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Agriculture effects on geochemical soil properties and stability of soil organic carbon on tropical Andosols

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The impact of soil age on geochemical properties and carbon cycling has been studied via chronosequences. However, only few studies have addressed how land-use and soil age might interactively shape properties of Andosols and in turn their capability to retain organic carbon (OC). Geochemical soil analyses and laboratory incubation experiments were carried out to assess soil characteristics and mineralization of soil organic carbon (SOC) in Indonesian soils with two contrasting land uses, viz. pine forest and horticulture. Both of these land uses are the results of conversion of primary forest which had similar parent materials, soil age, as well as weathering intensity. Results showed that intensive agricultural practices (+ 40-50 years) did not result in a significant loss of SOC or the increase of bulk density compared to forest. On the other hand, they were found to increase pH, exchangeable cations, base saturation, and most strikingly non-crystalline materials (i.e. $Al_0 + \frac{1}{2} Fe_0$) leading to phenotype formation in agricultural soils. Positive correlations were found between non-crystalline materials with properties such as soil specific surface area and micropores volume, and it was also positively correlated with SOC, particularly in the subsoil. This study highlighted the resilience of Andosols to soil degradation under agricultural practices and its ability to stabilize SOC.