Elements of physically fractionated soils in a tropical seasonal forest in northeast Thailand

M.Sakai[1], K.Sera[2] and S.Goto[3]

[1]Forestry and Forest Products Research Institute
1 Matsunosato, Tsukuba, Ibaraki, 305-8687, Japan

[2]Cyclotron Research Center, Iwate Medical University,
348-58 Tomegamori, Takizawa, Iwate 020-0603, Japan

[3]Takizawa Laboratory, Japan Radioisotope Association,
348-1 Tomegamori, Takizawa, Iwate 020-0603, Japan

Abstract

The climate change is emerging as perhaps the greatest environmental topic of the twenty-first century. Forests in tropics have very important roles in climate change. A half of global C is stored in soils. Soil organic matter is recognized as an important factor in C-driven climate change. In order to evaluate the relationship between the stabilization of soil organic matter and the behavior of elements in soil, we studied the elements of size-fractionated soils.

The study site was located at Sakaerat Silvicultural Research station (14°28′06.1″N, 101°54′15.0″E; alt., 420 m), Nakhon Rachasima Province, Northeast Thailand. Meteorological conditions were 26°C, annual mean air temperature and 1,100 mm, annual precipitation with the dry (November–April) and wet (May–October) seasons. The soil type is Orthic Acrisols (FAO/UNESCO).

A total of 3 profiles including two natural forests and one grassland, were sampled at 0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm, 20-30 cm, 30-40 cm, 40-50 cm and 50-60 cm depth intervals. Visible plant residues and roots were removed, and soil was air-dried and sieved (<2 mm).

The size fractionation procedure for fine soil (<2 mm) was essentially that of Aoyama etc. (1999), modified to separate fine soil into corse sand (2000-212 μm), fine sand (212-20 μm), and silt-clay(<20 μm) fractions by wet-sieving. Each fractionated soil was ground into powder using an agate mortar and pestle for carbon and elements analysis. The element concentrations were determined by the proton-induced X-ray emission (PIXE) method at NMCC (Nishina Memorial Cyclotron Center). Soil samples were adjusted by the internal reference method.

We detected 25 elements, Al, Cl, Si, Fe, Ti, Zn, Na, Zr, Ca, Cr, Br, Sr, Ni, Mn, Y, Ga, Rb, S, Nb, Cu, K, V, Pb, Mg, and As. The 16 elements, Al, As, Br, Cr, Fe, Ga, Mg, Mn, Ni, Pb, Sr, Ti, V, Y, Zn, and Cuin the silt-clay(<20 μm) fraction show the higher contents than that in other fractions. Si element showed the lower content of the silt-clay (<20 μm) fraction then that of other fractions. That indicated that Si physically breaks into finer particles during weathering. We did not find any correlation between soil carbon contents and element contents in the sand-sized fraction, while there are relationship between soil carbon contents and the contents of 4 elements, Ca, Mn, Br, and S in the silt-clay (<20 μm) fraction. The behaviors of these elements in the soil performed same as soil carbon. These 4 elements show the good index of decomposition of soil organic carbon.