Geophysical Research Abstracts
Vol. 19, EGU2017-5713-2, 2017
EGU General Assembly 2017

Using dual carbon isotopes, ^{13}C and ^{14}C, to resolve the origin, mixing and alteration of major carbon pools in shallow-water CO_2 vents (Kueishantao hydrothermal field, offshore Taiwan)

Shing-Lin Wang, Yu-Shih Lin, George Burr, and Chau-Chang Wang
College of Marine Sciences, National Sun Yat-sen University, Kaohsiung, Taiwan (jslwang@ntu.edu.tw)

Submarine hydrothermal vents at convergent boundaries tend to emit CO_2-rich fluids due to the subduction of marine sediment. In the shallow-water hydrothermal field, the carbon dioxide gas bubbles can reach to the surface seawater and may alter the surface seawater chemistry and the planktonic microbial community. We use duel carbon isotopes, ^{13}C and ^{14}C, to evaluate the effect of additional CO_2 input on the major carbon pools in ambient seawater of hydrothermal vents. Radiocarbon (^{14}C) is undetectable in hydrothermal CO_2 ($\Delta^{14}C$ $\sim$-1000‰), so this "radiocarbon-dead" CO_2 can be used as an end-member to constrain the carbon sources in the hydrothermal field. Here we report $\delta^{13}C$ and $\Delta^{14}C$ values of CO_2(g), dissolved inorganic carbon (DIC) and particulate organic carbon (POC) within and above two vents, yellow vent (YV) and white vent (WV), in the Kueishantao shallow-water hydrothermal field, northeastern offshore Taiwan. The results show that the $\delta^{13}C$ value of vent CO_2 gas is around -6‰ within the range of mantle source. DIC was ^{13}C-depleted (around -9‰) than CO_2 gas and POC were more ^{13}C-depleted in YV (-25.7‰) and in WV (-22.4‰). The $\Delta^{14}C$ values of vent CO_2 are slightly higher than -1000 ‰ with -949.2$\pm$16.0 ‰ in YV (Temp. = 116°C) and -890.7$\pm$7.6‰ in WV (Temp. = 58°C). It suggests the radiocarbon composition is more than 90% radiocarbon-dead carbon mixed with less than 10% modern carbon. Our result clearly indicates the main component in vent CO_2 gas is the mantle-derived carbon and it is supported by helium isotopic compositions (YV, 7.5$\pm$0.1 Ra; WV, 7.1$\pm$0.2 Ra). We expect the $\Delta^{14}C$ values of DIC and POC above the two vents will also reflect the mantle-derive signal and it will also reveal how much the carbon is emitted from hydrothermal vents and exchanged within these major carbon pools in the ambient seawater.