# MOBILITY OF $^{137}Cs$, $^{10}Be$ AND $^{210}Pb$ IN SOIL AS A FUNCTION OF THE SOIL TEXTURE, ORGANIC MATTER CONTENT AND pH

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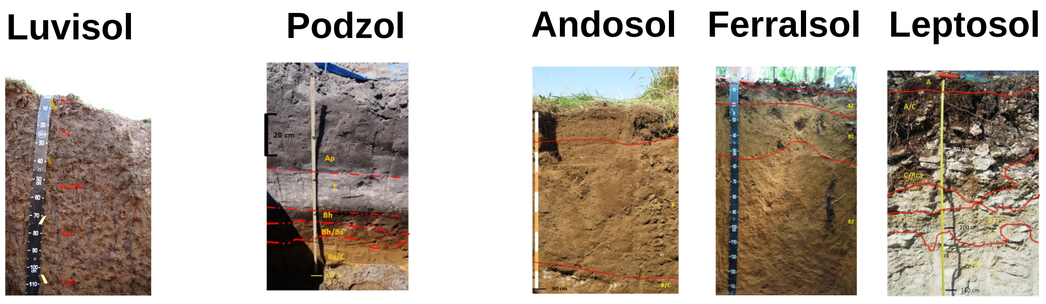
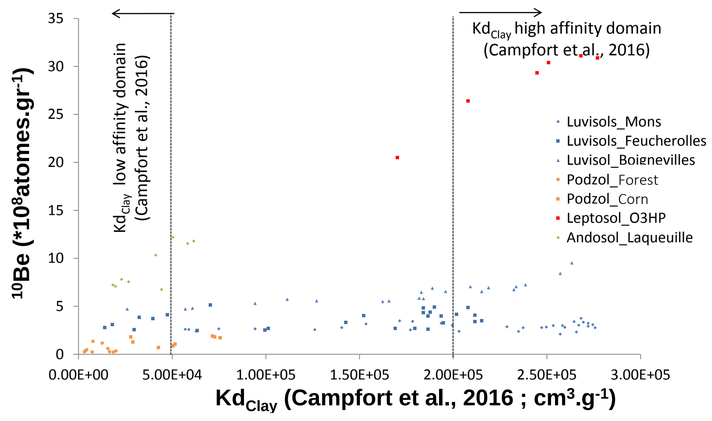
## INTRODUCTION

Vertical matter transfer processes in soils and their dynamics are up to now poorly constrained although they are responsible for the temporal evolution of the ecosystem services of the soils through the redistribution of most of their components with depth, especially the finest ones responsible for the main properties of soil surface layers. In order to better constrain and quantify these processes, we developed a kinetic quantification of the involved transfers based on vertical profiles of $^{210}Pb$, $^{10}Be$, $^{137}Cs$ and C isotopes in Luvisols. All these elements penetrate the soil system through its surface and are known to be poorly soluble under certain physicochemical conditions (low organic carbon (OC) content and neutral to basic pH, both conditions encountered in Luvisols) for which the elements are retained on the clay particles. Along the studied Luvisols, vertical profiles of these isotopes were fitted by a single advection - diffusion equation, demonstrating (i) that their soluble transfer could be neglected under the encountered pedological conditions, and (ii) the potentiality of the approach to trace vertical particle transfers in soils. The range of applicability of this type of approach was nevertheless not tested. In this work, we analyzed $^{210}Pb$, $^{10}Be$, $^{137}Cs$ in soils exhibiting organic matter, pH and less than 2 µm fraction gradients (Podzol, and Andosol Ferralsol). Acidic soils and large organic matter contents were considered.

