

CASE: Monetizing substantial lithium mineral deposits

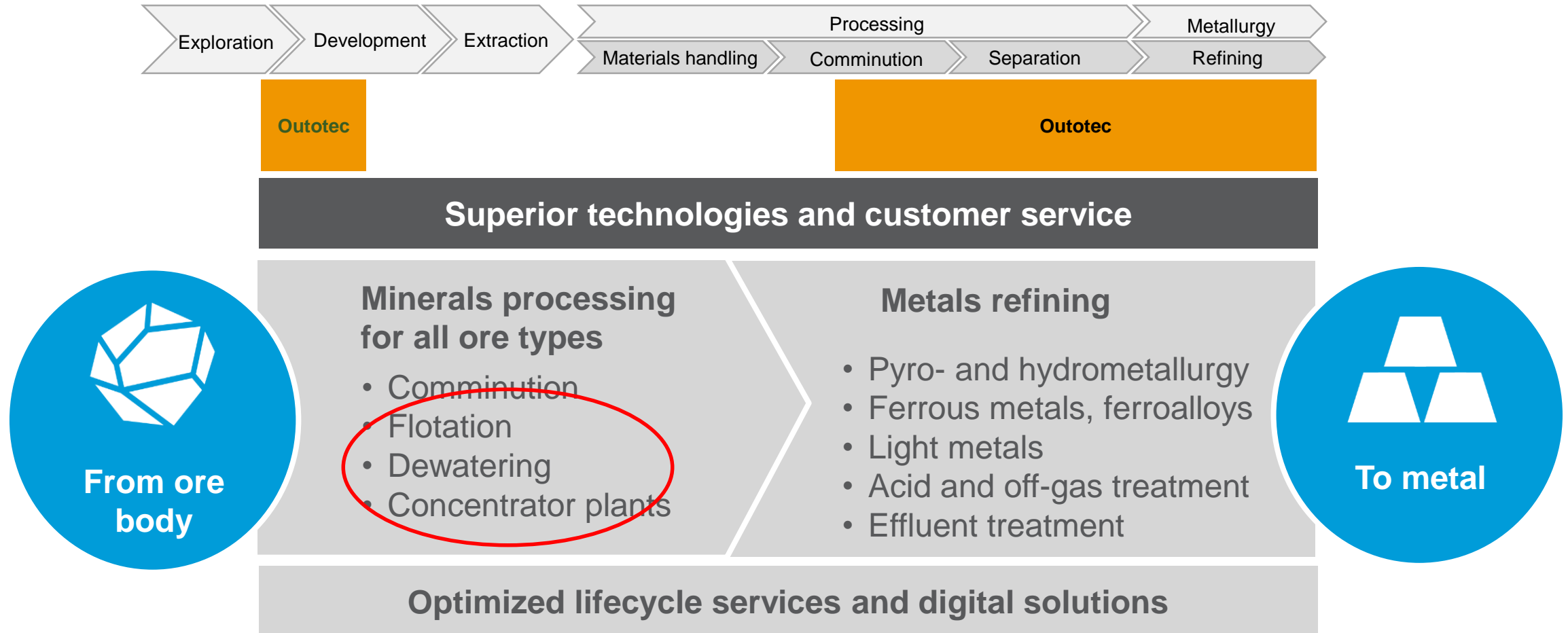
Outotec Capital Markets Day 2017

Kimmo Kontola, President – Minerals Processing

Outotec House – September 21



Our business on the value chain from ore to metal



Monetizing substantial lithium mineral deposits at AMG Mineração, Brazil

AMG

Advanced Metallurgical Group N.V.

- Produces aluminum master alloys and powders, titanium alloys and coatings, ferrovandium, natural graphite, chromium metal, antimony, tantalum, niobium and silicon metal

AMG Mineração S.A. (Brazil):

- Produces tantalum and tin concentrates
- In 2018 production for lithium carrying spodumene concentrate



Turnkey delivery of spodumene concentrator plant

- Engineering, procurement and construction (EPC) of the plant
- Proprietary equipment; grinding mill, high intensity magnetic separators, slurry conditioners, flotation cells, thickeners, PF filter, sophisticated process control with on-line automatic slurry analyzers

