Influence of submarine groundwater discharge on phytoplankton primary productivity at nearshore coasts in Beppu Bay and Otsuchi Bay

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In recent years, a number of studies have shown that submarine groundwater discharge (SGD) is an alternative nutrient pathway and can drive primary production in coastal seas. However, little is known about a relationship between input of nutrients through the groundwater and response of primary production. To clarify the relationship, we conducted *in situ* measurements of primary productivity (PP) using stable ^{13}C tracer method under different strength sites of SGD at nearshore coasts in Beppu Bay and Otsuchi Bay during the summer in 2016. Considering the differences of light intensity and water temperature at each site, we have also incubated the bottles taken from each site under same conditions of light and water temperature on land. In both bays, significant positive relationships between *in situ* PP and *ex situ* PP ($r > 0.91$, $p < 0.01$) indicated that *in situ* PP would be controlled by nutrient availability. In Beppu Bay, i*n situ* PP and ^{222}Rn activity ranged from 4.4 to 23.3 $\mu g\ C\ L^{-1}\ h^{-1}$ and 69.8 to 586.8 Bq m^{-3}, respectively. Although there was no clear relationship between *in situ* PP and ^{222}Rn activity, biomass specific PP (P_B, $\mu g\ C\ \mu g\ chl\ a^{-1}\ h^{-1}$) showed the positive correlation with ^{222}Rn activity. In Otsuchi Bay, i*n situ* PP and ^{222}Rn activity ranged from 4.5 to 10.7 $\mu g\ C\ L^{-1}\ h^{-1}$ and 298 to 765.8 Bq m^{-3}, respectively. ^{222}Rn activity did not related to *in situ* PP and P_B. This could be due to low phosphate concentrations in terrestrial confined groundwater. Our experimental studies suggested that the mechanism by which SGD affects phytoplankton production differs from one ecosystem to another.

Keywords: Primary productivity, 222Rn, Submarine groundwater discharge, Nearshore coast

