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Differential scanning calorimetry and X-ray diffraction at several temperatures to study a Brazilian soil clay fraction

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This work aimed to employ differential scanning calorimetry to find the possible desidroxylation/amorphization temperatures of the main minerals composing a particular soil clay fraction, as well as characterize this fraction mineralogically through XRD at several temperatures. The clay fraction comes from the hardsetting horizon of a Yellow Latosol (Oxisol) formed from sandy and sandy-clayey non-consolidated sediments from the Barreiras formation (Pará State). Considering the soil solid phase, composed of organic and mineral matter, with several and specific physical and chemical properties, it becomes difficult to identify minerals directly only using the X-ray diffraction, since due to their amount, many diffraction peaks overlap. Thus, the samples thermal treatment represents a good alternative to help identify the crystalline mineral phases present in the sample. The clay fraction sample was collected by the Stokes Law. The DSC analyses were used with 30 mg sample heated from 25 °C to 800 °C at 10 °C/min rate and a 20 mL/min Argon flow. The XRD analyses were carried out using a diffractometer with CuKα radiation; in 2°/min continuous scanning and 2θ from 3° to 100° extension, with an oven coupled to the diffractometer for heating at 200 °C, 300 °C, 400 °C, 470 °C, 510 °C, 600 °C, 700 °C and 800 °C. The disappearance of goethite peaks at 400 °C and kaolinite peaks at 510 °C were observed through the XRD analysis, in accordance with the DCS analyses whose temperatures corresponding to the endothermal peaks were 328 °C and 516 °C, respectively, so that the use of such analyses helped to clarify the mineral composition of the clay fraction under analysis.