EGU2020-17822
https://doi.org/10.5194/egusphere-egu2020-17822
EGU General Assembly 2020

Discussing the dating of ferruginous duricrusts: promises from mineralogy of supergene minerals with non-destructive microsampling

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Ferruginous duricrusts record a part of the Earth's geodynamical and climatic history in tropical area, because they can be formed over a wide geologic period. However, the events and processes related to their formation, transformation and distribution are still obscure. This is mainly due to the complexity arising from their finely divided and polycrystalline nature together with the coexistence of various generations of supergene minerals, such as iron and aluminum oxides, oxyhydroxides or hydroxides (e.g. goethite, hematite and gibbsite) and kaolinite, even at microscopic scale. Classical mineralogical investigations are often realized using powders samples, which hinders subsequent analyses on the same sample, such as SEM or (U-Th)/He dating. Thus, the aim of this study was to propose a new way to investigate the mineralogy of supergene ferruginous samples on micrometric grains that will be analyzed by (U-Th)/He dating method. Prior to this analysis, we first compare the X-ray diffraction data of grains and small amounts of powders looking to reveal the mineralogical composition of populations of secondary minerals of a ferruginous duricrust by taking into account the heterogeneity of the material. Samples were collected from a ferruginous duricrust with pisolitic structure developed over epiclastic conglomerates and sandstones deposited by alluvial fan and fluvial streams from the Upper Cretaceous at the western Minas Gerais state (Brazil). The geomorphology of the study area is delineated by remnants of paleosurface (up to 1,000 m a.s.l.), which comprises an important record of long-term Brazilian continental history.Macroscopic facies recognized on duricrusts sections were described, which allowed the identification of various populations of secondary minerals. After this detailed description, grains (size < 0.5 mm) were collected and powder samples of each population were prepared by crushing. Overall, the results point out that the grain and powder samples could be used to identify mineralogical composition at fine resolution of secondary minerals from ferruginous duricrusts. In addition, XRD results are similar for both types of sample preparation, however the < 0.5 mm grain samples are more advantageous because they are not destructive and thus allow to get a finer description of the mineralogy of different

populations and can subsequently be used for e.g. (U-Th)/He dating, providing critical information for interpreting and discussing the ages of iron oxides.

Grant: 19/10708-7; 17/22292-4; 17/20788-2, São Paulo Research Foundation (FAPESP)

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