



Dating iron duricrusts in central Amazonia, Brazil: relation with paleoclimate change.

PhD position in environmental mineralogy, geochemistry and geochronology: We are inviting applications for a PhD position that would be shared between the Geosciences Paris Sud laboratory (GEOPs, University Paris Sud, Orsay, France) and the Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie (IMPMC, Paris, France). This will be part of the collaborative research program entitled “Reconstructing the influence of climate change on laterite formation” (RECA) funded for 4 years by the Agence Nationale pour la Recherche, (ANR) in France.

Project summary: Laterites are deep weathering covers of the critical zone that occupy 80% of the total soil-mantle volume from continental landscape (Tardy et Roquin, 1998). They significantly participate to the global geochemical budget of weathering and erosion, and to greenhouse gas consumption. Despite their factual importance at the Earth’s surface, the timing of their formation and evolution in response to climatic and geodynamic forcing are still obscure. We will concentrate our effort on geodynamically stable Central Amazonia region, where laterites formed through the whole Cenozoic and can be associated with major geomorphological units. We will date mineralogically well-identified populations of iron oxides and oxyhydroxides (hematite, goethite) and clay minerals (kaolinites) by using geochronometric tools (i.e, (U-Th)/He, (U-Th)/Ne and electron paramagnetic resonance spectroscopy, respectively; Shuster et al., 2005 ; Balan et al., 2005 ; Allard et al., 2018). These recent methods are appropriate because they can be applied to the most common secondary minerals found in laterites and span geological time scales. The timing of duricrust formation will then be related to paleoclimatic conditions (temperature, rainfall) derived from a combination of geochemical or mineralogical indices and proxies at global scale or at a more regional scale. Coupling age and duricrust elevation will yield average erosion rates, whereas geochemical budget will document cumulative weathering, allowing comparison with other weathering environments or paleo-environments at the Earth’s surface.

The PhD student will work specifically in the Amazonia region and perform field trips in the areas, in collaboration with our colleagues from Brasilia and Goiania universities. After field trip, mineralogical studies of the collected Fe-duricrusts will be characterized using different mineralogical tools and suited samples will be dated. All the ages will be integrated regionally to identify the weathering phases that lead to duricrust formation. The obtained ages will be linked to the main climatic change occurring during Cenozoic area.

Requirements: Candidate should hold a master degree and good knowledge in geosciences, mineralogy, geochemistry, and soil science.

Starting date: October 2018

Application: please provide a letter with a declaration of interest, motivation and qualifications for the project (max. 1 page), a detailed CV, copies of diplomas with grades and honors where appropriate, and two signed reference letters.

References :

- Allard, T. et al., 2018. Combined dating of goethites and kaolinites from ferruginous duricrusts. Deciphering the Late Neogene erosion history of Central Amazonia. *Chemical Geology*, 479: 136-150.
- Balan, E. et al., 2005. Formation and evolution of lateritic profiles in the middle Amazon basin: Insights from radiation-induced defects in kaolinite. *Geochim. Cosmochim. Acta*, 69(9): 2193-2204.
- Shuster, D., Vasconcelos, P., Heim, J., Farley, K.A., 2005. Weathering geochronology by (U-Th)/He dating of goethite. *Geochim. Cosmochim. Acta*, 69(3): 659-673.
- Tardy, Y., Roquin, C., 1998. *Dérive des continents. Paléoclimats et altérations tropicales*, Orléans.

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