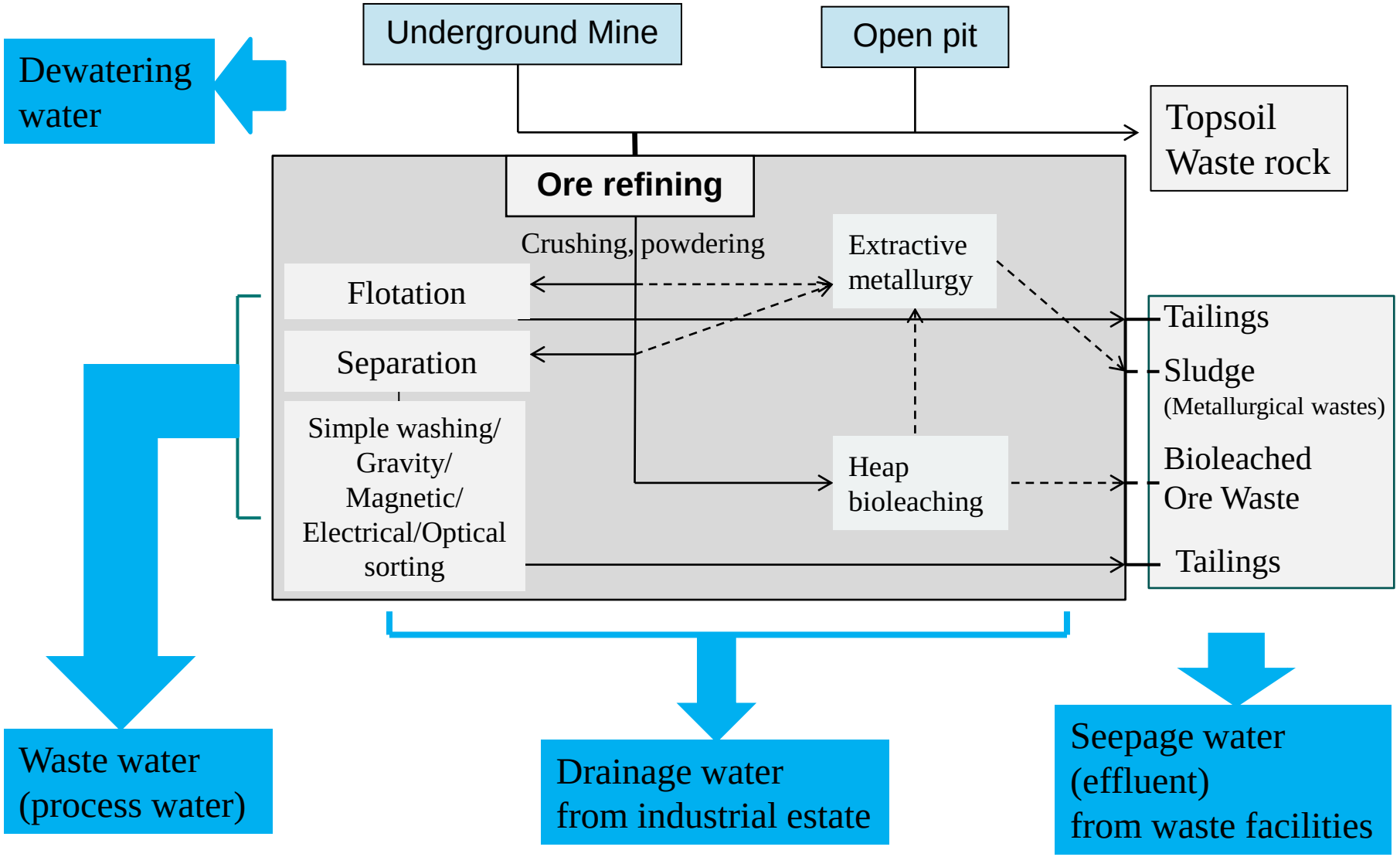

Rautuvaaran suljettu kaivos, Kolari

Geochemical characteristics of mine waters – Challenges to the treatment methods

Marja Liisa Räisänen

Geological Survey of Finland, Regional Office for Eastern Finland


Dewatering water
Underground Mine
Open pit
Topsoil
Waste rock
Ore refining
Crushing, powdering
Flotation
Separation
Simple washing/ Gravity/ Magnetic/ Electrical/Optical sorting
Extractive metallurgy
Heap bioleaching
Tailings
Sludge
(Metallurgical wastes)
Bioleached Ore Waste
Tailings
Waste water (process water)
Drainage water from industrial estate
Seepage water (effluent) from waste facilities

