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Polymetallic phytomining of mine tailings from Queensland

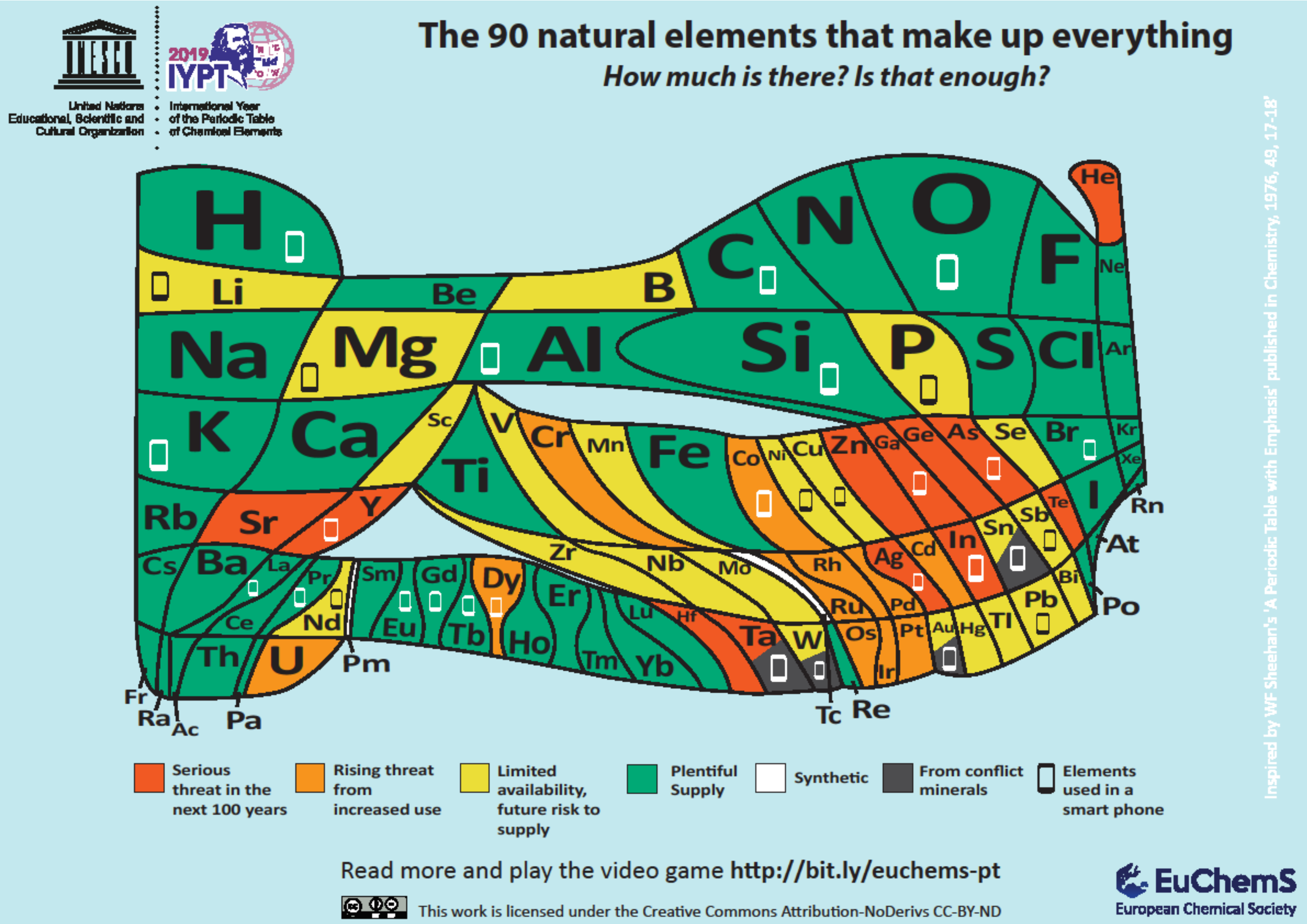
Philip Nkrumah, Antony van der Ent, Peter Erskine (CMLR)

