Influence of underlain rock on the organic nutrients and metal release in the forest soil - Okinawa Island, Japan

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Introduction

Soil organic matter (SOM) is known to contribute significantly to the C and N cycles in terrestrial ecosystems, to soil formation, and pollution mobilization and transport. In forest soil nutrients mineralization is regulated by abiotic factors (example, soil fertility, moisture, temperature and texture) and biotic factors such as changes in microbial activity with soil depth and rates of litter inputs. It was reported that forest in the limestone areas has higher diversity than that from silicate areas in Okinawa Island (Feroz, 2003). This difference might be due to the difference in quantity and availability of the nutrients. Therefore, this study was conducted to investigate the influence of underlain rock type and soil pH on organic nutrients and metal release in the forest soil.

Materials and methods

Three sampling points were established for each soil type (limestone, marlstone and silicate). Samples were taken from surface and subsurface soils in each site and analyzed for total organic C, total N, total P, dissolved organic carbon (DOC), soil pH and metal concentrations.

Results and discussion

The soil pH ranged from 4.95 to 7.52 and 6.31 to 7.09 in limestone and marlstone soils respectively, while that from silicate rock was strongly acidic with pH ranged from 3.62 to 5.62. Limestone soil showed much more organic nutrients followed by marlstone and silicate soils in both surface and subsurface mineral soils (Fig.1). This depicts high inputs and decomposition of leaf litter in limestone area, which is mixed well with mineral layers due to both high porosity and activities of soil animals. In comparison to soil layers, surface soils (0-10 cm) also contained much nutrients than subsurface soils (10-20 cm) in all sampling stations. All three types of soils revealed more favourable C/N ratio than C/P ratio. DOC concentration also was relatively high in limestone compared to the other two sites, which is likely affected by underlain rock types and soil depth. Regardless to the rock type effect, soil pH showed strong influence on Al, Fe and Cr while DOC was specific on Cu. In the silicate soil, concentration of trace metals (Co, Ni and Zn), was very high compared to the limestone and marlstone areas. This is probably due to the encompasses of low soil pH in silicate area which is increase the mobile fraction of heavy metals, while that in limestone and marlstone the soil pH is relatively high.

Reference