Estimating soil acidification rates for 7300 years in Yakushima Island, Japan

*Kazumichi Fujii[1], Seiichi Kanetani[1], Kenshi Tetsuka[2]

1. Forestry and Forest Products Research Institute, 2. Yakushima conservation association

Soil acidification is a natural soil-forming process, accelerated by acidic deposition, in forest ecosystems. Soils in Yakushima Island, southwestern Japan, are derived from bedrock (granite) and volcanic parent materials affected by aeolian dust inputs. Acidic deposition and low acid neutralization of granite-derived soils are hypothesized to result in export of acidic streamwater widely observed Yakushima Island, but it remains unclear whether acid neutralizing capacities are also limited in volcanic soils which are known to have high buffering capacities and weatherable minerals. To compare acidification rates of granite-derived soils and volcanic soils, we estimate changes in acid neutralization capacities in soils from granite and volcanic parent materials in the 7300 year soil development after the eruption, using mass balance of titanium. In soil development after the eruption, a decrease in acid neutralizing capacities and total base reserves was observed both in granite-derived and volcanic soils, compared to the respective parent materials. No difference was observed in soil acid neutralizing capacities between granite and volcanic parent materials. Cations contributing to acid neutralization could vary between ecosystems. A decrease in acid neutralizing capacities is mainly by aluminum in the coniferous forests, while acidity is neutralized by loss of basic cations from the volcanic soils in evergreen oak forests. The strong retention of potassium in silicates limits acid neutralization by bases and increases accumulation of exchangeable Al in granite-derived soils. In volcanic soils, base leaching and sorption of organic acids onto short-range-order minerals can neutralize acidity, while erosion and admixing of granite or aeolian dust-derived materials leads to reduction or dilution of acid neutralizing capacities in surface soil horizons.

Keywords: Soil acidification, Soil organic matter, Acidic deposition

