Geophysical Research Abstracts
Vol. 16, EGU2014-13208, 2014
EGU General Assembly 2014

Metal homeostasis in the foliose lichen Peltigera aphthosa from the northern hemisphere

Romain Darnajoux (1), Jolanta Miadlikowska (2), Francois Lutzoni (2), and Jean-Philippe Bellenger (1)

(1) Département de chimie, Université de Sherbrooke, 2500 Boul. de l'Université, Sherbrooke, Québec J1K 2R1, Canada (jean-philippe.bellenger@Usherbrooke.ca), (2) Department of biology, Duke University, 125 Science Drive Durham, North Carolina, United States of America

Lichens are critical contributors to the biogeochemical cycling of carbon (C) and nitrogen (N) in high latitude ecosystems (boreal and polar). While, lichens have been intensively used as biomonitors for metal depositions, metal acquisition and homeostasis in lichens remains mostly uncharacterized. Lichens are symbioses between two to three different organisms each of them with specific and distinct requirements with regards to metals. For instance the trimembered lichen Peltigera aphthosa, an ubiquitous cyanolichen in boreal ecosystems, is constituted of organisms from three different kingdoms of life (a fungus, an algae and a cyanobacterium) with distinct metabolisms; the fungal part is heterotroph to C and N while the alga undergoes photosynthesis and the cyanobacterium is able to fix atmospheric dinitrogen. Moreover, each organism might achieve different tolerances to specific metals, leading to different sensibilities within the symbiosis to metal contaminations. How and to what extend lichens control the acquisition and allocation of metals to the different symbionts in order to optimise symbiosis function remains mostly unknown.

Here, we present the result of an extensive study on the characterization of metal homeostasis in P. aphthosa. We collected specimens over 5 area of the northern hemisphere characterized by different metal expositions (Alaska, Alberta, Quebec, Sweden, and Russia). Using separation techniques and mass spectrometry (ICP-MS) we determined metal contents in the whole thallus and in each symbiont. We analyzed a wide array of metals including essential (Fe, Mg, Mn, Ni, Cu, Mo, P, Co, Zn), neutral (Al, Ti) and toxic metals (Cd, Pb, V). Data were then processed using multivariate statistical analysis.

Our results show that the allocation and concentration of most metals in the different symbionts is tightly regulated and is consistent with the biological requirement or toxicity of the metals to each partner. This is particularly true for essential metals such as molybdenum, the metal cofactor of the nitrogenase. The mechanisms allowing P. aphthosa to tightly control metal homeostasis (concentration and distribution within partners) remains to be characterized. Lichens offer an interesting model for the study of metal acquisition within symbiosis.