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Age dating and flow path evaluation of groundwater by SF_6 and microbe in the foot of Mt. Fuji, central Japan

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A variety of industries are developed at the foot of volcanic mountains in Japan and the groundwater is major source for industrial activity in those regions. The age of groundwater has been estimated to be from 10 to 30 years in Mt. Fuji regions by using ^{36}Cl and ^{3}H. However, the age has not been evaluated using SF_6 with higher time resolution in these regions. Also, the total number of prokaryotes shows a specific value in each spring water, suggesting different path and age of the groundwater. Therefore, we aim to estimate residence time and the groundwater flow in three dimensions using the multi-tracers approach; CFCs, SF_6, the total number of prokaryotes, the stable isotopes of oxygen-18, deuterium. We collected totally 25 spring water samples in Mt. Fuji and analyzed concentration of inorganic ions, the stable isotopes of oxygen-18, deuterium, CFCs, SF_6.

The apparent age of the spring water was estimated to be ranging from 4 to 19 years at the foot of Mt. Fuji. These results are reasonable as considering the existed age data by^{36}Cl (Tosaki, 2008) in this region. The spring water with younger age tends to show higher total number of prokaryotes, suggesting that the groundwater flows dominantly through the shallow and young lava with the higher total number of prokaryotes, leads to younger age. Focusing on a specific spring water, the seasonal change of SF_6 and total number of prokaryotes were monitored. The spring water showed a younger age and higher total number of prokaryotes during the high water flow season, whereas it showed an older age and lower total number of prokaryotes. Therefore, the total number of prokaryotes shows a good negative correlation with the residence time of the spring/ groundwater in space and time.

This shows a possibility that the total number of prokaryotes could be a useful tracer of groundwater for time and space in the three dimensions information.