

## Geochemistry of nitrate nitrogen pollution groundwater in the Shimousa Group, Chiba Prefecture

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We investigated temporal and spatial changes of major element and isotopic compositions of shallow groundwater samples used for domestic purpose at the Noda city, northwestern part of Chiba Prefecture, and these compositions of fertilizer and domestic detergents to clarify anthropogenic pollutant sources of nitrogen in the shallow groundwaters. The high proportions of  $\text{Cl}^- + \text{SO}_4^{2-} + \text{NO}_3^-$  suggest strong influence of human activities to the groundwater. The high nitrate concentrations of the groundwaters with greater than 60 mg L<sup>-1</sup> are mainly distributed in farm land. The  $\delta^{15}\text{N}$  values of fertilizers and domestic detergents used in the studied area range from -1.3 to +0.1 per mill and from -2.9 to +3.6 per mill, respectively. The  $\delta^{15}\text{N}$  values of nitrate in the groundwaters ranging mainly from +2.5 to +10.3 per mill. Judging from the groundwater with low  $\delta^{15}\text{N}$  value distributed in farm land, it is suggested that the nitrogen contamination is caused by cultivation with ammonium-containing fertilizers and domestic sewage. At the Noda area including the residential district, groundwater samples were strongly contaminated by domestic pollution. On the other hand, the  $\delta^{34}\text{S}$  values of fertilizer and domestic detergents used in the studied area range from -2.7 to -0.4 per mill and from -4.2 to -0.7 per mill, respectively. The  $\delta^{34}\text{S}$  values of sulfate in the groundwaters ranging mainly from +1.1 to +7.8 per mill suggest that the sulfur contamination is also originated from chemical fertilizers, and domestic sewage and/or industrial effluent.