Ecodynamics of trace metals in assisted phytoextracted contaminated soils

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Introduction

Many domestic, industrial and agricultural activities result in soil contamination by trace metals(Adriano,2001).The methodological guide of the French Geological Survey (BRGM) has reported the lack of knowledge on metal(loid)s in soils. Total metal(loid) concentrations in soils establish the hazard source but delivers little information on the risks. Moreover the physico-chemical analysis is not enough to evaluate the toxicity of soils on living organisms . In contrast the simultaneous investigation of the ecodynamic of trace metals and their ecotoxicological effects on an instrumented site shows several advantages. Additionally the characterisation of the ecotoxicological impact(s) by biotests representative of the various organisation levels of the ecosystems is a complementary step in the environmental risk assessment.Several investigations were performed to assess the (im)mobilisation mechanisms of metal(loid)s in CCA contaminated soils and the effects of the mineral and/or organic amendments and phytoextraction strategies.

Material and methods

The studied site is located in South-western France, Gironde County (44°43'N; 0°30'O). This site has been contaminated with high concentrations of CCA (Cu,Co,As). The site is divided into five pieces depending on the increasing of the concentration of Cu contamination in topsoils. One kilo of soil from each sub plot was put in the pots. Grains of dwarf beans (Phaseolus vulgaris L. cv vroege Limburgs) were sown in all pots and cultivated (18 days) under controlled conditions. Then the moisture of soil was raised to 80% at the beginning of germination stage of grains. In the end of the period the plants were harvested and biometrical parameters, i.e. fresh weight (FW) of roots, shoots and primary leaves, and leaf surface area, were determined together with the leave dry weigth. The solution of soil was extracted by Rhizons and DGT (diffusive gardients in thin films) were deplyed for 24h in the soils to assess the remobilsiation of trace metals.

Results and conclusion

Results suggested that plant extractable amounts of Cu are increased by the incorporation of organic and mineral amendments in the soils. Additionaly both the organic compost and addition of dolomite provide a mechanism for metal retention in the soil.

[1] Adriano, D.C., 2001. *Trace elements in terrestrial environments: biogeochemistry, bioavailabilityand risks of metals. 2nd Springer-Verlag, New York, Berlin, Heidelberg*

North Atlantic's hold on the Earth's asymmetric climate

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Modern climate is characterized by a strong bias in temperature toward the northern hemisphere, a feature that has been described as the result of Atlantic Ocean circulation and/or the concentration of continental area north of the equator. Sediments from the Cariaco Basin off Venezuela and the northeastern Arabian Sea record this asymmetry, which manifests itself in the position and strength of the Intertropical Convergence Zone (ITCZ) over the Cariaco Basin and in summer monsoon strength over the Arabian Sea. New sediment core records of unprecedented temporal resolution indicate an unbroken correspondence between warm climate conditions over Greenland, a northerly position of the Atlantic ITCZ, and a strong Indian summer monsoon over the last 110,000 years. Given that Greenland temperature changes cannot be explained by insolation changes or by the lower latitude forcings, the tight coupling among records can only be explained by a dominant role of the North Atlantic in the hemispheric asymmetry of climate. The abruptness of the Cariaco Basin and Arabian Sea changes requires fast communication from the North Atlantic via the atmosphere.

Over millennia, the maintenance of North Atlantic conditions and their influence on global climate points to an underlying control of the Atlantic Meridional Overturning Circulation (AMOC) associated with Heinrich events. However, it apparently cannot explain some of the climate structure of the Dansgaard-Oeschger cycles: Heinrich events populate only a fraction of the cold stadials, and they occur at the end – not the beginning – of those stadials. Our new sediment records indicate that, during peak stadials, a southward shift in the trade winds caused the boreal summertime ITCZ to remain south of the Cariaco. This ITCZ shift would have reduced summertime equatorial Atlantic upwelling, reducing ocean heat transport to the North Atlantic. This positive feedback between subpolar North Atlantic cooling and ITCZ position represents a mechanism for Dansgaard-Oeschger cycles that complements AMOC changes.