



USER MEETING 2016

24-25 NOVEMBER

National Centre for Synchrotron Science



Ansto

Australian
Synchrotron

Contribution ID: 236

Type: Oral

Multi-technique investigations of nickel hyperaccumulator plant ecophysiology

Thursday, 24 November 2016 11:00 (15 minutes)

Our team, together with international collaborators, has been studying plants that hyperaccumulate trace elements, especially nickel, from various ecosystems around the world. The aim of these investigations has been to advance our understanding of the ecophysiology of these unusual plants.

We have employed a range of micro-analytical methods to reveal the in situ distribution, biogeochemical pathways and chemical speciation of nickel and other elements. Elucidating the cellular and tissue-level distribution of trace element ions is inherently challenging due to the limitations of all analytical techniques. Therefore, we have combined the strengths of different techniques to interpret physiological processes in hyperaccumulator plants. Synchrotron X-ray Fluorescence Microscopy (XFM), micro Proton-Induced X-ray Emission (PIXE) and Scanning Electron Microscopy-Energy Dispersive X-ray Spectroscopy (SEM-EDS) have been used to map elemental distribution at the tissue-level and also at the sub-cellular level. X-ray Absorption Spectroscopy (XAS) has been used to reveal the chemical speciation of nickel and cobalt in intact plant tissues. The use of bright-field microscopy as well as SEM is essential for visualizing underlying anatomical features of the plant material being studied. Optionally, laser confocal microscopy in combination with selective fluorescent probes can assist to map trace element ions. Critical to the use of all aforementioned methods is appropriate sample preparation. The use of samples in frozen-hydrated state is preferred to minimize the effects of radiation-damage and movement of the sample during measurement. Therefore samples for XFM, PIXE and cryoSEM are rapidly frozen either using liquid propane or a metal mirror technique to affect water in vitreous state (direct freezing in LN2 is not suitable due to the Leidenfrost Effect). The use of a small LN2 cryoshipper enables collection of samples directly in the native habitat in the field. If not measured in frozen-hydrated state, then freeze-drying is suitable for measuring/mapping elemental concentrations providing the freeze-drying protocol is undertaken at a low temperature (starting <100°C) and with a long duration to limit sample shrinkage and morphological variations.

This presentation will demonstrate how combining multiple analytical techniques has shed light on the ecophysiology of nickel hyperaccumulator plants.

Are you a student?

No

Do you wish to take part in the Student Poster Slam?

No

Are you an ECR? (<5 yrs since PhD/Masters)

Yes

What is your gender?

Male

Primary author: Dr VAN DER ENT, Antony (The University of Queensland, Australia)

Co-authors: Dr BARNABAS, Alban (iThemba LABS, South Africa); Prof. ECHEVARRIA, Guillaume (Université de Lorraine, France); Prof. HARRIS, Hugh (The University of Adelaide, Australia); Dr MESJASZ-PRZYBYLOWICZ, Jolanta (iThemba LABS, Australia); Dr DE JONGE, Martin (Australian Synchrotron, Australia); Dr ERSKINE, Peter (The University of Queensland, Australia); Dr MAK, Rachel (University of Sydney, Australia); Dr PRZYBYLOWICZ, Wojciech (iThemba LABS, South Africa)

Presenter: Dr VAN DER ENT, Antony (The University of Queensland, Australia)

Session Classification: Concurrent Sessions 1: Biological Systems

Track Classification: Biological Systems