MAGNETIC ENHANCEMENT OF PRE-COLUMBIAN ANTHROPOGENIC DARK EARTH FROM AMAZONIA

Scardia, G.[1]; Stampanoni Bassi, F.[2]; Jovane, L.[3]; Carrasqueira, I.G.F.[3]; Rasbold, G.G.[4]

[1] Universidade Estadual Paulista; [2] Museu da Amazonia; [3] Universidade de São Paulo; [4] Universidade Estadual de Maringá

ABSTRACT: In the Amazon basin, pre-Columbian anthropic occupation and land use are associated with a dark, organic-rich soil, known as *Terra Preta do Índio* or Amazon Dark Earth (ADE). Although the anthropic origin of ADE is currently accepted, it is not clear yet if it resulted as by-product of daily human activity or it is an allochthonous sediment intentionally deposited to improve the fertility of the latosols. We performed rock magnetism analyses on samples from the Bom Socorro archeologic site (Itacoatiara, Amazonas), where the ADE occurs over an area of 6 ha at the rim of the fluvial terrace of the Urubu River. From top to bottom the site stratigraphy consists of ADE (30–50 cm-thick), a transitional horizon (50–60 cm-thick), and the lateritic soil. Two charcoals collected from the transitional horizon in two different profiles were dated by radiocarbon. Results indicate different ages, 385–535 cal yr AD and 1460–1635 cal yr AD respectively, for the same horizon, suggesting that ADE experienced a polyphasic development through at least two different moments of anthropic occupation, in agreement with the archeologic evidence.Magnetic susceptibility values show a ten-fold increase from the lateritic soil to the ADE, associated to the occurrence of low-coercivity magnetic mineral, interpreted as maghemite on the base of thermomagnetic curves and FORCs. Conversely, unmixing analysis of the IRM acquisition spectra indicates goethite as main magnetic mineral in the lateritic soil, with a minor amount of hematite. The hysteresis ratios M_{RS}/M_S and B_{CR}/B_C show distinct populations for ADE and the lateritic soil, both plotting in the classical pseudo-single domain (PSD) region for magnetite of the Day plot. Data from ADE are well clustered and point to a homogenous grain size distribution of the magnetic mineralogy, whereas shift towards higher B_{CR}/B_C values observed in the lateritic soil must be produced by a mixture of different magnetic minerals and/or different grain sizes, as highlighted by the analysis of the IRM acquisition curves and the coercivity spectrum. The hysteresis ratios of the transitional horizon overlap both ADE and lateritic soil values, suggesting that is a former horizon of the lateritic soil with secondary precipitation of ADE elements by percolation and/or faunal reworking.The distinctive magnetic properties of the ADE may have originated from pyromagnetic soil enhancement by fires related to the daily anthropic activity at the settlement, including both ceramics production and waste burning. Formation of maghemite, primarily responsible for the magnetic enhancement of the ADE, should be directly linked to burning in the presence of organic matter. Temperatures of about 200-300 °C allow the conversion of iron (oxyhydr)oxides from the lateritic soil to magnetite, which eventually transformed into maghemite by low-temperature oxidation.Magnetic enhancement of the ADE with respect to the underlying lateritic soil may be used as discriminant physical property for future large-scale prospections, considering that the total extent of the ADE in the Amazon basin is still largely unknown.

KEYWORDS: ROCK MAGNETISM, MAGNETIC SUSCEPTIBILITY, SOIL, AMAZON BASIN