Geophysical Research Abstracts
Vol. 14, EGU2012-6427, 2012
EGU General Assembly 2012

To what extent clay mineralogy affect soil aggregation? Insights from fractionation analyses conducted on soils under different land-uses.

O. Fernandez-Ugalde (1), P. Barré (1), F. Hubert (2), I. Virto (3), C. Girardin (4), E. Ferrage (2), L. Caner (2), and C. Chenu (4)

(1) Laboratoire de Géologie, CNRS-ENS, Paris, France (barre@geologie.ens.fr), (2) Laboratoire Hydrasa, Université de Poitiers, Poitiers, France, (3) Dpto. Ciencias del Medio Natural, Universidad Pública de Navarra, Pamplona, Spain, (4) Laboratoire Bioemco, AgroParisTech, Thiverval-Grignon, France

Aggregation is a key process for soil functioning as it influences C storage, vulnerability to erosion and water holding capacity. While the influence of soil C content or tillage on aggregation has been documented, much less is known about the role of soil mineralogy. The aim of this study is to determine quantitatively if different clay minerals of a temperate soil contribute differently to aggregation and if their contribution is modulated by soil management. We compared the aggregate-size distribution of three cropping systems in a silt loam soil in Versailles (France): organic cropping system (ORG, tilled yearly), direct seeding mulch-based cropping system (DMC, tilled every 4 years), both from a long-term trial, and a nearby grassland. Soil samples from 0-5 cm were wet-sieved to 5 mm and air-dried before aggregate-size separation. For each aggregate class, fraction <2 μm was separated and analysed using X-ray diffraction. Organic C content was determined both in aggregates and <2-μm fractions. C content was lower in ORG than in the two other treatments. The proportion of large-macroaggregates (500-5000 μm) was greater in DMC and grassland; while microaggregates (50-250 μm) showed greater proportions in ORG. In the three treatments, microaggregates had the greatest amount of clays, with preferential accumulation of smectitic phases. In grassland, clays from all aggregated fractions showed more smectitic phases than free-clay fraction. The results indicate that smectitic phases contributed particularly to the microaggregates dynamics. Their contribution to aggregation was lower for larger aggregate sizes where the influence of organic matter was preponderant. Moreover, it was observed that cultivation (ORG and DMC treatments) reduced the relative enrichment of smectitic phases in stable aggregates which makes them more vulnerable to slaking erosion and alters their physico-chemical functions.