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Soil Erosion Through Geochemical Activity of Heavy Metals Within Soil Profiles in Korea

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1. Introduction

Mountainous landscape and heavy rainfalls have been the main factors influencing soil erosion in Korea. Soils erode away much of the soil cover to the extent of exposing the soil subsurface layer, and even at times the bedrocks, through various types of soil erosion such as landslides, pipe, rill and gully erosions occurring intensely by flows on mountain hillslopes. The soils are eroded and transported by overland and through flows, along the vertical and lateral directions in hillslope soils, i.e., soil erosion generates intensive leaching of soil particles with chemical components and its re-deposition within the subsurface soil profiles. To date, most investigations on soil erosion in Korea have mainly focused on engineering construction and agricultural issues as for only surface soils. Consequently, geo-scientifically integrated measurement, estimation and control of soil erosion throughout subsurface soils are a priority in Korea. According to the RDA (1999), there are 7 soil orders and 390 soil series consisting of Podzol grey soils in northern part, Red soils in southern part and Mountain forest brown soils in most part of Korean Peninsula. Present study considers the soil erosion inferred from geochemical intensity by spatial distribution of heavy metals within Ferrasols, Entisols, Cambisols, Vertisols, Acrisols and Arenosols (FAO, 1994) in Korea.

2. Materials and methods

Soil samples were taken from Acrisol and Vertisol in Gangneung, Entisol and Acrisol in Yeongcheon, Ferrasol in Tongyeong, Cambisol in Muan-gun, Arenosols in Uijongbu, and Cambisol and Luvisol in Yangsuri. In order to estimate the geochemical intensity of these soils, geochemically active heavy metals such as Cu, Pb, Zn and Ni have been analysed by ICP-AES at SNU and KIGAM, and evaluated by a proportion to a clark standard values on regional and global levels by Kabata-Pendias (1989). The most soils in Korea, formed on acidic granite and granite genesis on hills, are rather coarse and prone to erosion by overland flow, and have entirely lost a natural formation and primary features. Moreover, the soils have been intensely disturbed by human activities, such as agriculture and construction etc, i.e., the soils in Korea consists of Anthroposols.

3. Results and discussion

The geochemical activity of the soils along the hill-slopes showed comparative high levels than global clark values, which indicates that the soils on backslopes are highly vulnerable to erosion by overland flow, associated intensive redistribution of soil particles on downslopes (Orkhonselenge.A, 2006). In particular, the catenary sequence along the hillslope has been distinctly revealed by spatial variabilities of Cu, Pb, Zn and Ni in Acrisols, Luvisols and Arenosols. The most heavy metals are 1.3-2.8 times as geochemical active in Ferrasols, Pb and Zn are 2.0 and 1.2 times in Cambisols, and Pb and Ni are 1.5 and 1.7 times in Vertisols, respectively comparing with standard clark values at global level. The high values of the heavy metals show the intensive soil oxidation and leaching of geochemical constituents within the soil profiles. Therefore, the geochemical activity of these soils indicates the different intensities of soil erosion by overland flow and throughflow between soil types and within soil profiles, i.e., soil geochemistry on hillslopes in Korea indicates the peculiar features due to climatic conditions, geomorphologic features, soil properties and parent material characteristics.

4. Conclusions

The geochemical intensity of the soils in Korea has been evaluated by a proportion to a clark standard values on regional and global levels. The spatial distribution of heavy metals within the soil profiles and along the slopes indicates that these soils in Korea are intensely vulnerable to erosion, consequently geochemical process which generated by overland flow or throughflow has actively occurred. The geochemical intensity of these soils indicated the differences between soil types and distinctive catenary features along the slope due to amounts of annual precipitation, acidic condition and mountain landscape.

References

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