James Vaughan (School of Chemical Engineering)

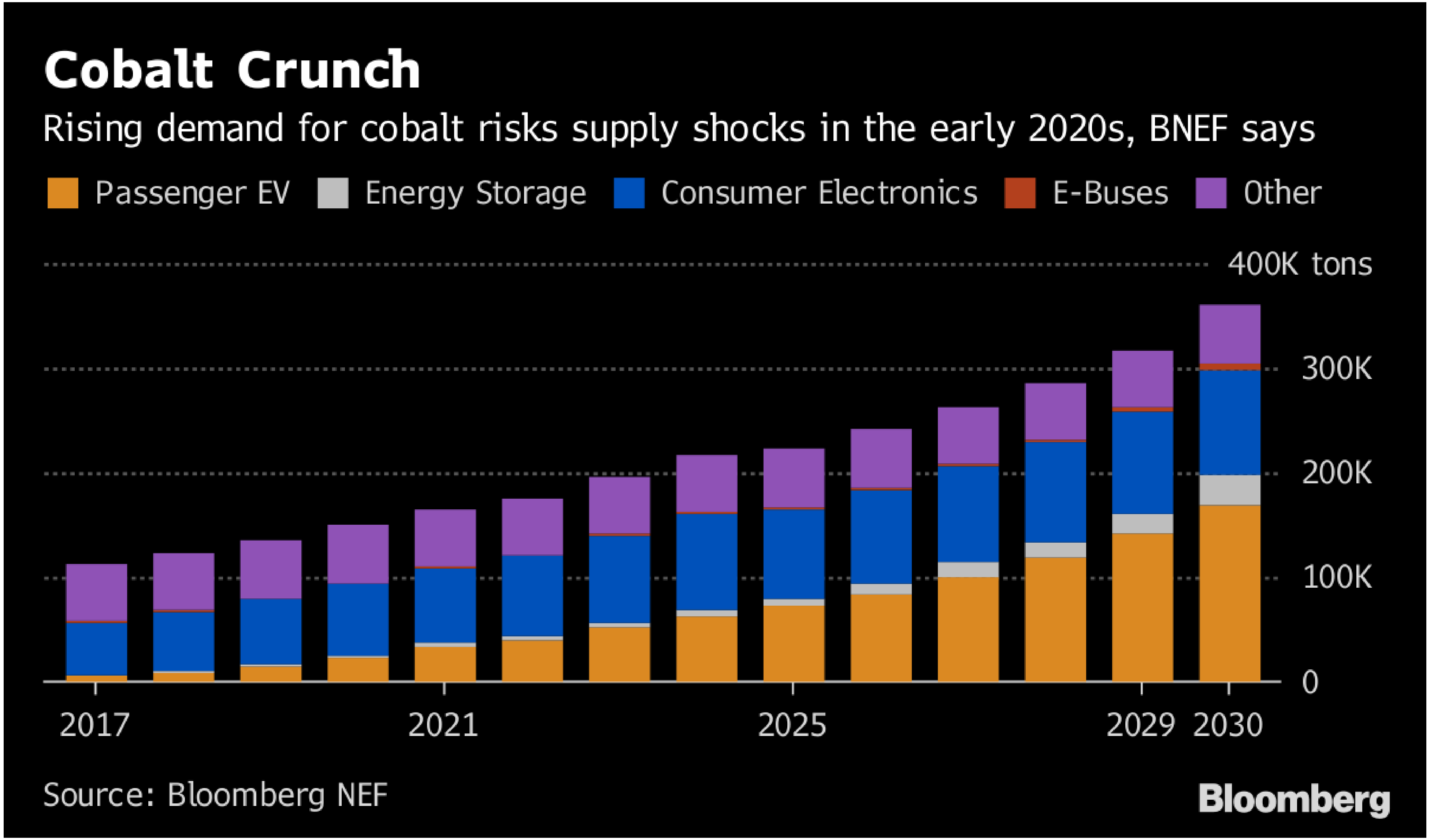
Eleonore Lebre (CSRM, CMLR)