Substantial lithium mineral deposits residing in tailings ponds and stockpiles

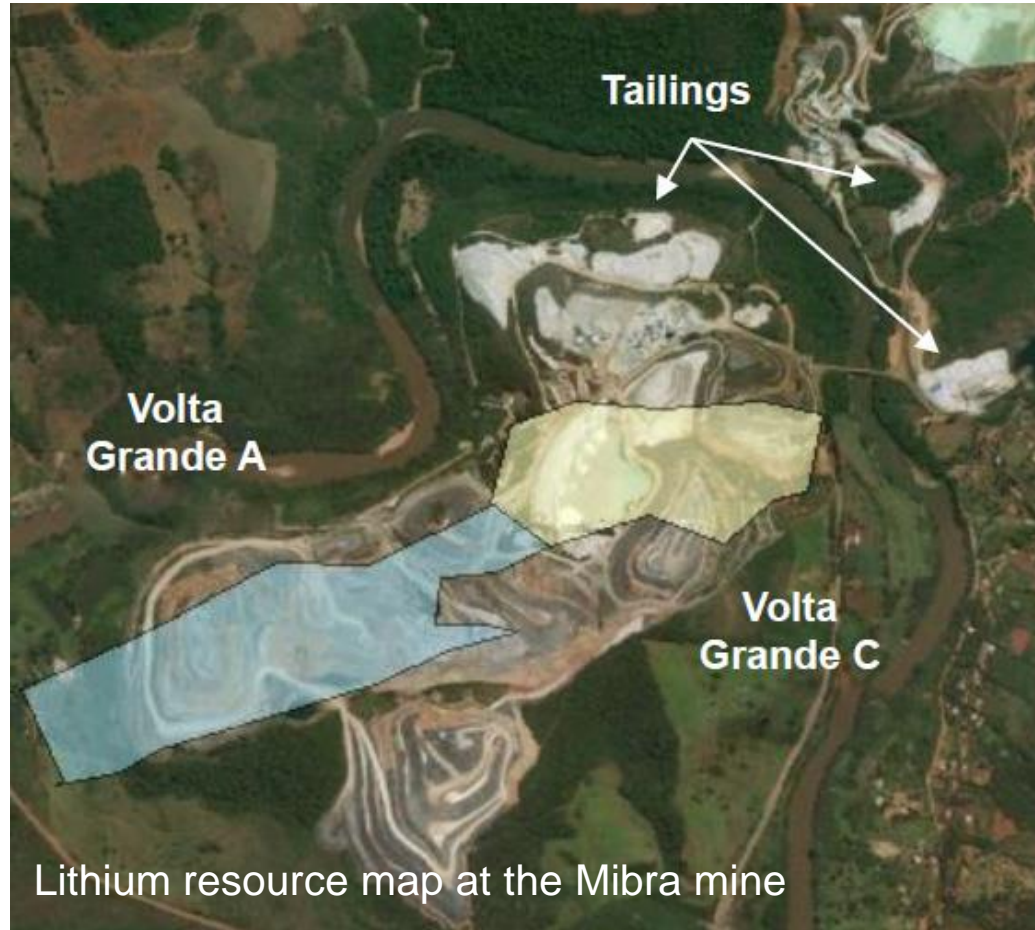
What are tailings?

- Tailings are the materials left over after the process of separating the valuable minerals from the uneconomic fraction of an ore.
- The amount of tailings can be large, ranging from 90–98% in valuable minerals to 20–50% with less valuable minerals.

What are the applications for lithium?

- Lithium mineral concentrate is used in applications such as glass and ceramics.
- A high growth market for lithium chemicals is in re-chargeable batteries, and the growth is accelerating with the demand for electric vehicles, grid battery storages and personal electronic devices.

Background to the project at the Mibra mine



- Tailings from AMG's tantalum plant are collected to a tailings pond
- New tailings are continuously generated from the operations
- The tailings contain valuable lithium
- For close to 10 years AMG has studied the utilization of lithium carrying tailings, and Outotec has been involved since 2010

Finding the right solution at the Mibra mine



- In 2014-2016 Outotec completed conceptual, pre-feasibility and definitive feasibility studies for lithium carrying spodumene production
- October, 2016: AMG and Outotec agreed to build a 90 kilo-tonnes per annum spodumene plant on EPC turnkey basis
- Guarantees for process performance, project budget and schedule
- Order value exceeds EUR 35 million, commissioning starting in May 2018

Our local team supports plant commissioning and operation with sophisticated process control



Operational support and services by Outotec's local team in Brazil

The plant has sophisticated process control with high-end analyzers. AGM has the possibility to remote advisor support for operation and maintenance by Outotec global technology centers.

Benefits of our solution for the customer

Monetizing the substantial lithium mineral deposits currently residing in tailings with low production cost

Fast-track access with our EPC delivery to the growing lithium market

Tailings area reduced for future operation, reclaimed water back to the process reducing fresh water need