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硫黄安定同位体比を用いた森林土壌における硫黄動態変化の評価
Evaluation of the sulfur dynamics change in Japanese forest soils using sulfur isotope ratios

石田 卓也 [1*], 陀安 一郎 [2], 竹中 千里 [1]
Takuya Ishida[1*], Ichiro Tayasu[2], Chisato Takenaka[1]

[1] 名古屋大学大学院生命農学研究科, [2] 京都大学生態学研究センター
[1]Graduate School of Bioagricultural Sciences, Nagoya University, [2]Center for Ecological Research, Kyoto University

Anthropogenic sulfur emissions have been increased with human activities and affected sulfur dynamics in forest ecosystems. Since the stable sulfur isotope ratios (delta-^{34}S) of various origins have specific values, the values of various environmental samples from forest ecosystems have been used for evaluation on the effect of increased sulfur deposition. In Japan, some studies showed that much more sulfate ions have been adsorbed in soils compared with North America and Europe [1, 2]. The effect of sulfur deposition may be larger in the soils with higher adsorption capability than a lower one, but little data is available.

To understand the effect of sulfur deposition on soils with high adsorption capability, we measured depth distributions of delta-^{34}S and the adsorption equilibrium of sulfate concentrations between soil particles and soil water, which are influenced by sulfur deposition.

The investigation was carried out at three study sites, Yokkaichi (YOK), Inabu (INA), and Ijira (IJR), in central Japan. These study sites have different history of sulfur deposition. YOK had been affected by quite high sulfur deposition on 1960's. IJR has relatively received high sulfur deposition recently. INA is located about 60 km NE of main urban area (Nagoya City). Two soil pits were excavated in each site and mineral soil samples were obtained at each depth.

The delta-^{34}S were measured for total sulfur and phosphate-extractable sulfur including mainly adsorbed and water soluble sulfate. The sulfate concentrations in adsorption equilibriums were obtained by adsorption isotherms.

Although the phosphate-extractable delta-^{34}S (delta-$^{34}S_{phos}$) values showed the same range (2.4-6.6 per mil) in all sites, the depth distributions were different among the sites. The delta-$^{34}S_{phos}$ values in INA and IJR were similar in depth of 20-80 cm or increased with depth. On the other hand, those in YOK had the lowest values (2.4 and 2.9 per mil in YOK-1 and YOK-2, respectively) in depths of 40-80 cm in each soil pits. In addition, the equilibrium sulfate concentration curve in YOK-1 was higher position in depth of 40-50 cm where showed the lowest delta-$^{34}S_{phos}$ value. These results indicated that in YOK anthropogenic sulfur with lower delta-^{34}S values deposited in the past existed in a certain depth of forest soil, and sulfate adsorptions on soil had increased in the range of those depths.

References

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