Geophysical Research Abstracts, Vol. 8, 07625, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07625

Influence of maize rhizosphere and associated microflora on weathering of Fe and Mn oxides and availability of trace elements in a New Caledonia Ferralsol

I. Paskiewicz and J. Berthelin

LIMOS, UMR 7137 CNRS-UHP Nancy I, Faculté des Sciences, BP239 F-54506 Vandoeuvre-les-Nancy Cedex, France (isabelle.paskiewicz@limos.uhp-nancy.fr / Phone: +333 83 68 42 83)

In New Caledonia Ferralsols, nickel toxicity has been shown on Zea mays (maize) (L'Huillier, 1994). This metal and others (Co, Cr) are contained in iron and manganese oxi-hydroxides and are released when these minerals are reduced and dissolved in particular by iron reducing bacteria (Becquer *et al.,* 1997; Quantin *et al.,* 2001). This mobilization of metals, particularly Cr, and damage to the crops are increased with phosphorous fertilization (Becquer *et al.,* 2003) by ionic exchange. So it is of high interest and application to know the biogeochemical cycle of Fe, Mn, and trace associated elements (Cr, Ni, Co) in soils and rhizosphere of plants in such type of environment. It has been already showed that plants of strategy II, like maize, are able to release phytosiderophores when the growth media is deficient in available iron and can dissolve iron from a synthetic goethite (Bertrand & Hinsinger, 2000). But no study has been done on the weathering of natural oxides and dissolution of associated trace elements in the rhizosphere of plants.

Experiments have been performed to determine the importance of maize rhizosphere in weathering of iron and manganese oxy-hydroxydes in New Caledonia Ferralsols and the change in availability of Fe, Mn, Ni, Cr and Co in well defined conditions, comparatively to microbial weathering during soil organic matter biodegradation. Experiments have been done using pot cultures of maize (Zea mays cv. DK250) during six weeks. The crop substrate was made of soil mixed with sand (soil/sand: 10/90 in weight) moistened at 80% of the Water Holding Capacity (WHC). Light, humidity,

temperature were also controlled. Non-planted devices and maize grown on sand have been used as controls.

The oxi-hydroxides weathering has been monitored by the quantification of the elements (Fe, Mn, Ni, Cr, Co) in solution, in the plants and in the different organo-mineral compartment of the soil using sequential extraction of the elements from the most (total and reduced water-soluble elements) to the less (well cristallized iron oxides) available phases. A weathering index (Iw) was also estimated. The elements toxicity for plants has been evaluated by the evolution of maize growth and mineral element uptake by plants.

Results show a relatively high bioavailability of Fe, Mn, Ni, Cr and Co, which were well absorbed by maize. Ni uptake in the shoots of maize exceeds the toxicity level defined by L'Huillier in 1994. The trace elements content seems to inhibit plant growth of 50% in comparison with culture on sand. Fe and Mn oxi-hydroxide weathering in New Caledonia Ferralsols by the effects of maize rhizosphere and of soil organic matter biodegradation is at the origin of a redistribution of the elements in the different geochemical compartments of the soil samples. A decrease in oxi-hydroxides cristallinity also occurs. A rhizospheric effect has to be underlined and increases strongly the transfer and redistribution of mineral elements (Fe, Mn, Ni, Cr and Co) from the more stable geochemical compartments to the most available phases (watersoluble and exchangeable).

Maize rhizosphere and associated microflora contribute to increase significantly the weathering and availability of non soluble elements, they occur strongly in the mobility and transfer of trace metals to the hydrosphere and biosphere. The involvement of iron and manganese reducing bacteria has to be better defined.