Demand for critical metals

The demand for critical metals is increasing at escalating rates

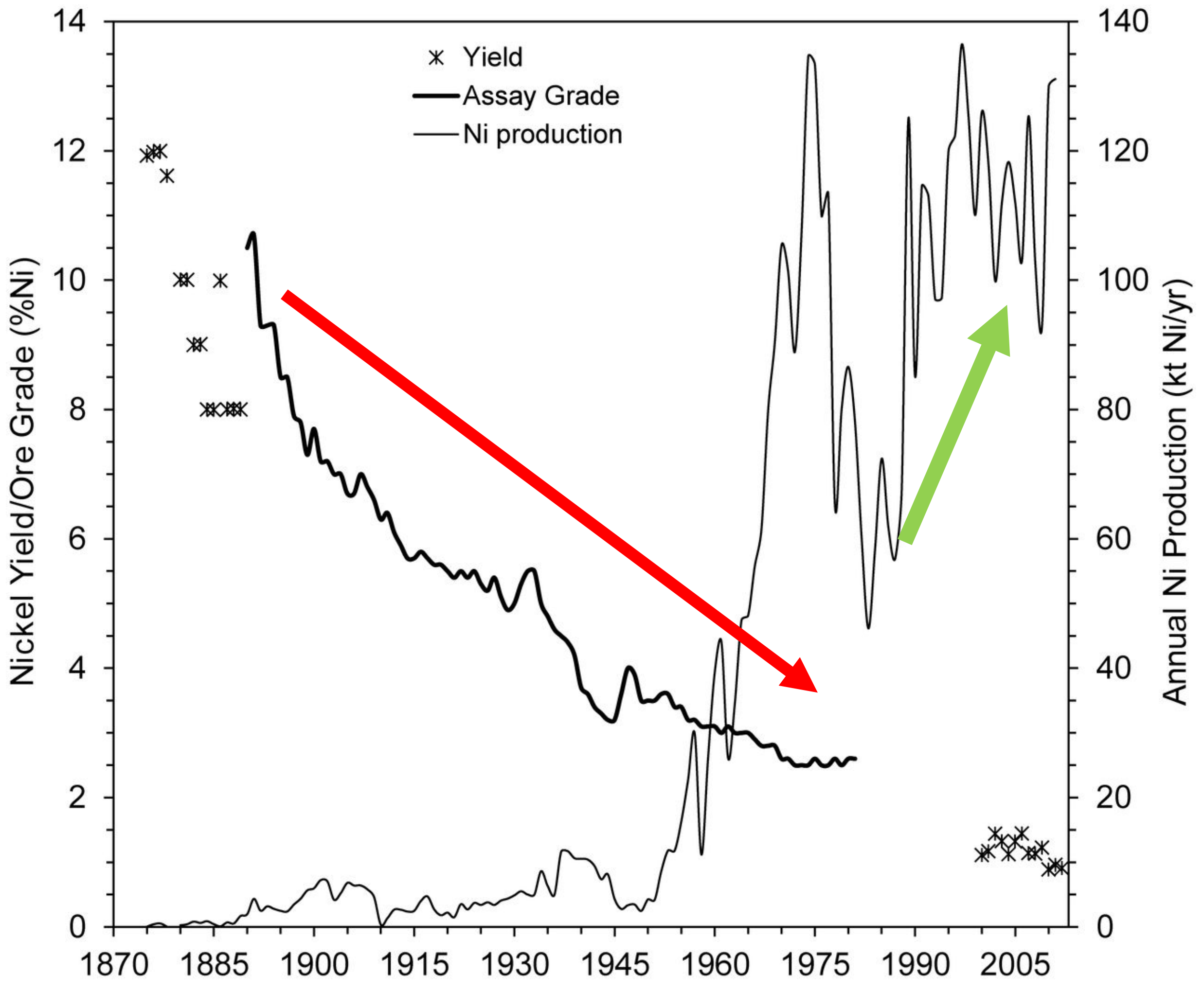


Demand for critical metals



Declining ore-grades

The rapid declining ore-grades challenges conventional mining methods and generates more waste material than ever before



