



# Wise process routes for varying feedstock in base metal extraction

VINNOVA

Boliden Mineral AB

LKAB

Adolf H. Lundin Charitable Foundation

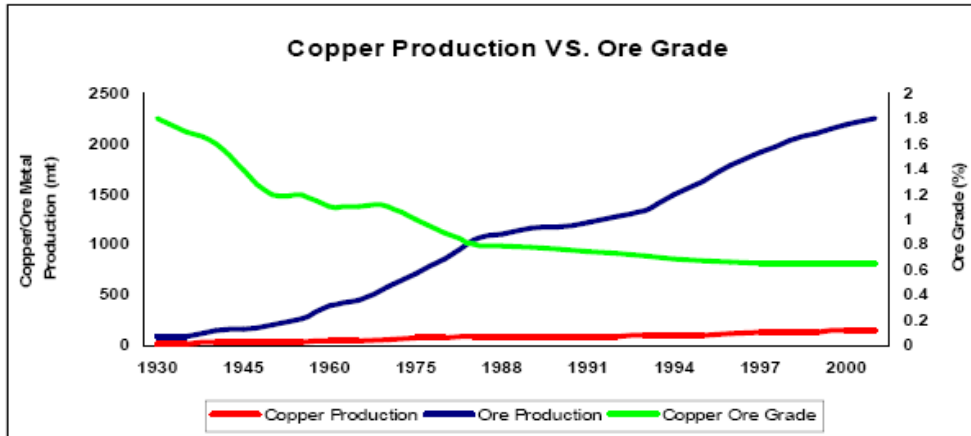
Division of Extractive Metallurgy, LTU





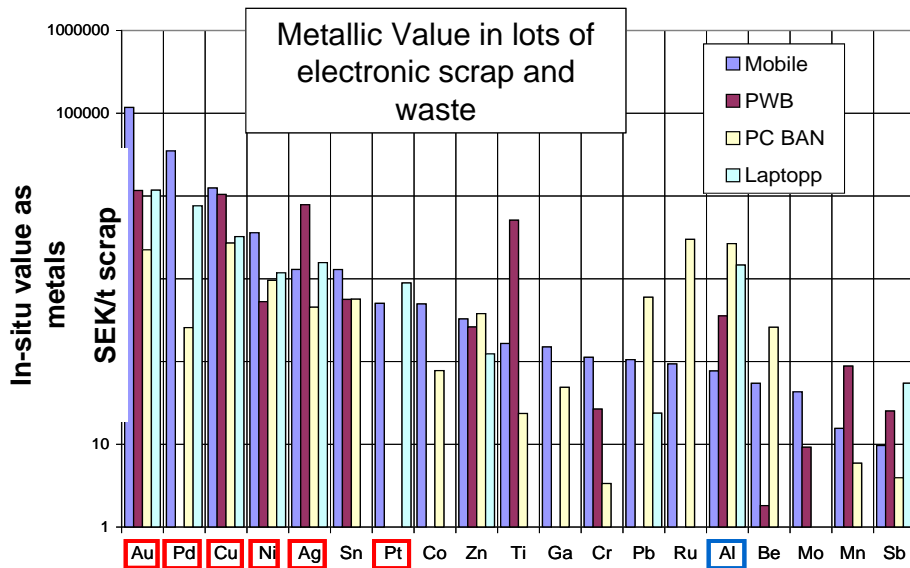
## Aim

- Predict consequences of changing raw material base, primary/secondary on the metal extraction chain
  - Complex and impurity rich mineralizations
  - Efficient use of secondary raw materials
  - Network



Source: Raw Materials Group, Stockholm

**Lower grade ores (e.g. As content)  
Secondary raw materials (varying and complex composition)**







## WP 1

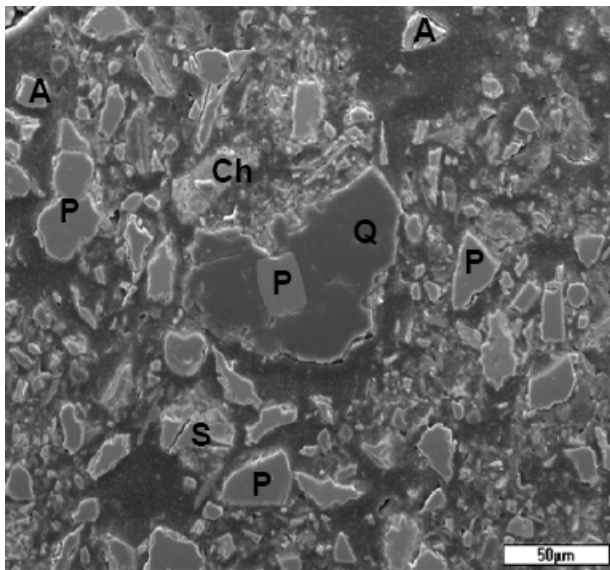
### Impurity management and valorisation

