Microbial activity and reaction kinetics

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Different ways of accounting for active microbial biomass in formulations of soil organic matter (SOM) decomposition lead to qualitatively different long-term predictions of SOM stocks [1]. Considering the entire microbial biomass in such models could be misleading because a large part of the microbial biomass is in an sustaining state in bulk soil [2]. The specific reation rates of this sustaining microbial biomass are much lower than the specific rates of the active microbial biomass [3]. Therefore, models of apparent reaction rates, often require a description of microbial activity.

Experiments on transitions between active and sustaining states after amending soil with small amounts of glucose show a rapid transition to active state and a slow back transitions to sustaining state [4]. In this study we present attempts of incorporating microbial activity in models of SOM decomposition and soil respiration. These models are challenged by the experimental data.

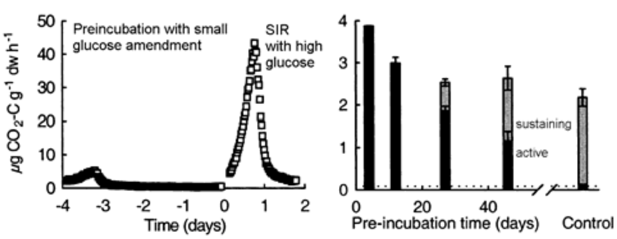

Figure 1: Measured respiration and partitioning of substrate induced respiration (SIR) into sustaining and active part (modified from [4]).

The kinetics of reactions mediated by microbial biomass depend on the activity state of the soil microbial biomass. This activity state depends on the history of the microbial biomass and can be modelled in dynamic models by an additional state variable.

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Eco-geochemistry: A new direction for geochemistry in China

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The eco-geochemistry has been put forward in China recently [1, 2] which studies the geochemical behaviors and characteristics of elements at a regional scale, using the data from national multi-purpose regional geochemical survey across China.

This survey was launched in 1999, and mainly employed the soil geochemical measurement at a scale of 1: 250, 000. An area of 1,600,000 km^2 has already been covered, while the target is 4,500,00 km^2. Tens of thousands soil chemical data were obtained by using standardized grid stratified sampling and analysis methods. Surface soils (at 0-20cm depth) were collected at a sampling density of 1site/km^2 with the deep soils (at 150-200cm depth) taken at a density of 1site/4km^2. And every adjacent four surface or deep soil samples were mixed for chemical analysis. 54 different indexes (concentrations of Ag, As, Au, B, Ba, Be, Bi, Br, Cd, Ce, Cl, Co, Cr, Cu, F, Ga, Ge, Hg, I, La, Li, Mn, Mo, N, Nb, Ni, P, Pb, Rb, S, Sb, Sc, Se, Sn, Sr, Th, Ti, Tl, U, V, W, Y, Zn, Zr, SiO_2, Al_2O_3, TFe_2O_3, MgO, CaO, Na_2O, K_2O, TC, C_{org}, and pH) were determined with low detection limits and high requirements on precision and accuracy.

With the achievements of Chinese multi-purpose regional survey, great progress has been made in eco-geochemistry to study regional geochemical characteristics of elements' distribution, transportation, transformation, and their ecological effects. Efforts have also been made to discuss the correlation between carbon cycling and global change. Eco-geochemistry has become a system consisting of eco-geochemical assessment, eco-geochemical evaluation, eco-geochemical warning and eco-geochemical remediation. Application to agriculture, land use, environment protection has been advanced as well.

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