

Traceability of SF₆ and CFCs for Groundwater Flow in Matsumoto Basin, Japan

Shinji Nakaya^{1*}, Hideto Aoki¹

¹Shinshu University

Chlorofluorocarbons CFC-12, CFC-11, CFC-113 and sulfur hexafluoride SF₆ are primarily of anthropogenic origin, while SF₆ also occurs naturally. Groundwater dating by CFC-12, CFC-11, CFC-113 and SF₆ is carried out in Matsumoto basin, central Japan, consisting of Quaternary sediments, in complex land use. CFCs and SF₆ concentrations are extremely over record (EOR) in 40 % and 10 % in sampling points of the well waters, respectively. CFC-113 in EOR comes from industrial areas, indicates the source of SF₆ in EOR in groundwater can be separated from industrial pollution of groundwater by CFC-113. CFCs in EOR must reflect the vertical infiltration of anthropogenic CFCs polluted surface waters in the basin. NO₃-N is also likely to increase with the concentration of CFCs in EOR. The relationship between concentrations SF₆ (Csf₆) and CFC-12 (C12) indicates that groundwater flow can be explained as 'piston flow model' in shallow and deep aquifers in Matsumoto basin and that CFC-12 of three groundwaters are decomposed under DO <1.0 and pH >8. Although isotopic ratios of oxygen and hydrogen indicate that the source areas of groundwaters are mountains side of 1,500 m (a.s.l.) and highland of 800 m (a.s.l.) surrounding basin, the SF₆ and CFCs tracers suggest that vertical infiltration of groundwaters from surface to well depth occurs within the basin. It is modeled that many recharged waters at mountain side move to the basin via river system and recharge again within sedimentary basin. Using SF₆ tracer, average residence time of groundwaters ranges from 4 years to 37 years.

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