- **Hydrometallurgical pretreatment**
  - Test material; complex concentrates, smelter residues
  - Hitherto focus on Sb
  - Leaching studies of complex concentrate
  - Fundamental studies on leaching of Sb-minerals
  - Electrowinning
  - Evaluation of hydrometallurgical treatment for other elements



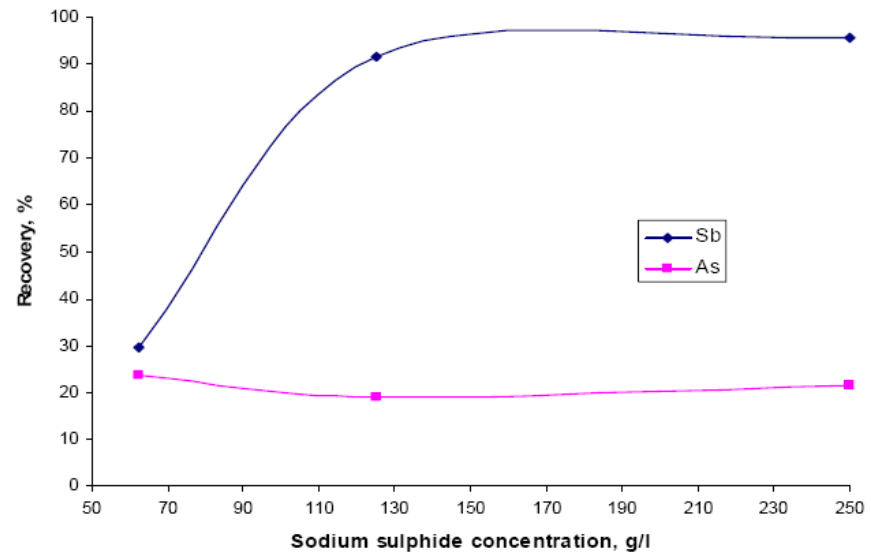
## Studies of Maurliden västra and Petiknäs norra

- Characterisation



Sb in the form of tetrahedrite (Maurliden västra)

