Carbon isotopic composition of CH_4 and CO emitted during biomass burning experiments

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Biomass burning is a major source of trace gases in the global atmosphere. Since these trace gasses play important roles in atmospheric chemistry, human inputs may affect seriously to global balance of atmospheric chemistry. Stable isotopic compositions have been useful tools in constraining on source and sink strengths of these gases. Here, we present the stable carbon isotopic composition ($\delta^{13}C$) of CH_4 and CO emitted from biomass burning under different burning stages and fuel types.

Each fuel (rice straw, maize, and woods) was burned using a furnace of 50cm in both diameter and height. Smoke gas samples were collected into glass bottles at 30-second to 3-minutes intervals. Concentrations of trace gases were measured by gas chromatograph. The $\delta^{13}C$ values were measured by using continuous-flow isotope ratio mass spectrometry.

The stable carbon isotopic compositions of CO_2 always coincide well with that of fuel and irrespective of the combustion stage. On the other hand, $\delta^{13}C$ of CO and CH_4 vary widely (~20 ‰) depending on their burning stages. During the flaming stage, CO and CH_4 are enriched in ^{13}C relative to $\delta^{13}C$ in fuel, whereas CO and CH_4 are depleted in ^{13}C during the smoldering stage. These variations in isotopic compositions are likely to be due to kinetic isotopic effects during both production processes and consumption processes (reaction with OH radical) of these gases. Since most of CO and CH_4 are emitted during the smoldering stage, the average isotopic compositions of these gases from biomass burning can be characterized to be depleted in heavy isotopes compared to that of the precursors.

Geochemistry of cluster of submarine lava cones, Kauai-Oahu channel, Hawaii: Implications of magmatism at plume edge

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There exist many submarine lava cones and flows at Kauai-Oahu channel. The 2001 KAIKO and the 2002 SHINKAI dives collected rock samples of two cones at the channel. Thickness of Mn-coating and preliminary K-Ar age dating (0.4 Ma; Noguchi and Itaya, in prep.) suggest that active ages of these cones are younger than 1 Ma, similar to those of North Arch, Honolulu (Oahu) and Koloa (Kauai) volcanics.

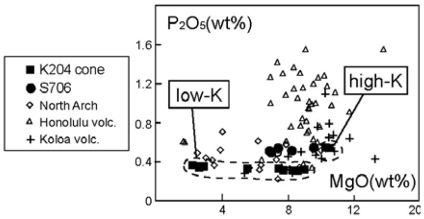

Figure 1. MgO vs. P_2O_5 diagram (wt.%) for the rocks in Kauai-Oahu channel and other rejuvenated stage rocks.

All the samples are the alkaline rocks, and can be classified into the rejuvenated stage type of Hawaiian volcano, on the basis of major, trace and rare earth elements geochemistry. In addition, Sr and Nd isotope ratios of the samples are intermediate between those of Honolulu and Koloa volcanics. These and the estimated active ages of the samples suggest that volcanic centers of the rejuvenated stage have been widely distributed from Oahu to Kauai islands. The geochemical features of these rocks are similar to those of North Arch. Thus, it could be concluded that volcanism of alkaline magmas occurred simultaneously (approximately since 1.5 Ma) at two regions, the North Arch and from Oahu to Kauai islands. These may be related to magma generation at the edge of the Hawaiian plume.

One of small lava cones (volume~$0.15km^3$) at the channel, K204 site, erupted two types of magma, low-K and high-K ones. Compositional variations of major and trace elements, and REE chemistry of these rocks, are nearly the same as those of the North Arch lavas. The variations could not be produced by a simple fractionation of a single primary magma. However, isotope ratios of both types are nearly the same, indicating that the variation might be produced by melting of similar source with distinct degrees of melting. Although K204 cone is small, it could give an important information of magma generation and transport processes at the edge of the Hawaiian plume.