

3-7 Development of a Methodology for Reconstructing Very Long-Term Geosphere Evolution — A Very Long-Term Groundwater Flow Analysis Using Numerical Simulation —

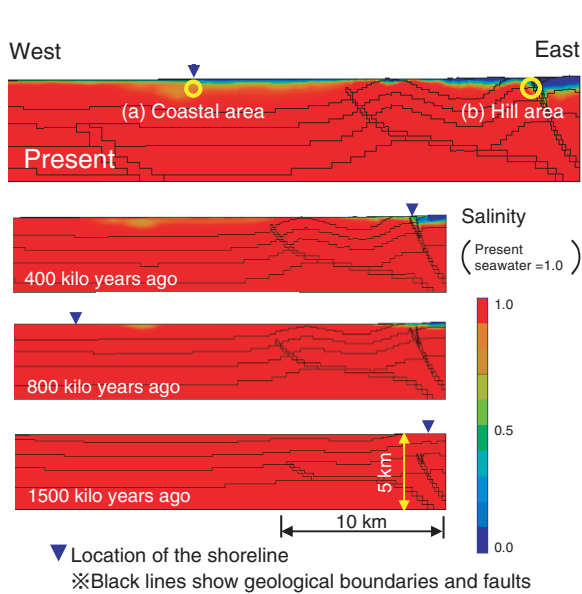


Fig.3-20 Evolution of groundwater salinity

The combined effects of the sea-level change and crustal movement play an important role in the evolution of groundwater salinity in the Horonobe coastal area.

It is crucial to demonstrate how the geosphere evolves over tens of thousands of years to ensure acceptance of the very long-term safety of geological disposal by society at large. One of the main methods for describing such future evolution is the extrapolation of past evolution based on phenomenological understanding; another method is numerical simulation by considering the mechanism of geosphere evolution. In this study, we reconstructed the evolution of groundwater flow/salinity over the past 1500 ka in Horonobe, northern Hokkaido, using numerical simulation developed at JAEA toward the development of a methodology for describing geosphere evolution over very long time periods in coastal and sedimentary environments.

We developed a methodology involving numerical simulation of the evolution of groundwater flow/salinity by considering geometric changes of topography/geological structures caused by uplift/subsidence as well as changes in groundwater recharge and sea level as a result of climate

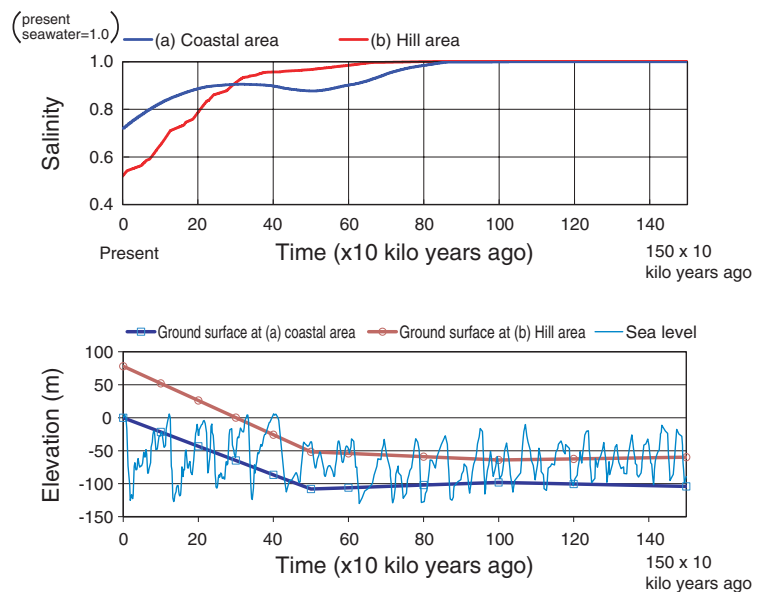


Fig.3-21 Evolution of groundwater salinity at 300 m depth

Groundwater salinity has been decreasing with uplift from 800 ka (upper figure) but differences in the evolution of altitude cause differences in long-term trends in salinity for (a) coastal and (b) hill areas (lower figure).

change. Application of the methodology to the Horonobe area suggests groundwater salinity decreases gradually in uplifted land areas, which were originally on the sea floor at 1500 ka (the uplifted area at the eastern end of Fig.3-20). The results also indicate the wide distribution of groundwater of very low salinity, i.e., fresh water, under the sea floor at present (the coastal area in uppermost Fig.3-20). This fresh water distribution was formed by the infiltration of rainwater when the present sea floor was land. The groundwater salinity at 300 m depth decreases with uplift in both coastal and upland areas, exhibiting different trends depending on the elevation change in each area (Fig.3-21).

The simulation results are confirmed by geophysical and borehole investigations. Furthermore, this study contributes to improving the technical basis for describing evolution of the geosphere over very long time scales in coastal and sedimentary environments.

Reference

Niizato, T. et al., Development of a Methodology for the Characterization of Long-Term Geosphere Evolution (1) Impact of Natural Events and Processes on the Geosphere Evolution of Coastal Setting, in the Case of Horonobe Area, Proceedings of 19th International Conference on Nuclear Engineering (ICONE19), Chiba, Japan, 2011, ICONE19-43163, 11p., in CD-ROM.