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Parameter determination in a deep coastal sedimentary basin by single-well ("push-pull") tests

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Recently, investigations were conducted for geological and hydrogeological characterisation of the sedimentary coastal basin of Horonobe, which is located at the north-western coast of the northern Japanese main island of Hokkaido. The basin is composed of poorly compacted neozoic sand-, silt- and mudrocks. The base of the basin consists of volcanic sediments and is located in depths of about 3,000 to 5,000 metres. Due to the periglacial influence the landscape is very gently. However, Hokkaido was not glaciated in the past. Coastal basins are typical geological settings in Japan, which are less tectonically active than the mountain ranges and good accessible by ship. For that reasons, coastal basins are considered as potential host rocks for the Japanese final repository for radioactive waste program.

The knowledge and the understanding of the history and the future development of dynamic deep groundwater systems are crucial for questions that have to be solved, e.g. groundwater velocities at depths of more than 1,000 metres; the "age" of groundwater; the evolution of these systems depending on different sea levels, etc. Methods and procedures are required for hydrogeological deep basin characterisation. In Horonobe, a test site including two deep boreholes (100 and 1,100 metres depth, respectively) was installed to develop and enhance test methods for hydrogeological parameter determination in greater depths. A major difficulty in deep groundwater flow research is the limited access. A standard tracer test with several involved groundwater monitoring wells is generally not possible at these depths. For that reason a Single-well ("push-pull") test was conducted. This method was already used as partitioning push-pull test to quantify organic pollutants at contaminated sites in relatively shallow depths of about 10 to 20 metres (e.g. Istok et al., 1997). In a push-pull test a known amount of several solutes including a conservative tracer is injected into the aquifer ("push") and afterwards extracted ("pull"). The measured breakthrough curve during the pumping back phase can be analysed by transport and reaction parameters. The aims of the push-pull test in the 100 metres deep borehole were to prove the scientific and technic applicability of the method in larger depths than 20 metres for the intended later adaption on the 1,000 metres deep well. For determination of different aquifer and fluid behaviour depending on the density of groundwater (due to saltwater-freshwater interface in coastal areas) the test was conducted twice: a groundwater-tracer mix and distilled water was injected and afterwards re-pumped, respectively.

The results and the experiences of this study should be used for a push-pull test in the 1,000 metres deep borehole. The findings of both tests are part of a better understanding of deep groundwater systems, and its previous and future evolution. The final goal of the project is a numerical model to make predictions about the long-term behaviour of groundwater flow and transport depending on parameters that change significantly at our time (e.g. sea level changes due to man-made climate change or regular Ice Ages; changing recharge and discharge areas and changing saltwater-freshwater interface due to sea level changes; changing amounts of precipitation).

References:

Istok, J.D., Humphrey, M.D., Schroth, M.H., Hyman, M.R. and Oreilly, K.T., 1997. Single-well, "push-pull" test for in situ determination of microbial activities. Ground Water, 36. 619-631