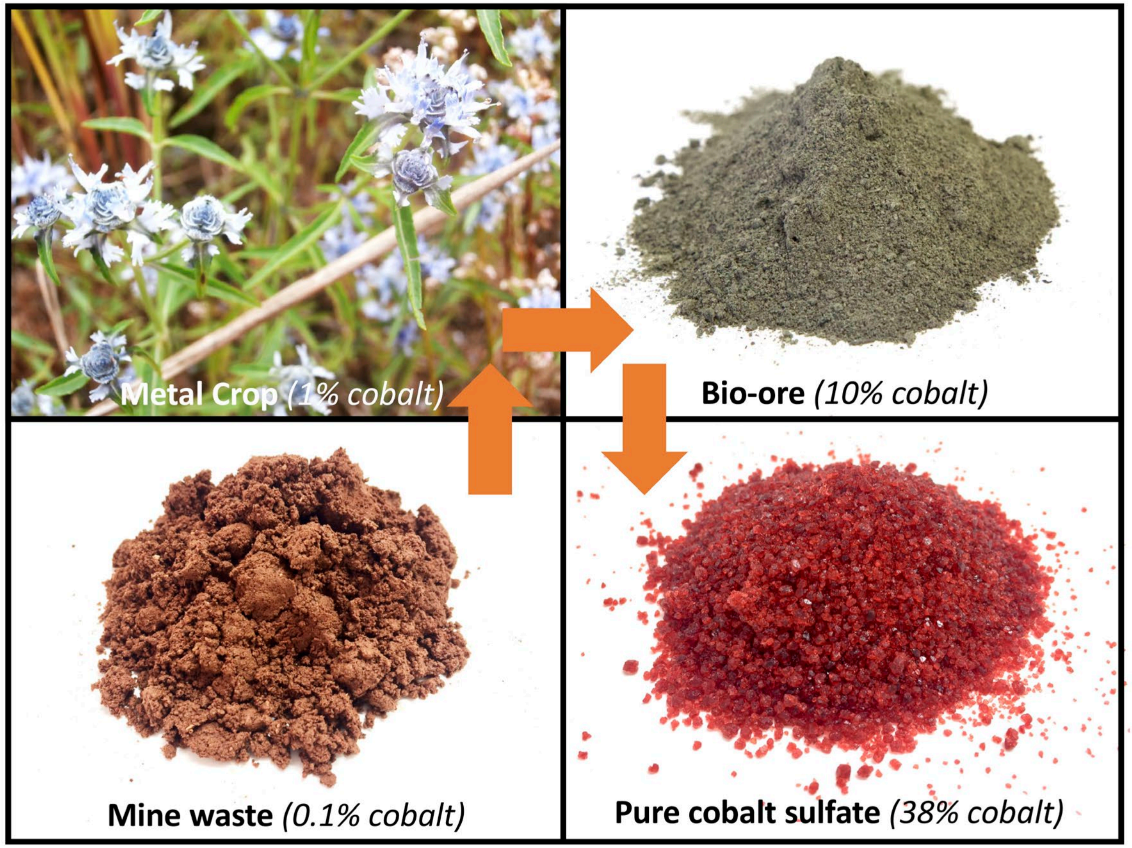
Hyperaccumulator plants

Hyperaccumulators are plants that have the remarkable ability to tolerate and accumulate exceptional concentrations of specific metallic and metalloid elements in their shoots

Phytomining

Phytomining operations cultivate hyperaccumulator plants on metal-rich soils, followed by:

- *Harvesting the biomass*
- *Incineration to produce a high-grade 'bio-ore'*
- *Recovery of targeted metals or pure salts*



Economics of phytomining

Phytomining at field-scale

Composition (mg kg^{-1}) of base metal mine tailings from Central Queensland

Site	Cobalt	Zinc	Thallium	Arsenic	Cadmium
Mt Isa	1960	10 200	75	1350	40
Dugald River	35	22 000	30	350	50

- Is there a possibility of using a variety of hyperaccumulator plant species of different elements in polymetallic mining from mine tailings?
- What cropping system will maximise metal uptake?
- How does the polymetallic nature of substrates and eventual bio-ore affect the recovery process?
- How does polymetallic phytomining fit into the circular economy concept?

