwater in the coastal area of Horonobe-town, Hokkaido and Suruga Bay in Shizuoka Prefecture. In this presentation, we will introduce the results of these efforts.

In Horonobe-town, Hokkaido, a ground survey by Japan Atomic Energy Agency started in 2000. AIST started the groundwater survey in the coastal area in 2007, and conducted three observation wells digging including a well with a depth of 1200 m and various physical explorations from the land to sea area in 6 years. Furthermore, an observation well with 350m depth was established in 2018. By combining the geological data and groundwater data obtained from this, it was clarified that freshwater groundwater recharged by the precipitation of the last glacial period exists continuously under the seafloor over 5 km offshore from the coastline. In addition, it was clarified that there are multiple groundwaters originating from the current precipitation to fossil seawater in the Quaternary Formation, which was not considered as a hydraulic basement. The existence of fresh groundwater under the seafloor has been fragmentarily reported by the development of oil, gas, coal fields, and the excavation of undersea tunnels. The existence of deep fresh groundwater under the coastal seafloor was visualized and the recharge process was clarified by the results of this project, for the first time.

In Suruga Bay, Shizuoka Prefecture, since 2013, we have been elucidating the groundwater flow process of the entire basin from the recharge area to the discharge area using regional scale groundwater surveys including both land and sea areas, bore hole surveys, and submarine groundwater discharge surveys. From 2014 to 2015, a survey borehole with a 350 m depth was excavated on the coast. This survey revealed that the groundwater age becomes newer with the depth direction below the saltwater-freshwater interface near the depth of 150 m. This is the first case in Japan that indirectly clarified the movement of salt water below the interface. Since 2020, borehole drilling assuming a depth of 800 m has been conducted to understand the movement of deep salt water and the state of groundwater in the Tertiary sedimentary rocks. In addition, we are developing technology that enables quantitative evaluation of the amount of submarine groundwater discharge on the bay scale. Finally, by systematizing the knowledge and evaluation technologies related to the coastal groundwater mechanism, we would like to contribute to the safe implementation of the geological disposal project.

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