Elevated atmospheric carbon dioxide alters soil biochemical stocks

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We measured the biochemical stocks and oxidative ratio (moles O_2 / moles CO_2 exchanged by photosynthesis and respiration) of the hardwood forest grown under free air CO_2 enrichment (FACE) in Oak Ridge, Tennessee. The annual oxidative ratio (OR) of net primary production under FACE was not different from ambient (1.036 ±0.001 and 1.037 ±0.002, respectively). However, the oxidation state of the soil carbon pool (C_{ox}) has increased significantly during 9 years of FACE (1998 – 2006), implying that carbon cycle models used for anthropogenic CO_2 sink apportionment may need to account for climate feedbacks from the soil carbon pool in hardwood ecosystems. We find that changes in the biochemistry of plant inputs to the soil organic matter pool do not explain the observed changes in soil C_{ox} and OR. Therefore, we hypothesize that [CO_2]-induced changes in soil C_{ox} are driven by changes in microbial activity or community structure. Based upon ^{13}C NMR data, we attribute changes in soil C_{ox} and OR to enhanced turnover of soil carbohydrates and amino acid stocks under elevated [CO_2].

The stable isotope composition of the mantle – Revisited

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Recent progress in analytical techniques have enabled isotope ratios to be determined with higher precision and better spatial resolution. This makes a critical evaluation of the isotope composition of the mantle appropriate, the more so that besides the classic light elements (O, H, C, N, S), data on elements like Li, B, Mg, Fe have become available

Considering the small isotope fractionations at very high temperatures, relatively large variations have been reported in mantle material (xenoliths and basalts), with isotope heterogeneities on all scales, from the nano- to the kilometer scale. These heterogeneities may be caused by a variety of processes ranging from partial melting – crystal fractionation processes to low temperature weathering processes. Stable isotopes, thus, offer important means by which recycled crustal material can be distinguished from intra-mantle fractionation processes. On the other hand, metasomatic and diffusion processes may cause additional fractionations making the interpretation of isotope variations a complex matter.

Since oxygen is the major component of the mantle, O-isotope variations are of prime interest and will be discussed in the context of other isotope systems.