



2013-2014 Internship

Host laboratory: ISTerre / Mineralogy & Environments group

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<http://isterre.fr/recherche/equipes/mineralogie-et-environnements/?lang=en>

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Proposed research

Clay mineralogical evolution induced by plant activity and potassium uptake

Keywords: Clay minerals, mixed layers, X-ray diffraction, crystal chemistry, Morrow plots, potassium uptake, potassium speciation, plant activity, sustainable agriculture

Summary

The Morrow Plots were established at the Urbana campus of the University of Illinois in 1876 to answer agricultural questions. They are the oldest agronomic experiment fields in the United States with a recorded history of cropping practices (systematic monoculture, crop rotations, and fertilization). Top soils were samples on a regular basis since the beginning of the 20th century. These unique series of samples thus represent a fantastic opportunity to investigate both short- and long-term influence of cropping practices on the status of potassium, an essential plant nutrient. As clay minerals represent, together with K-feldspars and micas, a major reservoir of potassium potentially available for plants their mineralogy is likely to be impacted by potassium uptake resulting from plant growth.

Proposed research activity will thus focus on the determination of clay mineralogy of samples selected from the 1904-2012 time series. Clay mineralogy will be determined from the simulation of X-ray diffraction patterns recorded of various size separates. The time evolution of clay mineralogy will be compared with that of K-speciation determined with X-ray absorption spectroscopy (coll. with Camille Rivard at the ESRF – Grenoble / Beamline ID21).

Unraveling the link between clay mineralogy and the geochemical cycles of elements, and more especially of nutrients such as K, will undoubtedly allow assessing the long-term sustainability of cropping practices.

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