Effect of rice growth on geochemical circle of silicon: Silicon isotope study on rice plants grew in field and laboratory

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Geochemical circle of silicon attracts more attention recently and plants play important role in global silicon geochemical circle. To understand the effect of rice growth on silicon geochemical circle, a silicon isotope study was carried out on rice plants grew in field and laboratory. It is found that the silicon contents increase from roots to stem to leaves, and then decrease to husks and grains (Fig. 1). It is also found that the silicon content in rice growth water solution reduces from 20ppm to around 1ppm in 4-5 days.

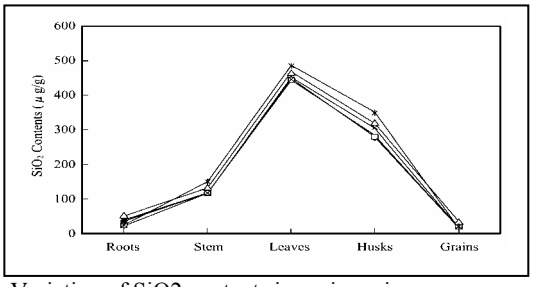

Fig.1 Variation of SiO2 contents in various rice organs

The δ^{30}Si values decrease from roots to stem, but increase from stem through leaves to husks and rice grains. When the silicon contents in water decrease from 20ppm to around 1ppm, the δ^{30}Si value increases 2-3‰. These facts can be explained with two kinetic isotope fractionations: one occur when silicon is taken by roots and the other occur when silica precipitate in plants. Based on these results, the effect of rice growth on silicon geochemical circle is discussed.

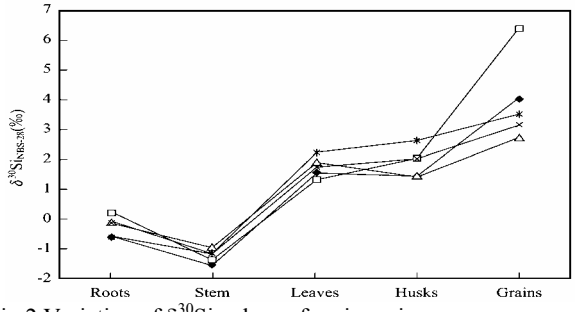

Fig.2 Variation of δ^{30}Si values of various rice organs

The life history and stock structure of groundfish from stable isotopic analysis of otoliths

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The study of stable oxygen and carbon isotope ratios of otoliths ($^{18}O/^{16}$ or $\delta^{18}O$, and $^{13}C/^{12}C$ or $\delta^{13}C$) has yielded valuable information on the life history and behaviour of some commercially important fish species along the Pacific west coast, particularly in identification of spawning aggregations and stock structure. Here we present a comparison study from otoliths of Pacific cod (*Gadus macrocephalus*), sablefish (*Anoplopoma fimbria*), and yelloweye rockfish (*Sebastes ruberrimus*). In general, the $\delta^{18}O$ values of Pacific groundfish started with a low range from -0.5 to 0.5‰ VPDB, and then increased to +1.8 ~ 2.5‰ VPDB as the fish get sexual maturity. The initial low isotopic values correspond to the natal sources, while the stable higher isotopic values correspond to the adult stage before the fish were caught. Similar isotopic variations were found in $\delta^{13}C$ from -5.0 to -2.5‰ VPDB at the breeding stock and from -0.5 to 0.5‰ VPDB as adults. The stable $\delta^{18}O$ values at the adult stage indicate that these groundfish might live at similar oceanic conditions, whereas their different $\delta^{13}C$ values in the juvenile stage reveal that the fish might have different diet or food sources. Based on isotopic records, we recognized two or more separate spawning stocks or subpopulations for Pacific cod and sablefish, except for yelloweye rockfish. It seems that the difference might relate to the different life history and behaviour, and stable isotopic signatures in otoliths could be used as a natural tag for identification of marine fish stocks. Thus, a new project on the stock structure of Pacific sardine (*Sardinops sagax*) has been initiated and the otolith analysis is underway.