Dewatering water, chemical characteristics

- Chemical remains from explosives
  - Nitrogen compounds (NO_3-NO_2, NH_4)
  - Al, Na, organic compounds (e.g. benzene)
- Elements released from the rocks blasted
  - Metals and/or metalloids dissolved from broken edges of minerals (sulphides, antimonides, Al-silicates etc.)
- Elements dissolved via oxidation of rock walls (acid rock drainage), long-term reactions
  - Release of Fe, S and other easily weatherable metal / metalloid sulphides
  - Al from silicate weathering etc.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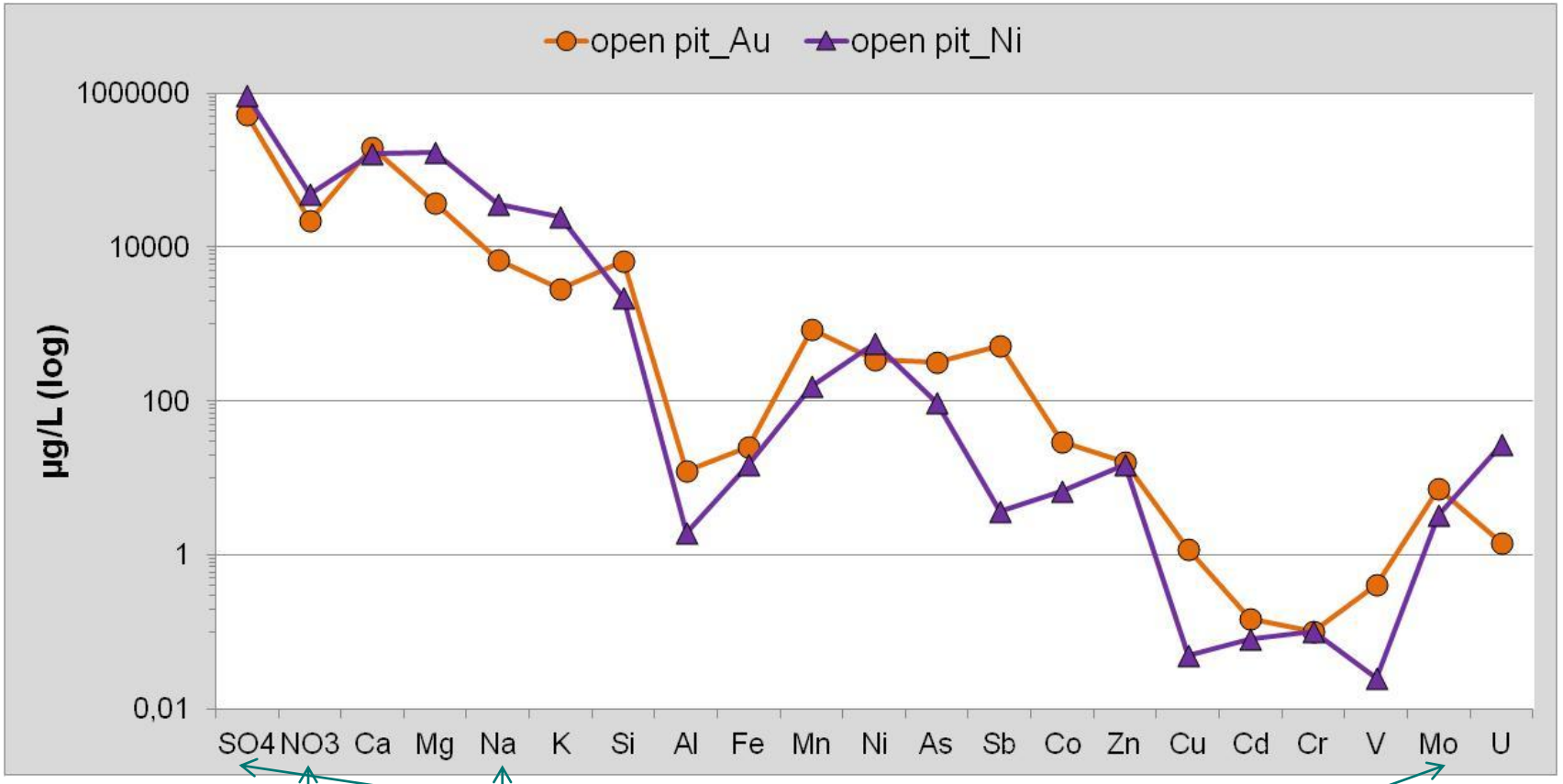
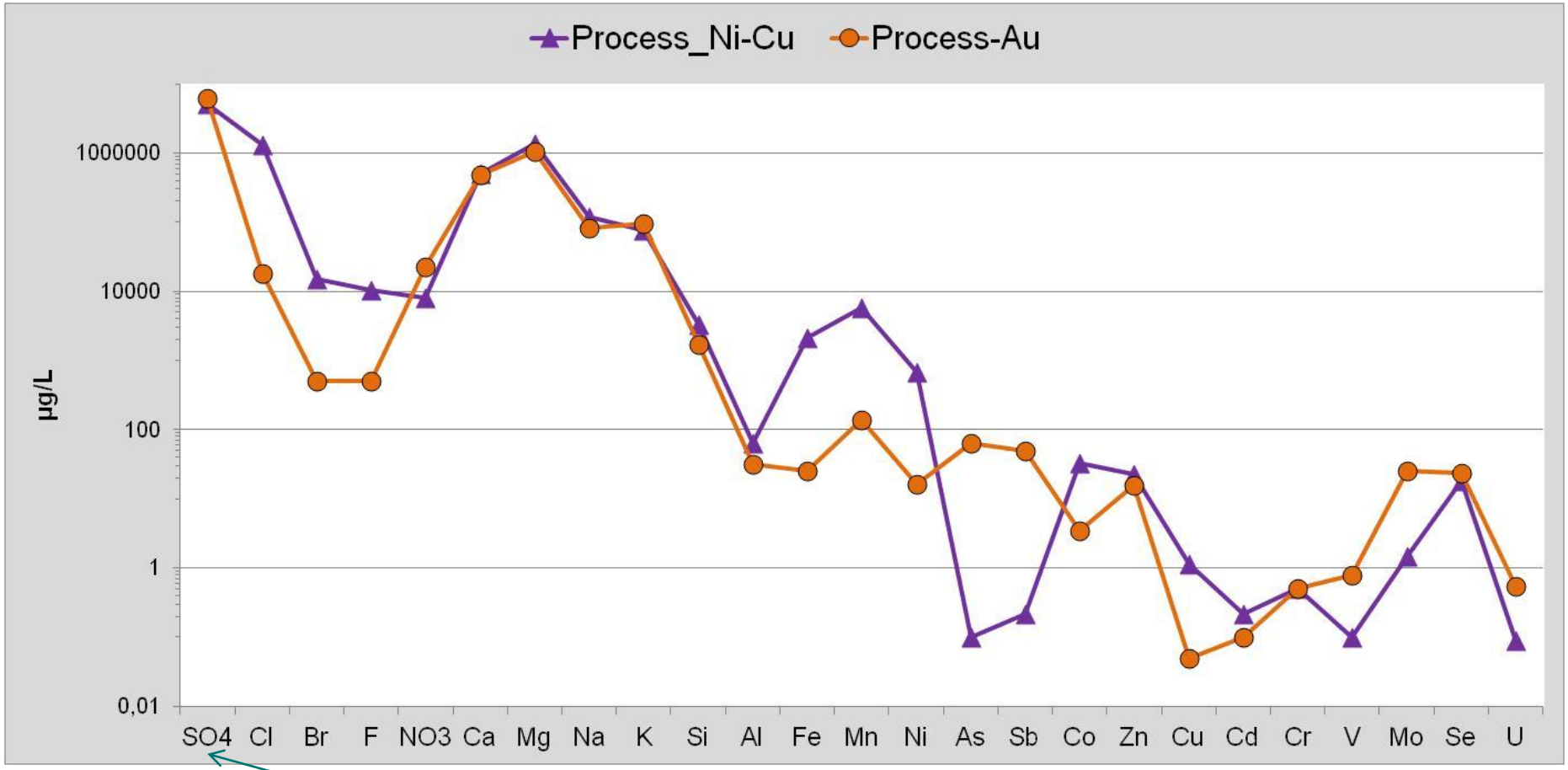
Examples:
element distribution in dewatering water

