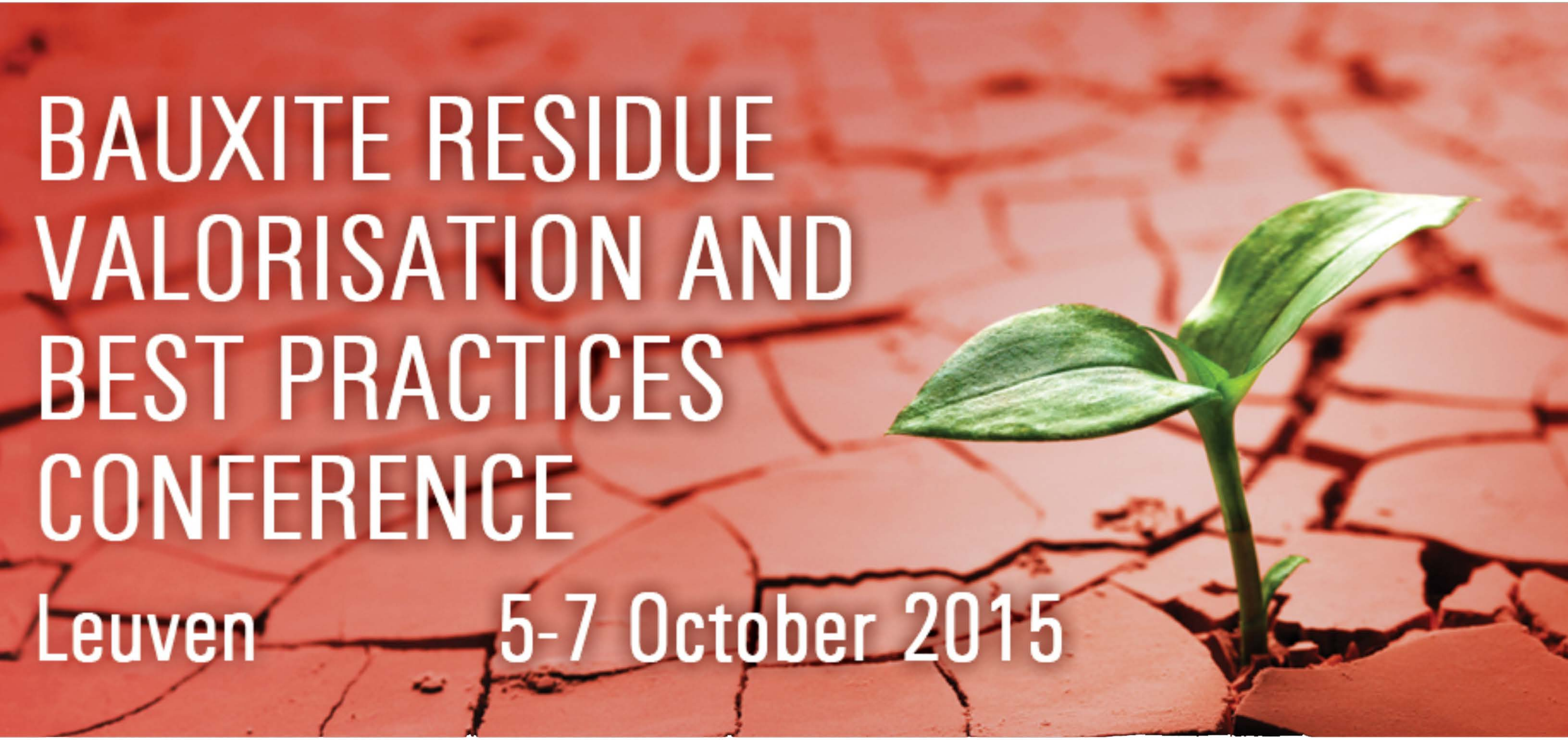
BAUXITE RESIDUE
VALORISATION AND
BEST PRACTICES
CONFERENCE
Leuven
5-7 October 2015

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MATERIALS & SURFACE SCIENCE INSTITUTE

Neutralisation, revegetation and beyond: An overview of a decade of bauxite residue research

R. Courtney

Department of Life Sciences, University of Limerick, Ireland
Materials and Surface Science Institute, University of Limerick, Ireland

Neutralisation, revegetation and beyond:
An overview of a decade of bauxite residue research

Bauxite residue

- \> 3 billion tonnes & growing
- Reuse & Recovery
  - <2% of residues re-used or further processed (Panov et al 2012)
- BRDA areas
  - Some several 100 hectares
- Problems / Issues
  - Land area
  - Risks

Why (re)vegetate?