Model species

A) *Haumaniastrum robertii* **(Cobalt: 15 000 mg kg^{-1})**

B) *Noccaea caerulescens* **(Zinc: 25 000 mg kg^{-1}; Cadmium: 1000 mg kg^{-1})**

C) *Biscutella laevigata* **(Thallium: 15 000 mg kg^{-1})**

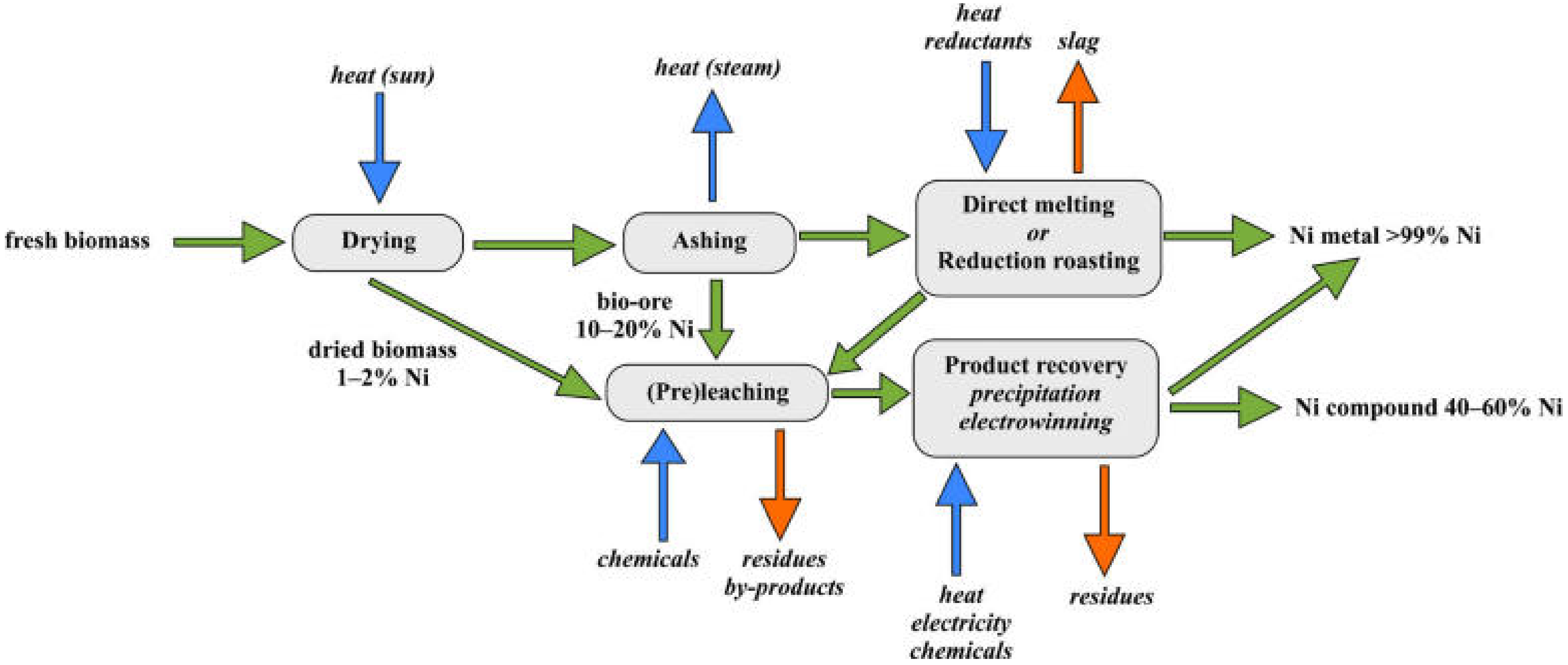
D) *Pityrogramma calomelanos* **(Arsenic: 9000 mg kg^{-1})**

