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Formation and evolution of lateritic profiles in the middle Amazon basin: insights from radiation-induced defects in kaolinite

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In this study, we show that paramagnetic radiation induced defects in kaolinite can be used to obtain time constraints on Tertiary geological processes. This approach is particularly suited for lateritic profiles developed on previously weathered rocks, corresponding to limited remobilization of radionuclides. Despite large uncertainties related to the evaluation of dose rate in external irradiation, estimated ages of formation can be proposed on the basis of the present-day dose rates for kaolinites sampled in lateritic soils and continental sediments of the middle Amazon basin. The scenario supported by our results suggests a pre-Miocene age for sedimentary kaolinite formation in aquifers and a Miocene-Pliocene age for the formation of nodular layers in the latosols. Topsoil horizons display evidences of more recent formation of kaolinite. However, the significant RID concentration measured in all the investigated kaolinite samples shows that these kaolinites cannot be viewed as representative of contemporaneous weathering conditions. It demonstrates that kaolinites of various ages can be present in the same lateritic profile and supports the use of kaolinite to decipher past geochemical and climatic conditions which have prevailed at the Earth's surface.