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Nitrate behaviors in unsaturated zone under farmlands with different fertilization log at Kumamoto region, Japan.

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Excessive application of fertilizer and manure in agricultural activities often caused an increase of nitrate concentration in groundwater. The study area, Kumamoto is also facing this type of problem. Previous studies using nitrogen-oxygen isotope ratios in nitrate, it was shown that accumulation of chemical fertilizer is the major factor of nitrate contamination in the Kumamoto region. However, once it loaded nitrogen component may change its form and isotopic composition during downwards transportation into the aquifer. Especially, in the study area where the groundwater is recharged through a thick unsaturated zone, and therefore, it is important to elucidate the phenomenon happened in the soil zone of this area. However, it has not been. To clarify the behavior of nitrogen and the change of nitrate concentration in the unsaturated zone, we analyzed the nitrogen-oxygen isotope ratios of the extracted soil water of the unsaturated zone soils, sampled in the farmland having different fertilization logs. In addition, we attempted to verify the origin of groundwater contamination by comparing with previous results. The plateaus-like topography of the study area is consists of the pyroclastic flow deposits. Land use is mainly farmland and this area is a major source of nitrogen load and transport route into the aquifer. Nitrate concentration in groundwater at terraces recharge area has been reported about 40 mg/L. Drilling survey carried out in the unsaturated zone soil on 4 farmlands with the different land use logs in such terraces. Drilling point KO and KTO were treated by both slurry and chemical fertilizers, on the other hand, point M1 and M2 were fertilized by only chemical fertilizers. The drilling depth was up to 14-15 m, and soil samples were kept on evacuated condition after sectioning into 10 cm interval. The soil water was extracted using a centrifuge machine. The extracted soil water was measured for the nitrogen-oxygen isotope ratios in nitrate and major ions concentrations. All cores showed high nitrate concentrations in the surface layer (260, 440, 172 and 244 mg/L for KO, KTO, M1, and M2 respectively). The concentrations became lower as depth increasing for all cores. However, the concentrations were still high even at the point of 10 m depth (about 100-200 mg/L) for all cores. For nitrogen and oxygen isotope ratios in nitrate, in the KO and KTO cores, the isotopic variation due to volatilization and nitrification was observed in the surface layer, but the M1 and M2 core did not show clear. The isotope compositions become homogenized downwards to have specific values depending on fertilization logs. This result is consistent with the previous studies. In the presentation, we will present detailer discussions regarding the behaviors of the isotope ratios in nitrate.