

Groundwater dating in southern Hamadori region, Fukushima, Japan

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Understanding of groundwater system characteristics, that control groundwater flow and mass transport in the system, is helpful for various purposes such as conservation of groundwater amount and quality, vulnerability assessment of groundwater system to pollution, and prediction of temporal and spatial variation of polluted condition. National Institute of Advanced Industrial Science and Technology conducted "Study on Risk Evaluation of Groundwater Pollution" to assess distribution of groundwater resources, characteristics of groundwater systems, and to utilize the information for reconstruction from the Great East Japan Earthquake. The authors participated this project and carried out groundwater survey in southern Hamadori region, Fukushima Prefecture (Muto et al., 2013). Residence time of groundwater is significant to estimate flow regime, and sulfur hexafluoride (SF₆) and tritium were analyzed in addition to major dissolved components, heavy metal elements, hydrogen and oxygen isotopes, etc.

Study area was Iwaki and Hirono in the southern Hamadori region. Groundwater samples were collected at 39 wells in Iwaki and 27 wells in Hirono. SF₆ was detected at all wells except for one well, and exceptionally high SF₆ concentrations were measured at four wells. These exceptionally high SF₆ concentrations were presumably caused by local source contamination because such concentrations cannot be explained from equilibrium between groundwater and modern air. Considering that SF₆ was industrially produced after 1953 (Maiss and Brenninkmeijer, 1998), the results imply that groundwater from the almost all wells contain fraction recharged after 1953, at least partly. 25 percentile of residence time assuming piston flow was 18.9 years, median was 21.8 years, and 75 percentile was 26.8 years. Analytical results of tritium are compared with SF₆ based on lumped parameter models (Zuber and Maloszewski, 2001), and regional characteristics of the estimated residence times are shown in the presentation.

References

Maiss M. and C. A. M. Brenninkmeijer, 1998, Atmospheric SF₆: Trends, sources, and prospects, *Environmental Science and Technology*, 32, 3077-3086.

Muto Y., K. Kashiwaya, T. Kubo, K. Koike, S. Yabusaki, N. Shibasaki, R. Ikawa, A. Marui, 2013, Groundwater systems in Hirono region indicated from geochemical characteristics of groundwater, Abstracts of Japanese Association of Groundwater Hydrology 2013 fall meeting, 204-209.

Zuber A. and P. Maloszewski, 2001, Lumped parameter models, in: Mook, W.G. (Ed.), *Environmental Isotopes in the Hydrological Cycle*, Vol. VI. UNESCO, Paris, 5-35.

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