- Offers a basis for
  - Stabilisation
  - Landscaping
  - Pollution control

- Cover with topsoil
  - Expensive method
  - Shortage of topsoil supply

Direct (re)vegetation

- Identify constraints
  - (and then correct)

- Amend residue
- Sow

What are the issues?

Bauxite residue

- High pH on fresh bauxite residue
- High salinity
- High exchangeable Sodium Percentage (ESP)
- Lack of nutrients & organic matter
- Physical - fine fraction dominates
- Bulk density

Physical properties

Issue	Approach
compaction	rip/scarify
surface erosion	stabilize surface (mulch)
lack of aggregation	organic matter addition
waterlogging	drain

Chemical properties

Issue	Approach
High pH	acidifying agents
sodicity	gypsum addition
salinity	leaching
lack of nutrients / retention	organic matter addition

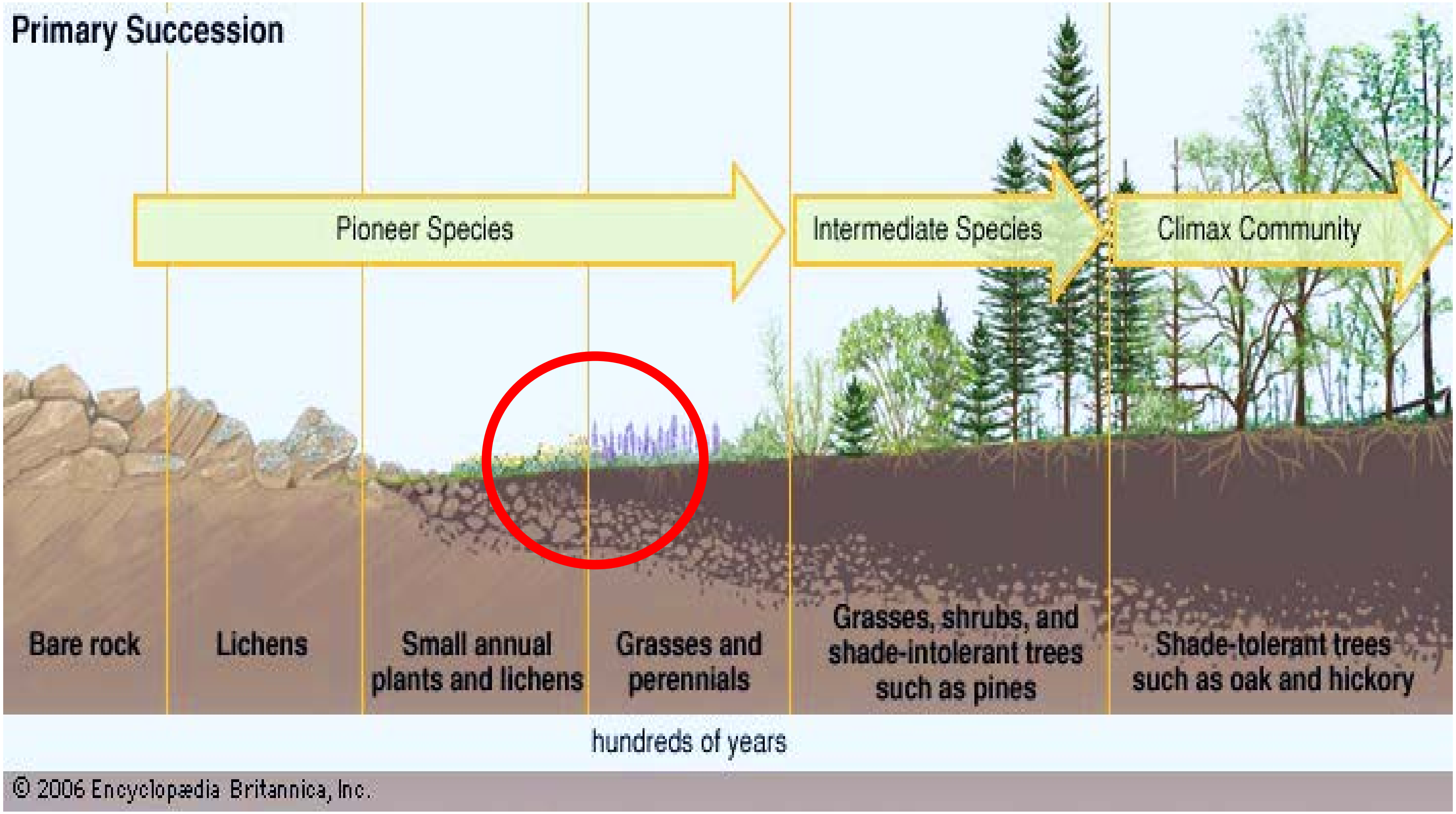
Biological properties

Issue	Approach
lack of microbial activity	add organic matter
lack of soil faunal activity	introduce
lack of ‘function’ – nutrient cycling, mineralization etc	functional biotic community

Appropriate Plant species

- Exotic or native vegetation?
  - grass/herbaceous or woody shrubs?
  - progression of vegetation?
  - nature of surrounding vegetation?
  - EPA requirements?
- Adapted to the climatic conditions of the site
- Tolerant to saline/sodic conditions
- Form a stable, long-lived community
- Self propagation essential

Grass growing is NOT revegetation



Metric or Criteria

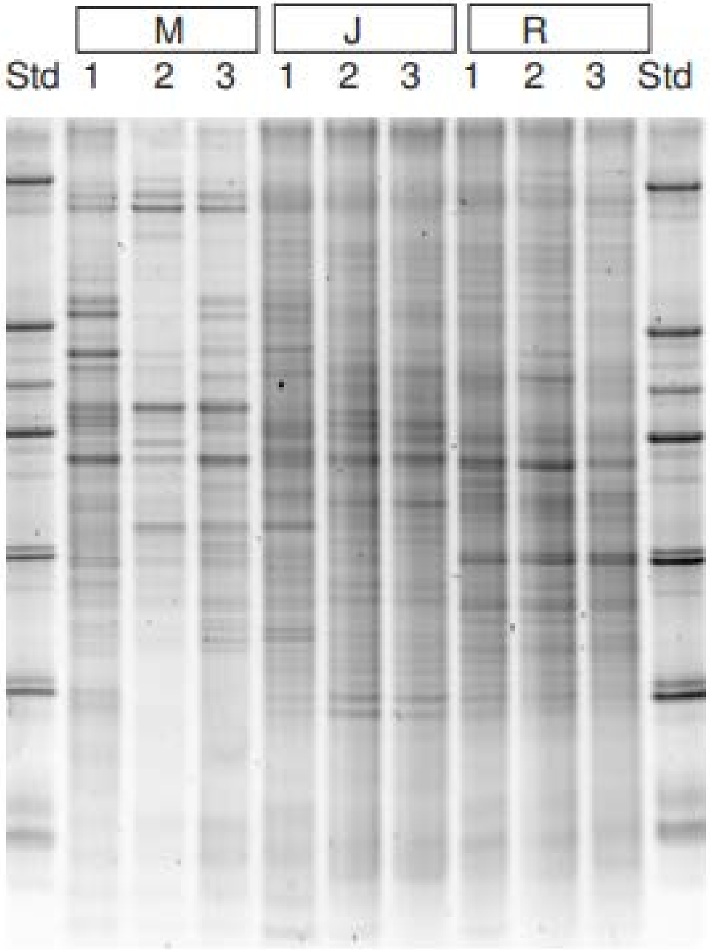
- Basic physico-chemical parameters
  - pH
  - Electrical Conductivity
  - Exchangeable Sodium Percentage
  - Bulk density