Experimental work

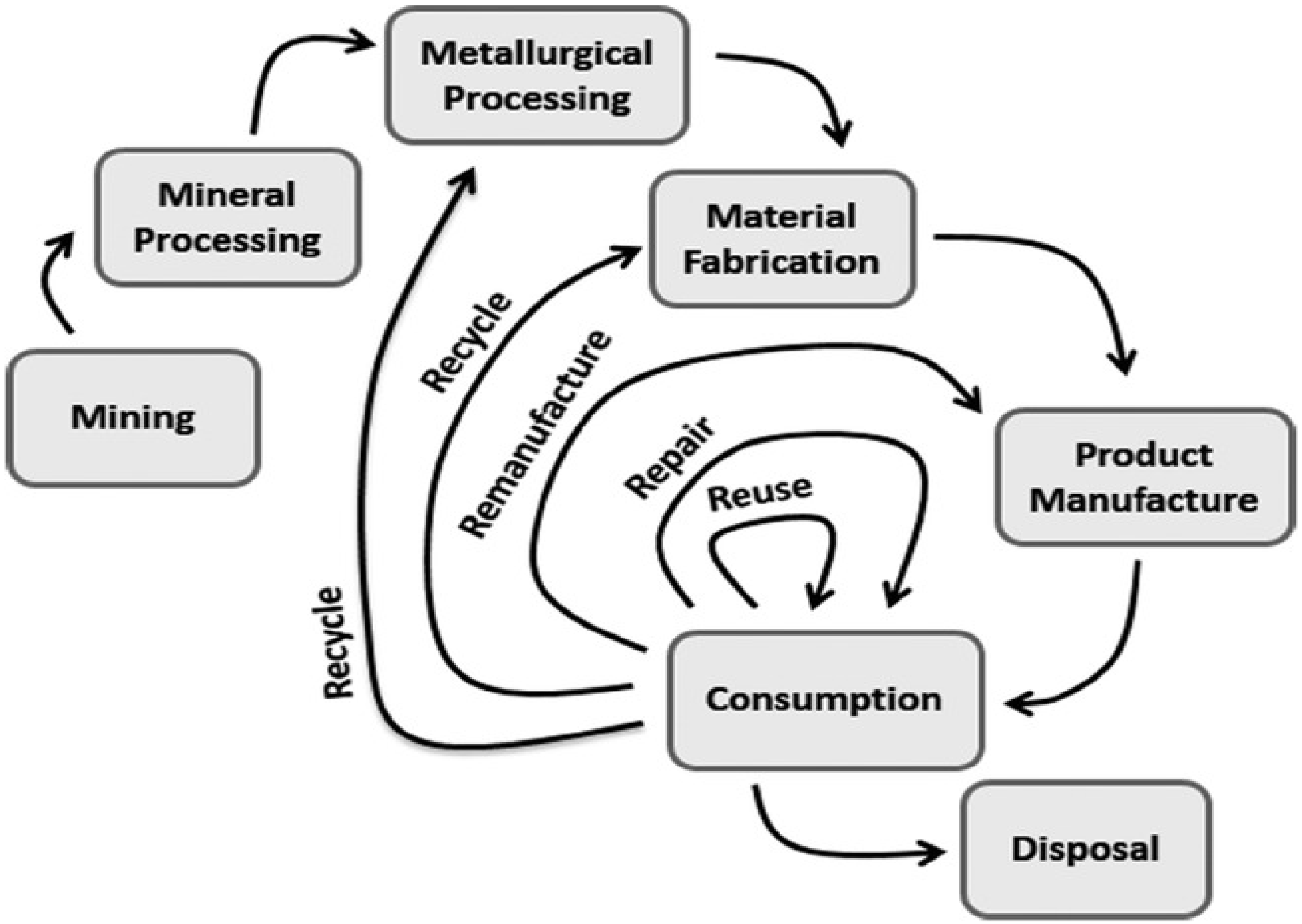
Assess growth performance and elemental uptake in the selected species

