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Clay Mineralogical Characteristics of Paddy Soils in Miyagi Prefecture, Northeastern Japan

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Clay mineralogical compositions in paddy soils affect the soil properties that are related to rice productivity and environmental pollution. Clay mineralogical compositions in alluvial paddy soils are closely related to topography and surface geology in mountains located on upper reaches. In terrace and hilly lands, volcanic ash soils and residual soils are prevalent and their clay mineralogy is strongly affected by volcanic materials, wind-blown loess or surrounding rocks. In this research, we clarified the characteristics of clay mineralogical composition of paddy soils in Miyagi Prefecture, Northeastern Japan by integrating point data of clay mineralogical composition, information on surface geology of mountains in upper reaches, topography types and soil types.

We collected paddy soil samples from the Soil Survey for Improved Utilization and Conservation of Soil Resources in Miyagi Prefecture (74 soil samples) and 60 supplemental samples. Clay mineralogical composition of the clay fraction was determined by X-ray diffraction and acid-oxalate (pH 3.0) extractable silica. The soils were then classified into 6 clay mineralogical composition types. In alluvial areas, where 94 % of paddy soils exist, point data on clay mineralogical composition type were expanded to incorporate plane information, based on the assumption that clay mineralogical composition is uniform in a "cell", which is a topographical plane subdivided by watershed.

Most alluvial paddy soils in Miyagi Prefecture were classified as being of smectitic type and medium smectitic type. It is considered that the paddy soils abundant in smectite are strongly influenced by the tertiary tuff in the mountains where many rivers originate. Paddy soils with clay mineralogical compositions of mixed type rich in chlorite existed in valley basins of the northeastern area and soils abundant in kaolin minerals were distributed into watersheds affected by shale and granite rock. Paddy soils abundant in 2:1-2:1:1 intergraded minerals were distributed on terrains and hills of the western area where non-allophanic Andisols and residual soils existed. Paddy soils with clay fractions dominated by amorphous clay were distributed on the Eastward side of the Zao volcano, which is located in the western part of Miyagi Prefecture.