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Declining element concentrations in groundwater in sulphide-rich tailings after remediation at Kristineberg, northern Sweden

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Luleå University of Technology is the centre of mining related research and education in Sweden.

In 2010, the Centre of Advanced Mining and Metallurgy (CAMM) was established based on strategic funds from the Swedish government.

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CAMM- Centre of Advanced Mining and Metallurgy

- **Geometallurgy and 4D geological modelling**
- **Deep mining**
- **Lean mining –production systems**
- **Particle technology**
- **Green mining – reducing the environmental footprint**
- **Raw materials for future iron- and steelmaking**

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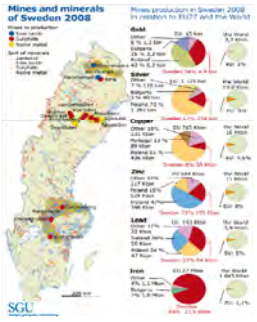

EUROPE

- Au, Pb, Zn (20-30%)
- Fe (89%)

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- In Sweden, management of sulphide-bearing mine waste is directed towards prevention of formation of acid mine drainage, also on a very long time perspective (next glaciation perspective).
- After closure, it should be possible to leave the remediated waste without continued maintenance.
- Treatment methods such as liming for ever or at least for a very long time is not an option.
- Dry cover and water cover

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In the last years, there has been a trend to study the use of waste or rest products from other industries or activities for remediation of mine waste.

Examples are sewage sludge, incineration ashes and waste from the forest and paper industries (such as Green liquor dregs (GLD), alkaline rest products from the paper production).

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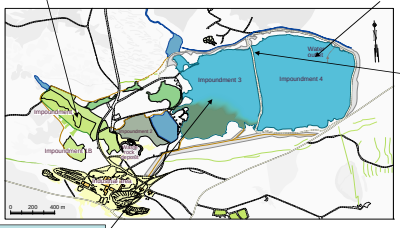
DRY COVER AND SATURATED TAILINGS

KRISTINEBERG

WATER COVER

LIMING



WATER SATURATED

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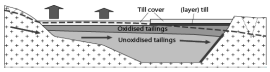
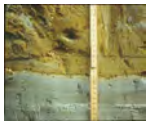
Impoundment 1

Sulphide tailings oxidised since 1946





Oxidised zone
(ca 1m, since 1946)
(Ca 26% pyrite)

Unoxidised zone
Depth 8-11 m

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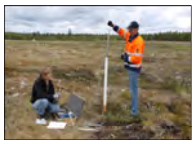
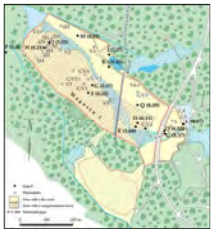
Groundwater sampling





Sampling of groundwater since 1998 =>

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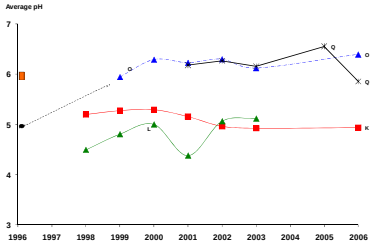
DRY COVER ON OXIDISED SULPHIDE TAILINGS



pH 4.8 (1983)

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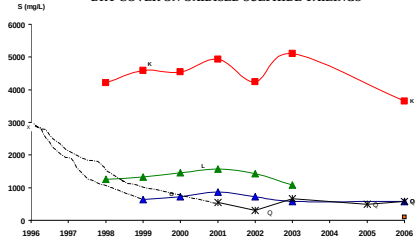
DRY COVER ON OXIDISED SULPHIDE TAILINGS



S 2900 mg/L (1983)

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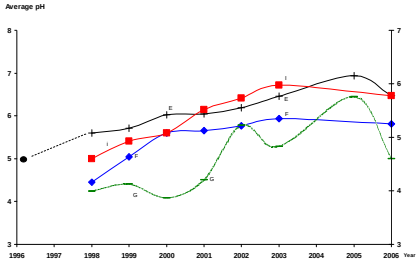
SATURATED OXIDISED SULPHIDE TAILINGS



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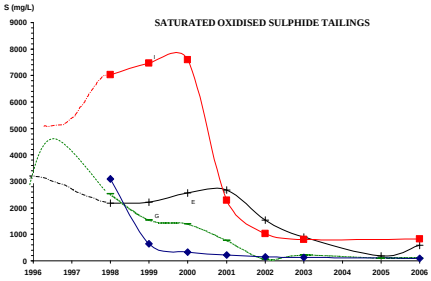

