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Geochemistry of Dark Earth Amazonian.

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In the Amazon Region there exist extensive areas where the soil was modified by the Pre-Columbian humans, such soils are known as Archeological Dark Earths (ADE), Indian Dark Earth, Dark Earth (DE) or Archaeo-Anthrosols (Kern & Kämpf, 1989; Kämpf at al., 2003; Kämpf & Kern, 2005). These areas represent old settlements with highly fertile soil, that seem not exhausted of chemical content under conditions of tropical forest. The DE it has high contents of Ca, Mg, P, Cu, Zn, Mn and organic C (charcoal) in relation to adjacent soils. This research intends to evaluate the resultant chemical transformations from patterns of prehistoric human occupation that produced dark earth and to try to understand the geochemical processes that promoted its formation. These anthropogenic soils are well drained, deep, with textures varying from sandy to very clayey. Moreover, they present a dark A horizon, with color between N2/ to 10YR3/2 and ceramic fragments and/or lithics that correspond to the layer of human occupation. The addition of organic residues during the process of formation of DE provoked significant modifications in the soil, either in the vertical direction (profile) or in the horizontal line (areal). Several authors confirm the high fertility of these soils, which contrast with those more commonly found in the region. In all the analyzed samples the contents of Ca are higher than Mg, K and Na, probably indicating the contribution of richer materials in Ca, as component of the organic substance. The maximum contents of 39,6 cmolc kg-1, were registered in the DE of Monte Alegre (Falesi, 1970) and the 0,52 minimum of cmolc kg-1 in ADE of Colombia (Eden, 1984). The higher levels of Mg have been detected in DE of Cachoeira-Porteira and Belterra region, in the order of 7 cmolc kg-1 (Kern & Kämpf, 1989 and Pabst, 1991). The higher levels of cations, especially calcium and magnesium result in high ctc, add and saturation of bases. Phosphorus deficiency is found in 90% Amazon soils, however the deficiency level depends directly on the type of culture (Rodrigues, 1996). The maximum contents of this element in DE with about 7,455 mg kg-1 in the A horizon, was observed in Itaituba-Pará, decreasing in depth (Oliveira Jr et al., 2002). As Kämpf et al, (2003); Kämpf & Kern (2005) note, these values are associated with prehistoric human occupation, so that P and Ca can be found in remaining portion of vegetables (manioc, açaí, bacaba, etc), animals (bones and excrements) and food residues. DE is formed by the continued or interrupted and successive accumulation of organic materials, contents 30% of dark carbon, probably originated through the incomplete burning of the biomass. This is probably responsible for the high supply of nutrients in the soil (Glaser et al, 2000). The maximum organic carbon content was found in DE of Trairão with 243g kg-1, (Pabst, 1991). For Pabst (1991), the organic substance of the DE differs also in amount terms, as in its structuring, and is more stable and richer in organ-metallic components that those of Amazon Latosols. According to Kämpf & Kern (2005), the Amazon Dark Earth present 38,9 medium values of g kg-1 for organic C; 507 mg kg-1 for available P; 9,4 cmolc kg-1 for Ca+Mg and pH 5,6. Opposing the averages of Latosols and Argisols of 1,6 g kg-1 for organic C; 1,7 mg kg-1 for available P; 1,4 cmolc kg-1 for Ca+Mg and pH 4,5. Mn, Cu and Zn detach with raised contents, when compared with the adjacencies. Moreover, they do not present significant differences in B horizon, strengthening the relation with the structure of the organic substance. According to Kern et al. (1999), the leaves of palms used as roofing material might be an important source of these elements. The study area demonstrates the existing relations between them, so that, the anomalies correlate and are concentrated in delimited portions of the small sites. The vertical and horizontal pedogeochemical variability of elements Ca, Mg, Cu, Mn, Zn, P and C in the DE can be related to the regularity, cultural diversity and density of past occupations, as well as the irregularity in the addition of organic residues (vegetal and animal) in the soil associated with intense pedogenetic processes.

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