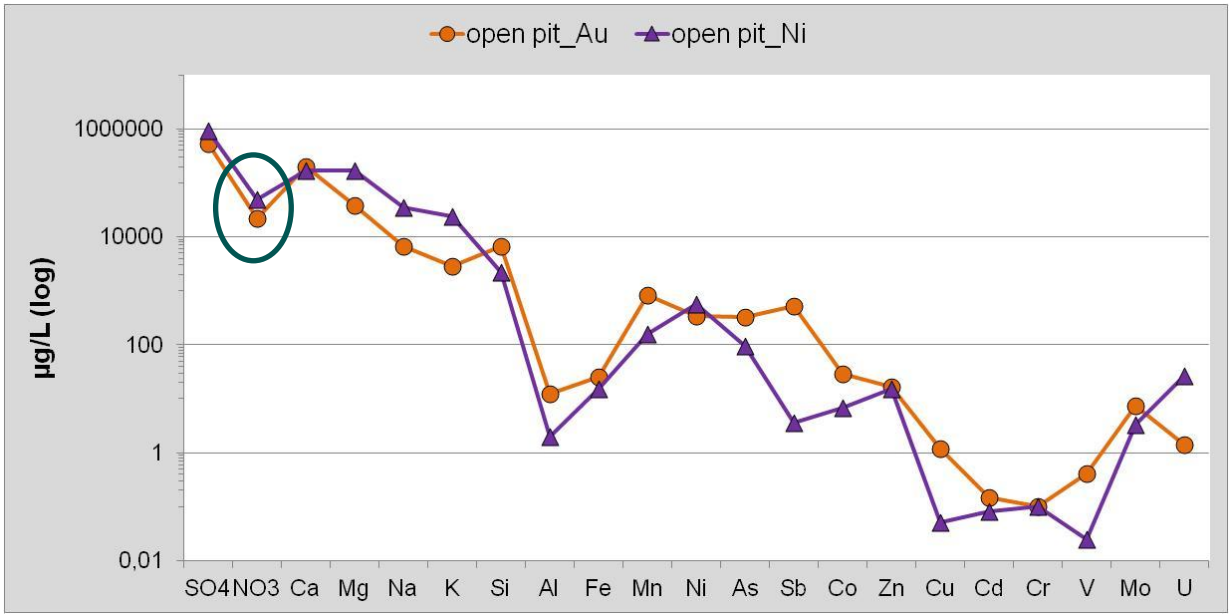


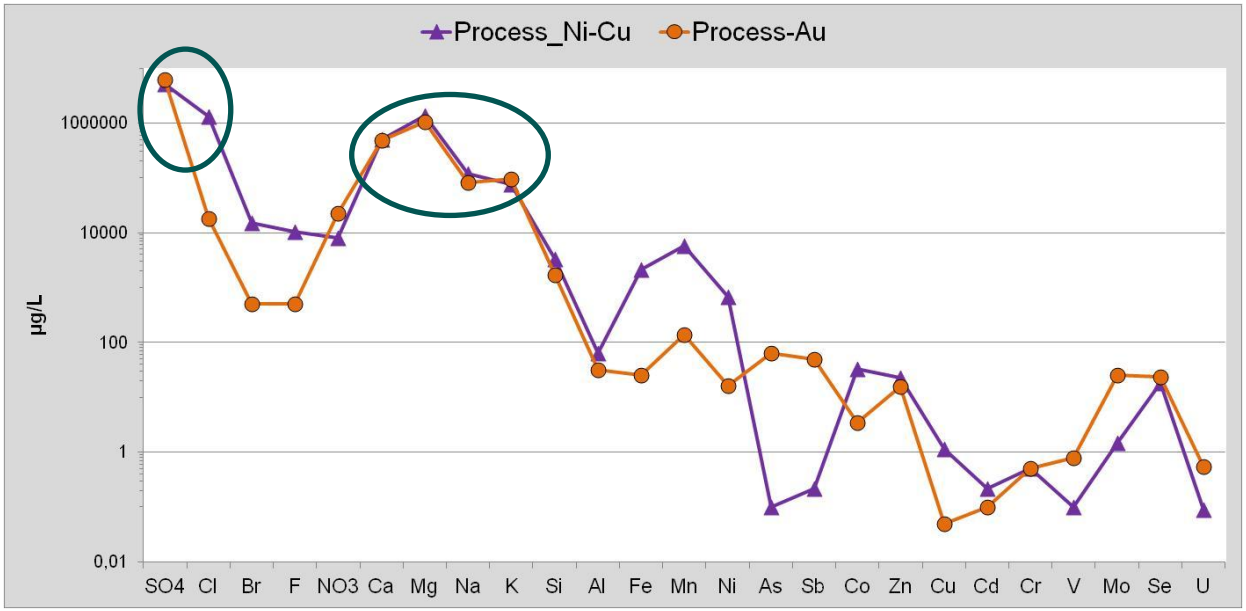
Process water

- Process chemicals (+ explosives) and their remains
  - Anions: SO_4, Cl, PO_4, NO_3 jne
  - Cations: Ca, Mg, Na, K
  - Carbon
  - Other remains of chemical compounds
- Elements released during grinding and refining from minerals
  - Metals, metalloids

