"Green remediation" : finding phytoremediating plants in derelict base metal mines

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OBJECTIVE

This study will find plants that allow effective, low-cost, environmentally friendly and sustainable treatment of sites contaminated with a range of metals and metalloids.

INTRODUCTION

Phytoremediation (extraction and stabilization) is a cost effective, environmentally friendly technology that can play a vital role in reducing soil erosion, contaminant dispersal and restoring the ecology at mined or industrial contaminated sites. "***Phytoextractors***", plants that extract and accumulate contaminants, can be used to remove contaminants for safe disposal elsewhere. "***Phytoexcluders***" do not take up metals so instead can be used to safely restore a stable surface to contaminated sites, preventing wind and soil erosion.

Phytoremediation is an alternative management strategy for contaminated site remediation. A further advantage of phytoremediation with native plants is that habitat is also provided for birds, insects and other animals concurrently with remediation outcomes.

Australia hosts thousands of old, derelict mines with surface contamination by metals such as copper and cadmium, and metalloids such as arsenic. These sites are natural experiments, where it is possible to prospect for phytoremediating plants. This research consists of three steps.

Step 1: Measure the composition of soil and plants at derelict base metal mines, using a combination of X-ray fluorescence spectrometry and laser induced breakdown spectroscopy.

Step 2: Use desktop Scanning Electron Microscope to find where ***accumulating*** plants store metals and metalloids.

Step 3: Use functional relationships and genetics to try to understand why ***accumulating*** plants store metals where they do, and why ***excluding*** plants are able to prevent the uptake of metals and metalloids.

METHODS

Step 1: Visit a range of base metal mines in NSW and sample and measure soils and plants using handheld XRF and LIBS instruments.

Burraga (copper)

Conrad (silver lead zinc arsenic)

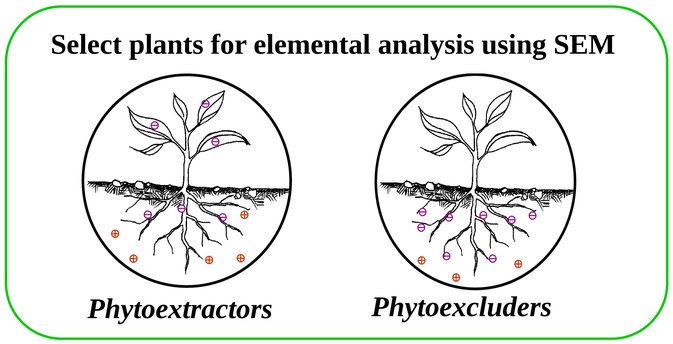
Sunny Corner (silver lead)

Phoenix (tungsten)

Figure 1. Selected mining sites in New South Wales (NSW)

Step 2: Analyze plants in detail using the ***Phenom ProX desktop Scanning Electron Microscope*** from ***ATA Scientific***.
The ***fast loading cycle*** and ***rapid scan times*** mean that many more species of plants can be audited, and the ***EDS*** allows quantification of critical elements including V, Cr, Co, Cu, Zn, As, Cd, Sn, Sb, Pb and Bi.

The innovative ***charge reduction sample holder*** will allow rapid processing of plant samples without coating, allowing further biological study of plant parts identified to be accumulating metals or metalloids.



Phenom ProX desktop SEM
http://www.atascientific.com.au/desktop-scanning-electron-microscope/phenom-desktop-sem.html

Figure 2. Schematic of phytoextraction and phytostabilisation (Left) with the Phenom ProX desktop SEM ((Right) for detail analysis

EXPECTED OUTCOMES

This research will;

- Find native plants for environmentally friendly phytoremediation, either through phytoextraction or phytoexclusion.

If supported;

- The research will be widely publicised as exemplar of the type of work the Phenom ProX can achieve, with ATA Scientific's support.

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