Distribution of root respiration using the trunk-freezing method: A new technique of *in-situ* measurement

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Forest soil respiration is composed of plant root and microbial respiration. The respective contributions need to understand carbon cycle in biosphere. Conventionally, contribution of root respiration was measured by the comparison between soil CO_2 flux with and without root exclusion. But this method can not observe the detail distribution of each trees because of disturbance of soil at root exclusion. We suggest a new technique here.

New Method - trunk-freezing

Our method was adopted a freezing of tree trunk by dry ice put in funnel made by an insulation sheet, instead of the root excavation. This funnel was set at *ca*. 1m heights from ground. After several hours, the inside of trunk was completely frozen and photosynthetic products can not be supplied to root system. Hence, total soil respiration was decreased owing stopping of root respiration. Of course, a large amount of CO_2 was supplied to the observation site, but its influence can be canceled using small fans.

Before starting observation, the litter layer was removed. Soil respiration was measured for a several days on normal situation, and measured again with freezing at the same points.

The observation was carried out in middle April 2003 at a deciduous forest, central Japan. The forest was dominated by oak trees, but the this method was applied to the broad-leaved evergreen tree because its diameter is comparatively small (5.5cm). Soil respiration was masured by the portable CO_2 flux meter (West System, Italy) at 36 points within circle area (diameter of 1.5m) centered the target tree. More 11 points were prepared for the comparison of soil flux change during the observation days.

Results

We found an apparent decreasing of soil flux around the frozen tree. It started from 1.5 days after freezing, and continued during observation period. The decreasing rates of soil flux were shown 30-50% at the 5 points, 50-80% at 5 points and 80-100% at 6 points. The decreasing points were located toward upper-side of ground declination from the target tree. This is consistent with the direction of the reaction wood formation of broad-leave trees.

In the present study, only preliminary results can be represented, but this method has great possibilities for the new technique to clarify distribution of root respiration.

Gas geochemistry of seafloor seeping bubbles at Kuroshima Knoll

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Introduction

The Kuroshima Knoll is located on the forearc region of the Ryukyu island arc. Large-scale chemosynthetic communities (both living and dead *Calyptogena* and *Bathymodiolus*), carbonate crusts including chimney like structures, and some gas bubbling sites have been found on the top of the knoll (depth = 650 m). In order to unravel the source of the bubbles and to clarify the migration processes of the bubbles (or gas-enriched fluids) within sediments and/or crust, we collected samples of gas bubbles and bottom seawater at Kuroshima Knoll by using submersible *SHINKAI2000* for geochemical analysis.

Results and Discussion

We could retrieve 3 samples of gas bubbles and 13 samples of bottom seawater by using lately developed multi bottle gas-tight sampler WHATS attached to the submersible. Besides, 15 samples of pore water have been squeezed from the seafloor sediments.

The gas bubble is mostly composed of CH_4. The contents of N_2, O_2, and H_2S are less than 1%. The contents of H_2 are also under the detection (< 10 ppm). The contents of CO_2 are about 100 ppm and those of He is about 10 ppm. The contents of non-methane hydrocarbons such as C_2H_6 and C_3H_8 are also limited ($C_1/ [C_2+C_3] = 3 \times 10^3$). While the high $C_1/ [C_2+C_3]$ ratios suggest that microbial production at shallow depths for the most reasonable source of the bubbling methane, the $\delta^{13}C$ values of CH_4 and C_2H_6 (–40 and –28 ‰$_{PDB}$, respectively) suggest that thermocatalytic breakdown of organic carbon must be also probable for the source. The $^3He/^4He$ ratios of ca. 0.44 R_{atm}, accompanying highly helium enriched $^4He/^{20}Ne$ ratios (from 15 to 550), are an order of magnitude greater than those of usual crustal helium (< 0.1 R_{atm}), so that the gases must have been stored in sediments and/or crust for a long period under the contributions of both ^{4}He-enriched radiogenic helium and mantle-derived ^{3}He-enriched helium that must be accompanying geothermal heat. We conclude that the bubbling methane is derived from thermogenesis of organic carbon at far beneath the knoll and subsequent migration processes to seafloor alter the relative compositions of hydrocarbons.