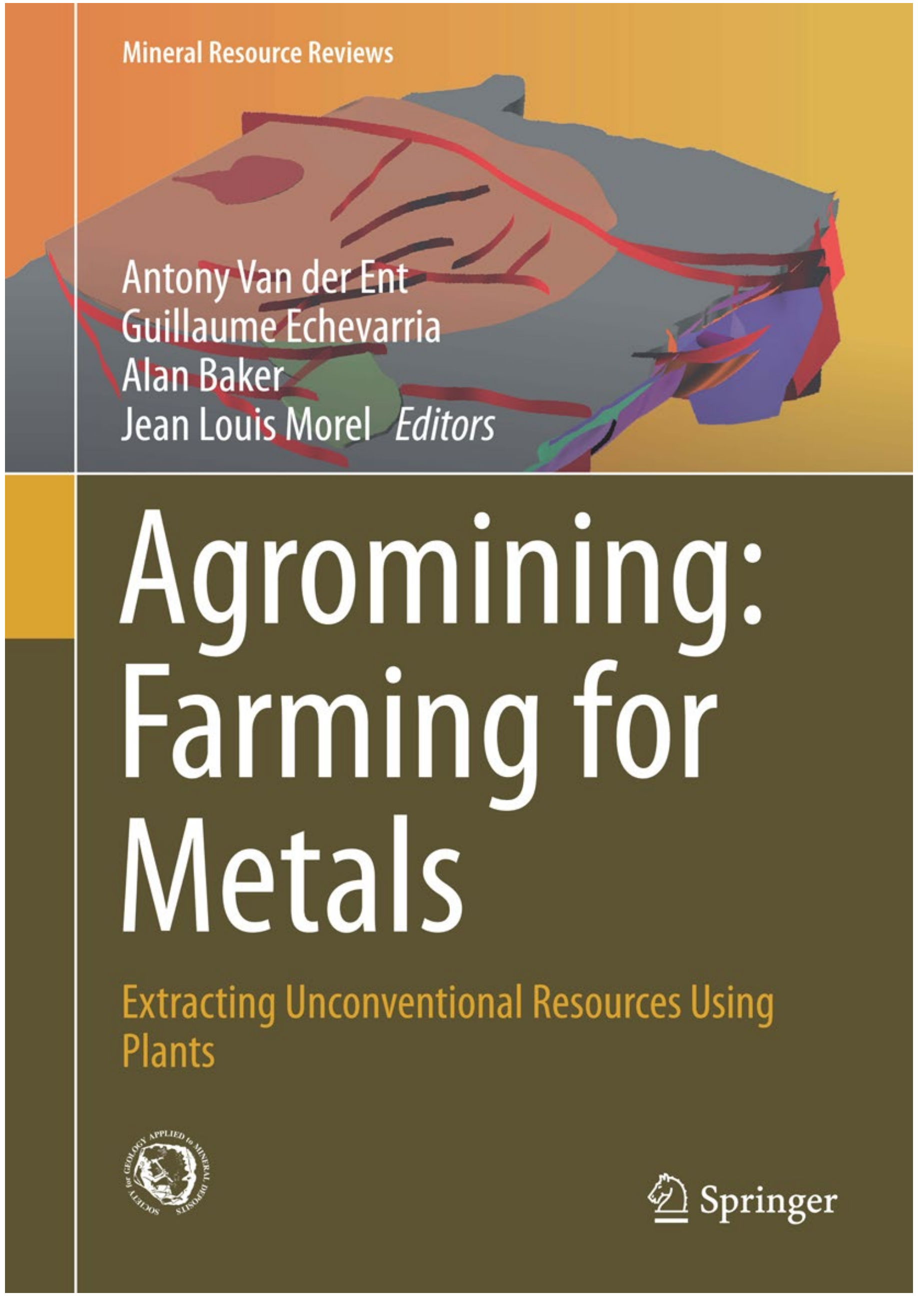
Experimental work

Test recovery processes of the metals from the harvested biomass



Develop a conceptual framework on the role of polymetallic phytomining in a circular economy




