Geochemical and isotopic investigation of the Laiwu-Zibo carbonatites from western Shandong Province, China and implications for enriched mantle source

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Major-, trace-element and Nd-Sr isotope data of the Mesozoic Laiwu-Zibo carbonatites (LZC) from western Shandong Province, China provide clues to the petrogenesis and the nature of their mantle source. The Laiwu-Zibo carbonatites can be petrologically classified as calico-, magnesio- and ferro-carbonatites. All these carbonatites show a similarity in geochemistry, they are extremely enriched in Ba, Sr and LREE and markedly depleted in K, Rb and Ti similar to those global carbonatites and extremely high in initial $^{87}Sr/^{86}Sr$ (0.7095 ~ 0.7106) and very low in εNd (-18.2 ~ -14.3), a character completely different from those global carbonatites. The small variations in Sr and Nd isotopic ratios suggest that crustal contamination cannot modify the primary isotopic compositions of LZC magmas and those values are representatives of their mantle source. The Nd-Sr isotopic compositions of LZC and their similarity to those of Mesozoic Fangcheng basalts and mafic dikes imply that they derived from an enriched lithospheric mantle. The formation of such enriched lithospheric mantle is connected with the gigantic collision between North China Craton (NCC) and Yangtze Craton, i.e. the middle or lower crustal materials from Yangtze Craton were subducted beneath NCC and the extensive interaction of Paleozoic mantle beneath NCC with melts derived from the subducted crust of Yangtze Craton produced the enriched Mesozoic mantle which is the source for LZC, Fangcheng basalts and coeval widely distributed mafic dikes. The absences of alkaline silicate rocks which are usually associated with carbonatites suggest that the LZC originated from mantle through directly partial melting mechanism.

Nitrogen stable isotope abundance of N_2O from composting of livestock waste: Its variation and mechanics

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Livestock waste is now understood as an important source of atmospheric N_2O. The flux and the isotopic signature of N_2O during its composting process were studied.

The N_2O emission factor (N_2O-N/Total N by weight) with and without turnover of the composting pile was 0.5 and 1.6%, respectively. The $\delta^{15}N$ of N_2O emitted from the piles showed a clear and large increase during the process from -23.1 to -0.2‰. Its range and an average of -9.6‰ were in the same range as those measured in other N_2O sources (Fig. 1).

A kinetic study for the observed variation of $\delta^{15}N$-N_2O suggested two kinds of mechanisms. A) the change in $\delta^{15}N$ value of NH_4^+ (a substrate of microbial N_2O production), which occurred via not only NH_3 volatilization but NH_4^+ immobilization (microbial transformation to organic nitrogen) with an overall enrichment factor ε of -5.8‰. The latter immobilization process seemed comparatively important, during which an isotopic fractionation has been little known. B) the effect of NH_4^+ availability to N_2O producers, which is likely more dominant to regulate $\delta^{15}N$ of N_2O, on the basis of a consistent decrease in |ε| of NH_4^+ ?N_2O with decreasing NH_4^+ concentration in compost.

It is possible that these mechanisms observed here for composting can commonly apply to other microbial N_2O sources in terrestrial environments.

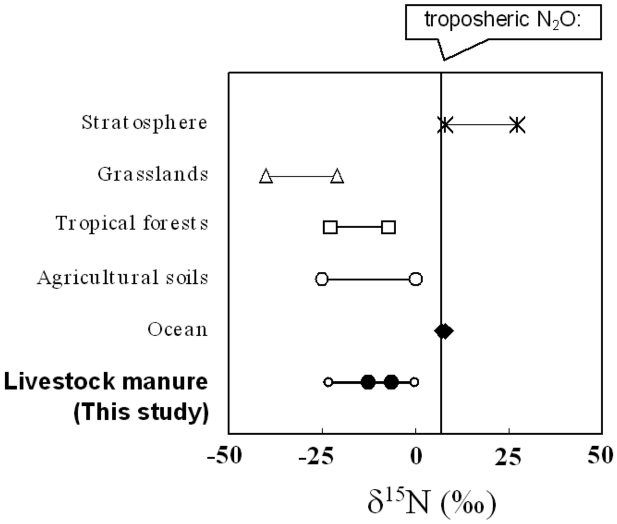

Fig. 1: The $\delta^{15}N$ value of N2O for major sources and in the trophosphere