Plant Biodiversity

Soil biological activity

- Absence / presence and activity of key species

Residue DNA



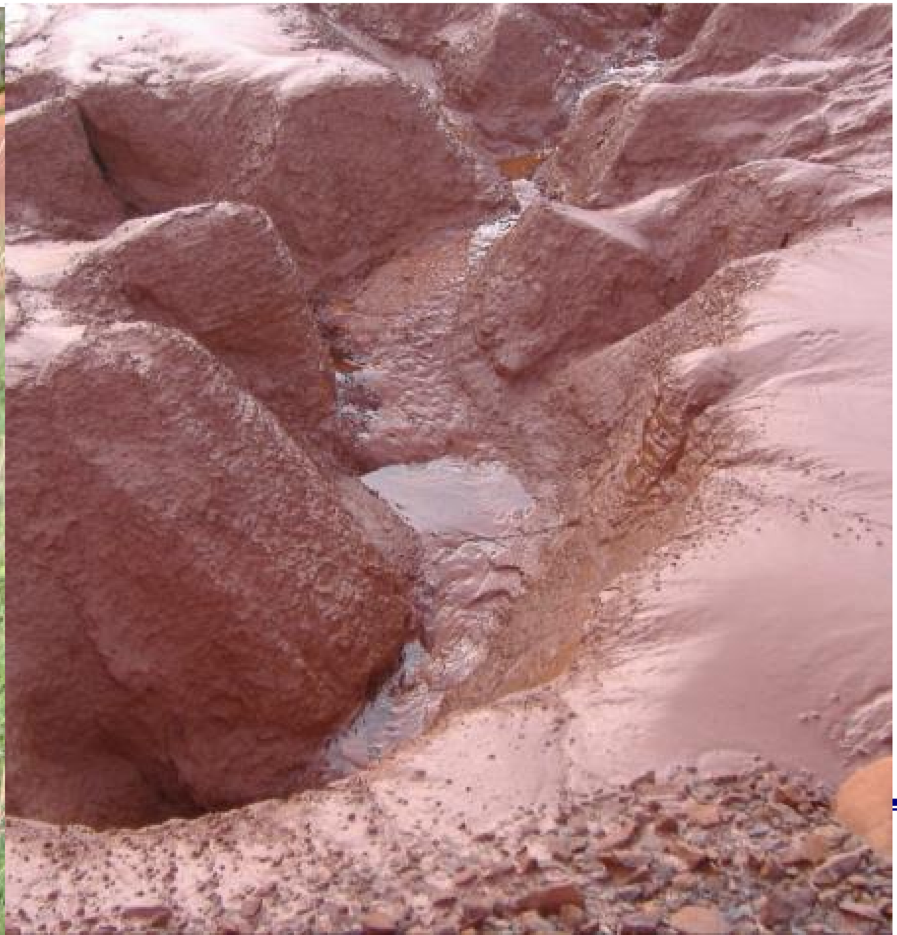
DGGE analysis of DNA product

bauxite residue site	*Acidobacteriaceae*/16S [% gene copy number]	standard deviation [±]	univariate analysis [P = 0.05]
M	0.29	0.31	A
J	13.55	3.98	B
R	15.85	5.01	B
S	15.11	7.98	B

PCR results of residue treatments and reference soil (S)

M, bare residue; J and R, restored residues

Soil attributes - function



Same revegetation strategy with different residue properties

- Multi-discipline approach
- Soil science, ecology, plant physiology etc

Conclusion & Challenges

- Residue is challenging but can be amended to create effective growth medium
- Is this soil?
  - Demonstrated soil function and processes
- Variation in bauxite residues
- Climatic / edaphic factors
- Prove Sustainability & Resilience
- Assess possible risks

Acknowledgments

- Rusal Aughinish RUSAL

- Dept of Life Sciences, University of Limerick

- Dr Ian Phillips, Alcoa, WA
- Prof R Haynes, University of Queensland
- Prof C Chen, Griffith University


Thank you