Examples:
element distribution in process water







Process water rich in anions and alkaline earth and alkaline metals

Seepage waters from mine waste facilities

- Acidic and metal, metalloid bearing waters or
- Neutral and metal, metalloid bearing waters

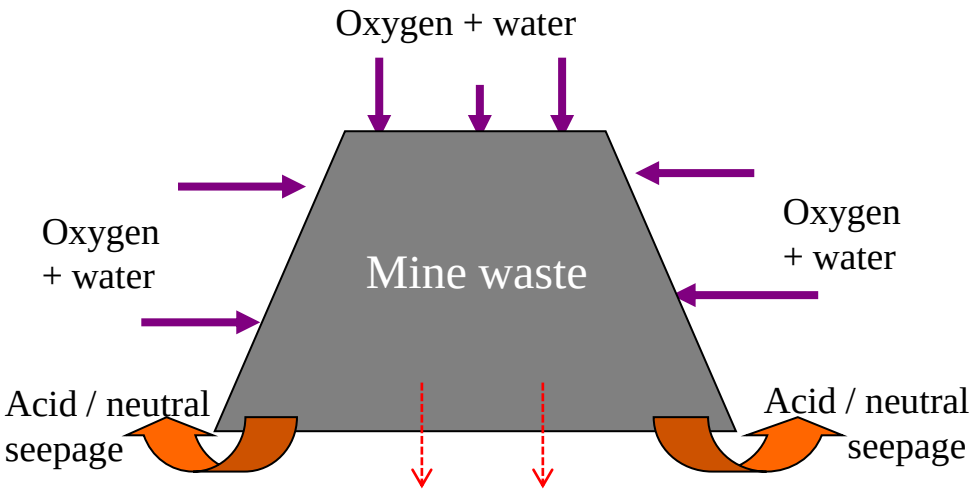
Geochemical characteristics of wastes ⇒ water quality