Mineral Resource Reviews
Antony Van der Ent
Guillaume Echevarria
Alan Baker
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Agromining: Farming for Metals
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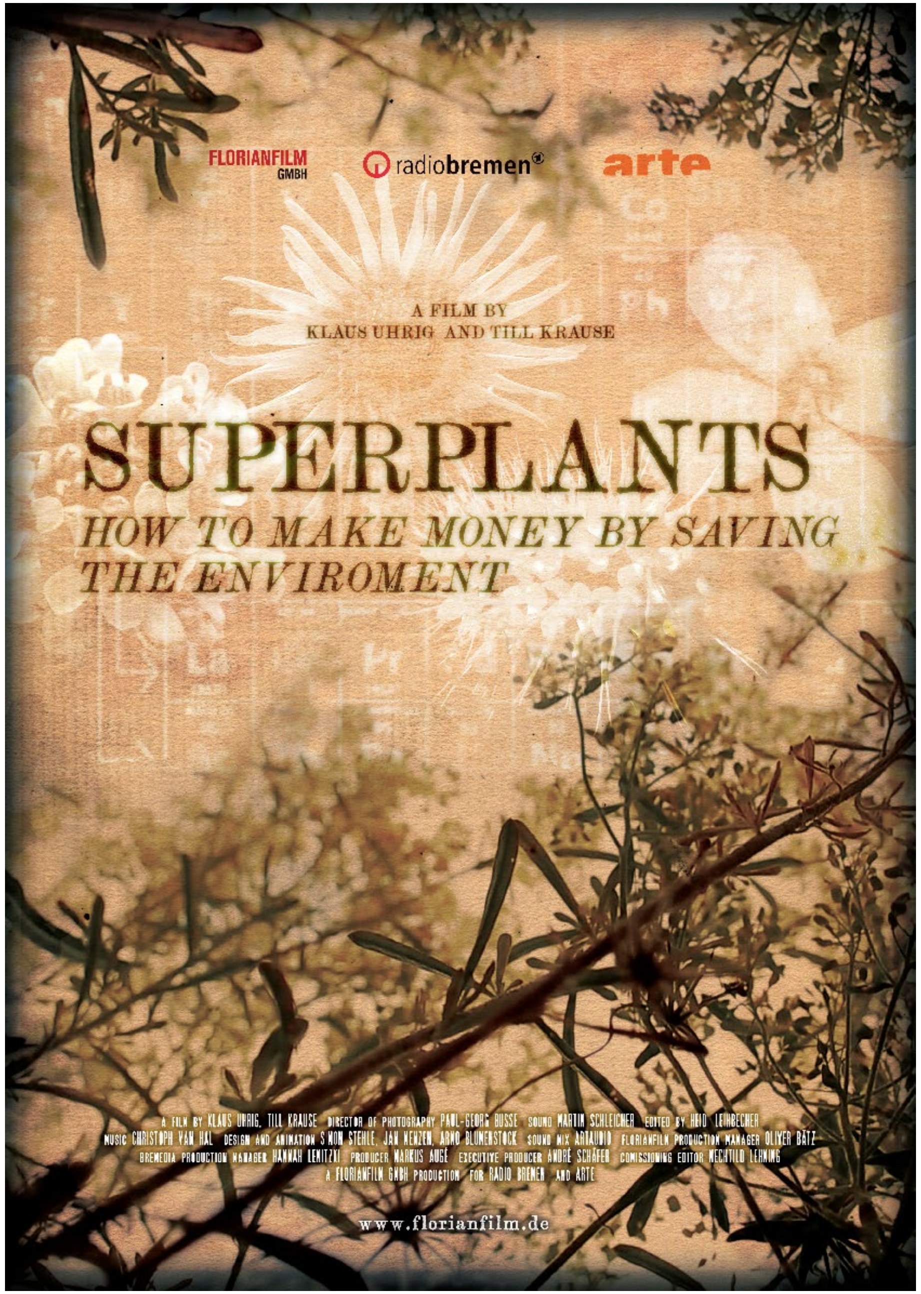
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Thank you

Dr Philip Nkrumah | Postdoctoral Research Fellow
Centre for Mined Land Rehabilitation
p.nkrumah@uq.edu.au