- Leaching test; alkaline sulphide solution proved selective to Sb





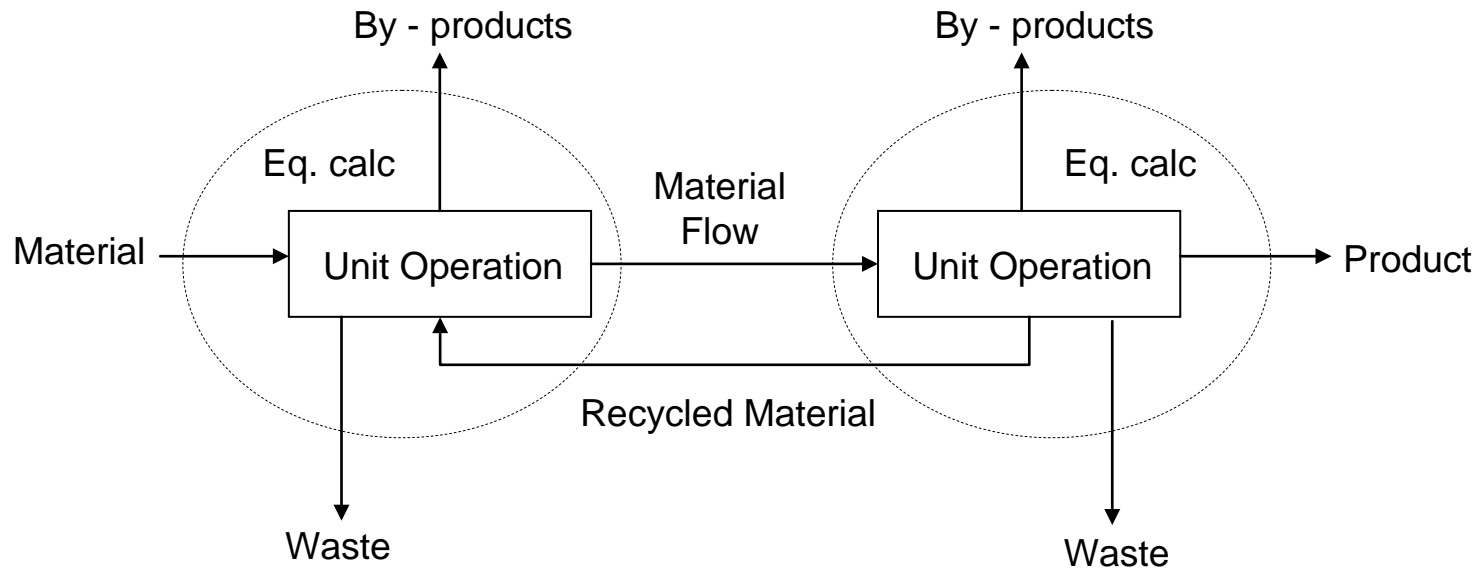
## WP 2

### Impact of impurities on extraction, smelting and refining processes

- Impurity distribution in smelting
  - Focus on thermodynamics
  - Evaluation of existing data
  - Develop models /determine data
  - Plant data; sampling and characterisation
- Impurity capacity
  - Focus on experimental studies in bench scale
  - Slag properties; impact of impurities; Al
  - Recycling of secondary mtrl. (CRT/LCD); impact on slag properties



# Thermodynamic calculations; impurity distribution of minor and micro elements



**–Literature survey; thermodynamic data for microelements is lacking**





## Slag capacity

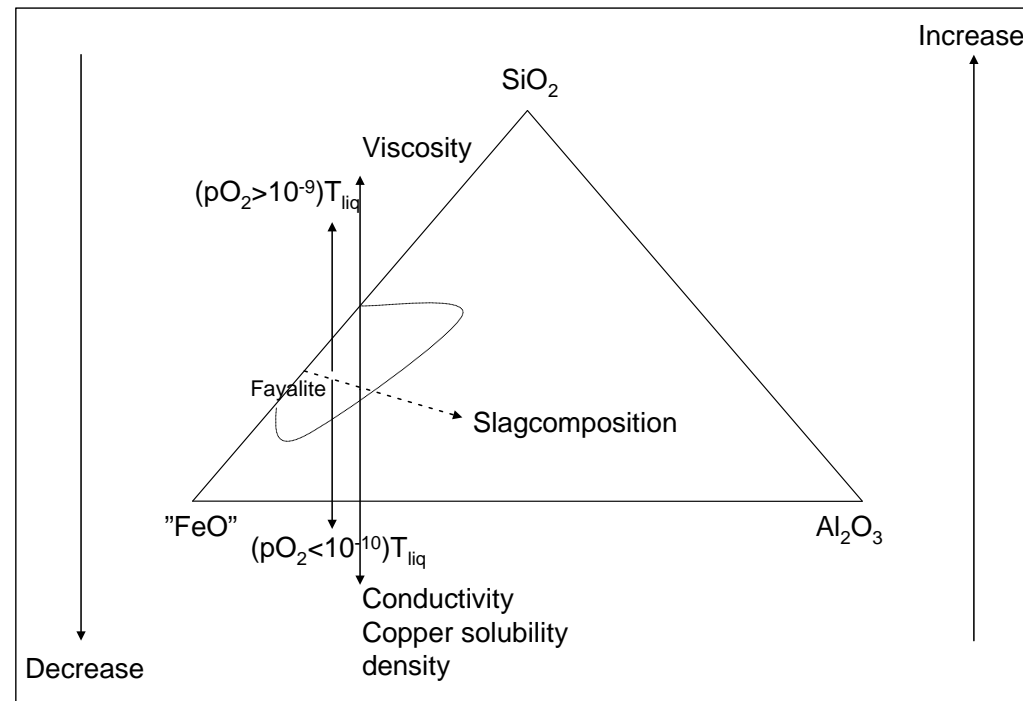
### •Recycling of CRT

- Mineralogy: above 10% addition to slag, a glassy structure identified

### •Impact of increased Al

- Mineralogy: Addition of 10%  $Al_2O_3$ 
  - new phase formed,
  - Spinell composition changes
- Melting
  - Stepwise melting
  - Increased liq. temp
- Leaching
  - no significant changes

### Literature survey; alumina





## WP 3 Evaluation of process options

- Selection of raw materials
  - Complex mineralizations (Maurliden, Rockliden)
  - Secondary materials
- Tools for modelling
  - SimuLink, SimuSage
- Collection of data
  - Literature survey (WP2)

**Resources should be used with wisdom and knowledge  
to give the future generations worldwide  
wealth in a healthy environment**

**Yet : ... Knowledge is about the past,  
Wisdom is about the Future.**

American Indian Chieftain