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Locaization of delta-34S value distribution in tree ring of Japanese cedar and evaluation on the S deposition history

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Anthropogenic sulfur emissions have been changed with human activities and affected sulfur dynamics in terrestrial ecosystems. Therefore, the information on sulfur deposition change should be important for understanding of the effects of anthropogenic sulfur on its dynamics. The stable sulfur isotope ratios (δ^{34}S) in tree rings are a useful archive for the history of sulfur deposition (Kawamura et al. 2006), since the δ^{34}S of various origins have specific values and there is few isotopic fractionation through absorption of sulfur by plant. However, only few studies have been conducted about the δ^{34}S in tree ring, and factors affecting the δ^{34}S in tree ring have not been understood.

The aim of this study is to clarify the localization of δ^{34}S distribution in tree ring. We also perform the evaluation of sulfur deposition history at locations received heavy anthropogenic sulfur deposition using tree ring.

The investigation was carried out at two study sites, Yokkaichi (YOK) and Inabu (INA) in central Japan. Both study sites have different histories of sulfur deposition. YOK had been affected by quite high anthropogenic sulfur deposition during 1960s. INA is located about 60 km NE of main urban area (Nagoya City). Three disk samples were obtained from Japanese cedar (*Cryptomeria japonica*) stump in 2013 at YOK and in 2012 at INA. The stumps at YOK were 63-year-old cut down in 2012 and those at INA were170-year-old cut down in 2007. In addition, at INA, three 40-year-old living stems were cut down in 2013 at INA and the disk samples were obtained. After washing and dried, the tree ring samples were divided into 5 year increments from bark toward the pith, and ground using power mill. The ground samples were digested with HNO_3 and H_2O_2 on a hot plate and after filtration $BaCl_2$ was added to obtain the $BaSO_4$. The δ^{34}S values (VCDT) were measured using EA-IRMS.

To evaluation the localization of δ^{34}S in sapwood, heartwood and pith, the data from the stump and the living wood samples at INA were compared. These samples showed the different localization of δ^{34}S against the age. There were no difference of δ^{34}S between the sapwood (living wood) and the heartwood (stump) at the same age. However, the δ^{34}S values of the pith (living wood) were higher than those of heartwood (stump). This result indicated that the specific composition of sulfur compound might be consisted in pith and the δ^{34}S of the pith should be unsuitable for evaluation of sulfur deposition history.

The δ^{34}S values in ring at YOK declined from the late 1950s to early 1970s and then increased again. This trend was almost homologized in ring at INA and air SO_2 concentration at near the YOK. In contrast, the minimum value of at YOK (-7.3 ‰) was lower than that at INA (-1.6 ‰). These results should be reflected by the deposition history of anthropogenic sulfur with low δ^{34}S value at each site.

Keywords: Tree ring, Sulfur isotope, Morphology, Sulfur deposition