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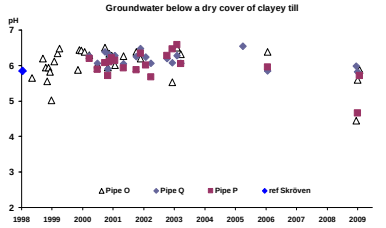

pH 4.8 (1983)

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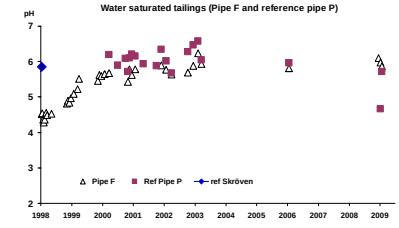

pH 4.8 (1983)

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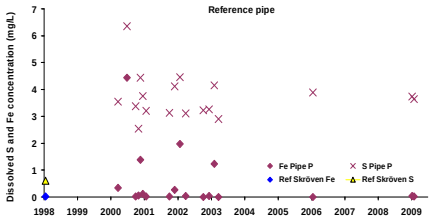

Fe 3900 mg/L
S 2900 mg/L
(1983)

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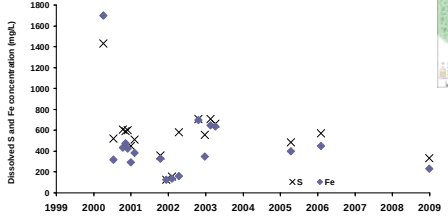

Fe 3900 mg/L
S 2900 mg/L
(1983)

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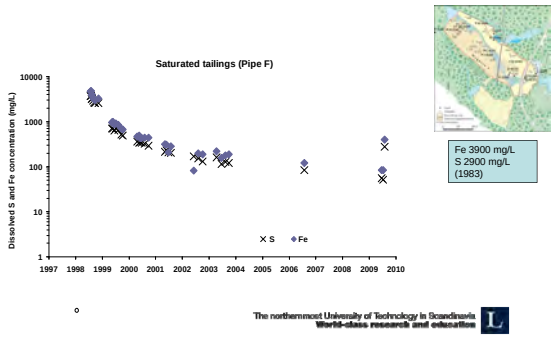

Fe 3900 mg/L
S 2900 mg/L
(1983)

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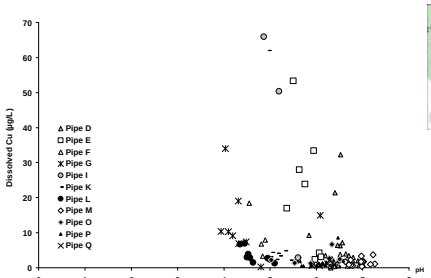

2500 µg/L (1983)

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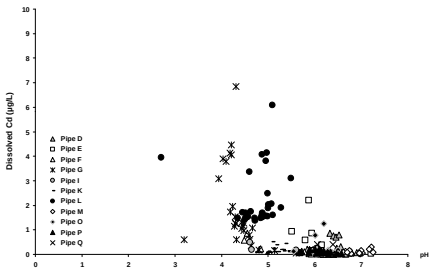

80 µg/L (1983)

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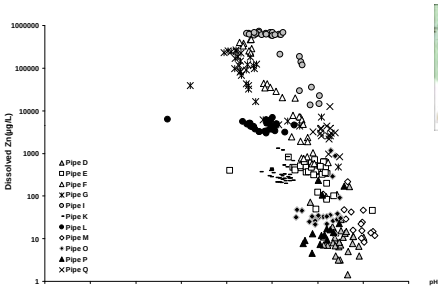

330 000 µg/L (1983)

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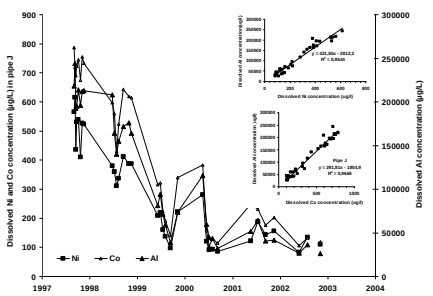

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Conclusions

- The concentration of elements such Cd, Co, Cu and S decreased by more than 90% after implementation of measures
- The pH reached levels similar to reference levels
- The initial wash-out of oxidation products when the groundwater table was raised delayed the decrease of elements concentration
- The concentration of trace metals decreased at pH > 5
- Al-oxide might be a potential sink for Co and Ni at pH>5 and high Al concentrations

GEORANGE

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