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Similar Soils, Different Soil-Forming Factors: Converging Evolution of Inceptisols in Brazil

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ABSTRACT

Since soils are the results of the interaction of five independent factors of soil formation, variations in only one factor as the others are kept constant are sufficient to produce very different soils. In this paper, we demonstrate an opposing trend, that two soils can be otherwise similar despite being the results of considerable differences in all factors of soil formation. We sampled two Oxic Dystrudepts formed from different parent materials (gneiss vs. mica schist), climate (tropical altimontane vs. warmer, drier plateau), topography (1,650 m, 45 % slope vs. 1,000m, 8 % slope), time (rejuvenated vs. old, stable surface) and vegetation (rainforest vs. Cerrado savanna). The two soils have similar chemical properties, whereas the soil on mica schist has finer particle size distribution, lower porosity and much lower saturated hydraulic conductivity. Micromorphological analyses showed that these properties were related to a coarser blocky microstructure, when compared to the altimontane Dystrudept on gneiss. Both soils presented active mineral weathering aside with pronounced pedoplasmation, as reflected in clay contents > 300 g kg^{-1}, although only the Dystrudept on gneiss showed coarse rock fragments. In addition, the C horizons of both soils presented fragmented clay coatings suggestive of argilluviation that is probably relict, since they were not observed in B horizons. The similarities in many properties of the two Dystrudepts, despite their contrasting factors of soil formation, suggest their converging evolution and that soil classification at the subgroup level was efficient in grouping similar formative processes in tropical conditions. Moreover, the present work presents evidence that similar pedogenic processes acting on different factors of soil formation can result in similar soil properties, at least for Inceptisols where further soil development is hindered by topographic limitations.
Key Words: soil micromorphology, soil genesis, mineral weathering, Soil Taxonomy

INTRODUCTION

Most studies on soil genesis in low latitudes focus on Oxisols, Ultisols and Entisols, since these are the main soil orders across a wide range of environments, especially in South America. However, a significant part of soils in Brazil and other tropical countries are comprised by Inceptisols, many of which are important to agriculture despite their inherent limitations, which for Udepts typically are steep slopes (Palmer, 2013) and shallow depths. According to Buol *et al*. (2011), all pedogenic processes are active to some extent in Inceptisols but none predominates, thus they have weakly developed profile features and comprise a wide diversity of soils. In consequence, Inceptisols were seldom considered as adequate models for pedogenetic studies in the humid tropics. In these regions, Inceptisols are typically one of the least understood soils, and the relatively few works on their genesis commonly describe mineral weathering patterns (Pinto *et al*., 2015) or the effect of one factor of soil formation, such as topography (Anjos *et al*., 1998) on their properties.