

Re-evaluation of groundwater flow system analysis with CFCs; with special reference to urban air effects

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Residence time of groundwater provides us fundamental information to evaluate groundwater flow system. Tritium has been used as an ideal tracer for determining residence time of relatively young groundwater by taking advantage of the anthropogenic release of tritium by bomb tests. However, because of the decrease of the atmospheric concentration of tritium has made the tritium analysis less straightforward.

Alternative tools, such as concentrations of chlorofluorocarbons (CFCs) have been devised for residence time estimation. Here, this study focuses on discussing pros and cons of CFCs application in Japan. The Kurobe alluvial fan was chosen for the studied area, and groundwater in Tokyo metropolitan area was also analyzed to examine possible effects by urban air on CFCs concentration in groundwater.

After removing obtained data which suggest possible direct contamination with CFCs at Kurobe, CFCs were shown to be dissolved in all groundwater samples except one deep groundwater samples. It indicated that groundwater in the Kurobe alluvial fan might be recharged 50 to 60 years ago, which was consistent with previous results using tritium. The possible effects for estimating residence time by CFCs data were discussed and it was found that the effects of recharge temperature and atmospheric concentration of CFCs would be significant.

Atmospheric concentrations of CFCs in the Tokyo metropolitan area were reviewed and CFCs concentrations in several shallow groundwater samples which have small drainage basins in Tokyo were analyzed. atmospheric concentration of CFCs in Tokyo was substantially higher than that of northern hemisphere background. CFCs concentrations in groundwater samples suggested the possible effects on urbanized air, however, further study is necessary to quantitatively evaluate the effects.