## ISOTOPES DEPTH DISTRIBTION




## IMPACT OF SOIL CHARACTERISTICS

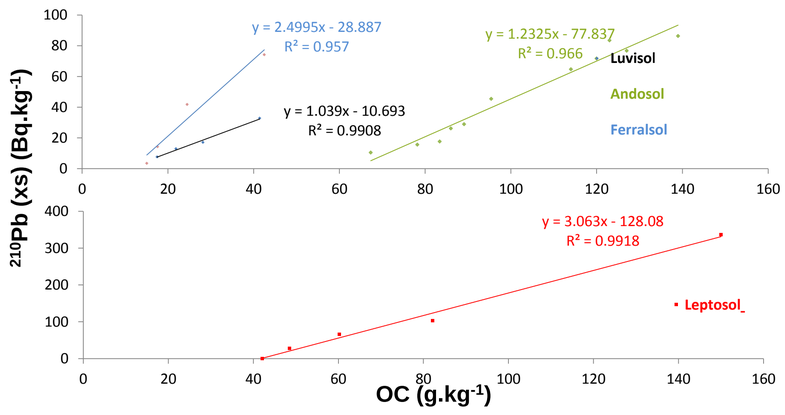



Concentrations in $^{10}Be$ as a function of the $Kd_{<2µm}$ (Campfort et al., 2016) obtained using the following equation:

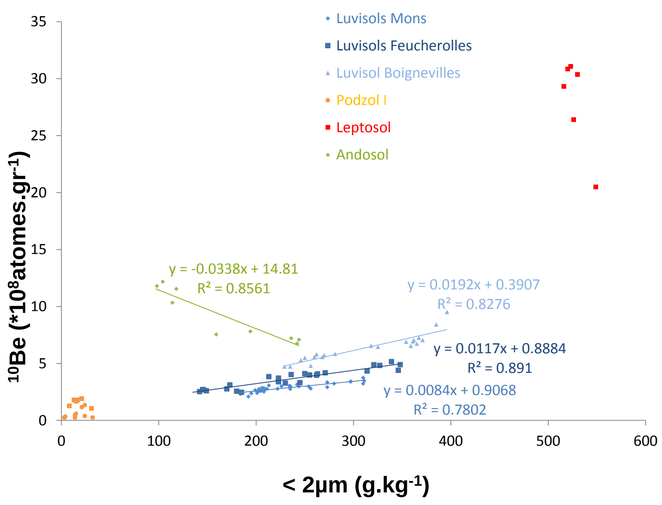
$Kd_{Clay}=10a/(1+\exp^{(-(b1+(b2*pH)))})$

with a=5.82 ; b1=-1.82 ; b2= 0.55.

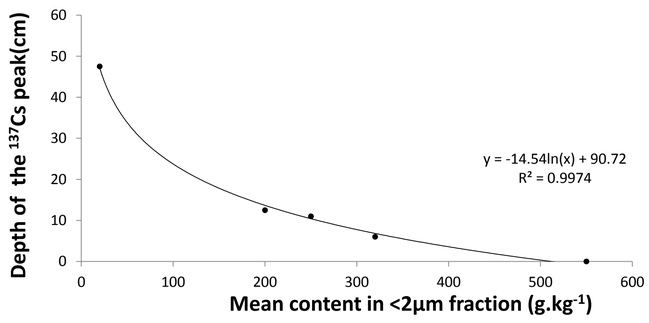
While $^{10}Be$ affinity for < 2 µm fraction is low in Podzol and Andosol, it is high in the Leptosol and intermediary in Luvisols.




$^{210}Pb$ (xs) activities are a function of the organic carbon in most of the considered soils




$^{10}Be$ concentrations are correlated to the < 2µm fraction in Luvisols, are anti-correlated to that fraction in Andosol and unrelated to that fraction in Podzol and Leptosol.




Depth of the $^{137}Cs$ peak is a function of the mean < 2 µm concentration

## CONCLUSION

This demonstrates that $^{10}Be$ and $^{137}Cs$ losses occur under soluble form in Podzol, especially those developed under more acidic forest cover. Soluble $^{10}Be$ transfers are also evidenced in Andosol while they can be considered as negligible in Leptosol. For $^{210}Pb$ (xs), soluble transfers are also probable for soils with pH less than 5.5 (Andosol and Ferralsol) and strong affinity for organic matter has been demonstrated. Thus, under acidic conditions and low < 2 µm fraction, soluble transfer cannot be neglected anymore.

**Reference**: Campforts, B., et al., 2016. *Earth and Planetary Science letters 439, 143-157.*

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