-Acid generating

-Non-acid generating

-Neutral, but metal rich drainage

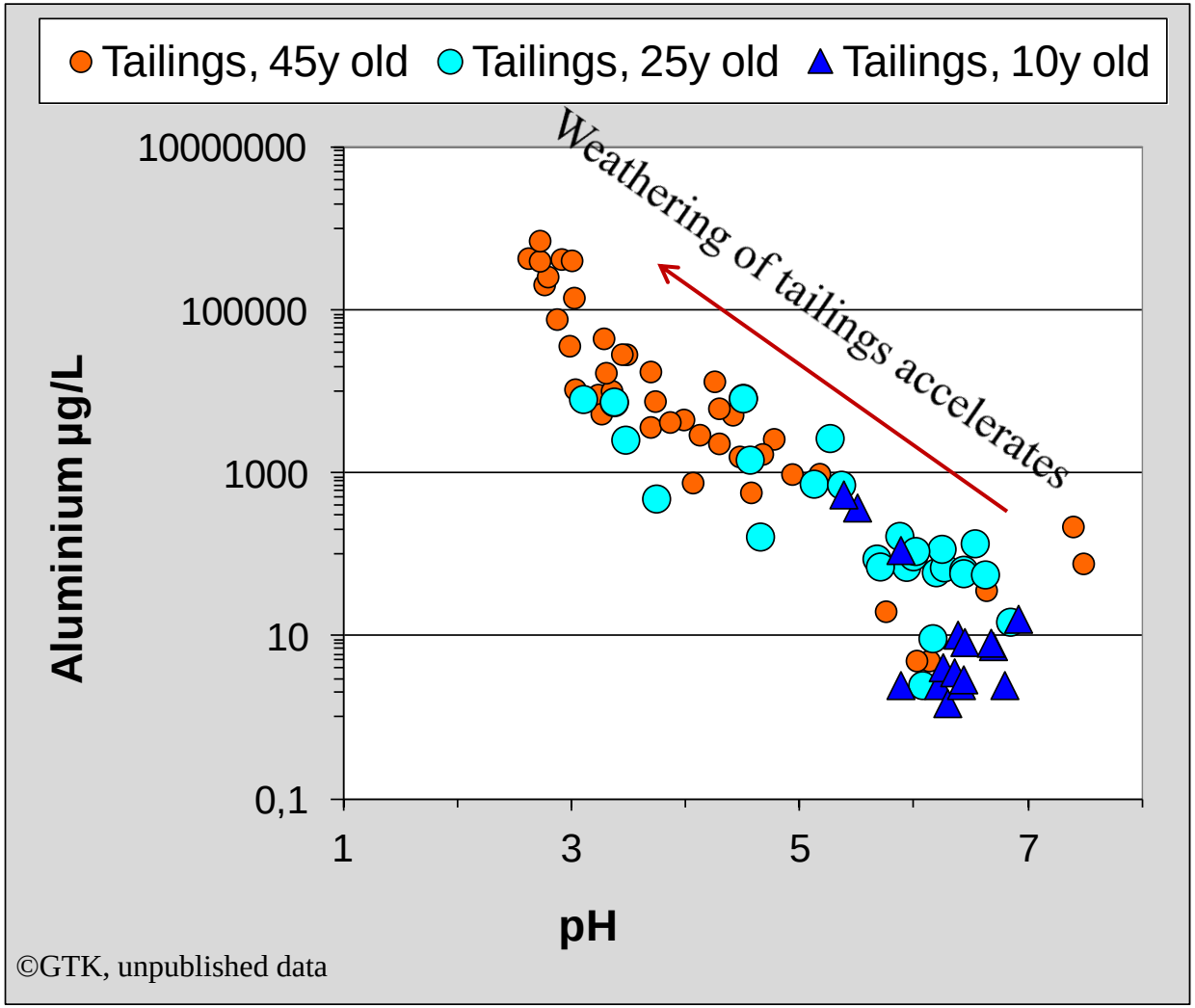
-Neutral, salt bearing drainage



Reaction: Iron sulfide + oxygen + water → sulfuric acid + iron precipitate

Similarities to the surface waters formed in the industrial estate

Seepage water quality of the closed tailings facilities - Al mobility and increasing acidity



Challenges to treatment methods

- Unwanted interaction with different elements
- Salinity (SO_4, Cl, Ca, Mg, Na, K etc.)
  - Limiting factors, e.g. Na_2SO_4 formation, supersaturation
- High concentrations of Fe / Mn / Al (easily precipitating)
- High content of N compounds
  - Abundance of trace metals limits in biochemical treatments of N
- Presence and quality of solids
  - Use on membrane techniques
- What else?

⇑ Single or treatment set? ← costs

THANKS!