Evaluation of the environmental condition of Submarine Groundwater Discharge (SGD) using carbon and oxygen stable isotope ratio of the sessile bivalve *Crassostrea nippona* shell

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Submarine Groundwater Discharge (SGD) results in various biogeochemical changes in the coastal environments, such as coastal primary production, eutrophication, and benthic production. The SGD condition of 6 sites along volcanic mountain coast in northern Japan was evaluated by using carbon and oxygen stable isotope ratio ($\delta^{13}C$ and $\delta^{18}O$) in the shell of sessile bivalves *Crassostrea nippona*. In order to estimate the proportion of fresh water flow rate in SGD (FR) from the respective $\delta^{13}C$ and $\delta^{18}O$ of *C. nippona* shell, we used the three end member (sea water, riverine water and fresh underground water) bayesian stable isotope mixing model. The significant positive correlation was found between $\delta^{13}C$ and $\delta^{18}O$ of the shell and those of ambient water, respectively. FRs estimated from three source model were 3.1 -8.6% at low ^{222}Rn sites and 21.9-28.5% at high ^{222}Rn sites. At the site (Nishihama) of river mouth, the $\delta^{13}C$ and $\delta^{18}O$ of the shell collected were low (estimated FR 10.6-25.0%) and ^{222}Rn concentration was also low. The contribution of DIC in SGD and riverine water for shell formation was estimated to be 19.8 % and 7.8%, respectively. In the present study, we demonstrated the effectiveness of $\delta^{13}C$ and $\delta^{18}O$ of *C. nippona* shell as the tool for estimating FR.

Keywords: Submarine Groundwater Discharge, carbon stable isotope, oxygen stable isotope, rock oyster shell, bayesian stable isotope mixing model

