

Geochemical Evaluation of Mine Water Quality in an Open-pit Site Remediated by Backfilling and Sealing

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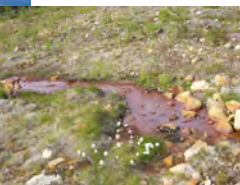
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Background

- The increase of open-cut mining due to the development of technologies has left and will leave many open pits sites with risk of water contamination and Acid Mine Drainage, affecting mine water quality.
- Studies assessing post-remediation water quality, though worthy, are not frequent.

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Aims

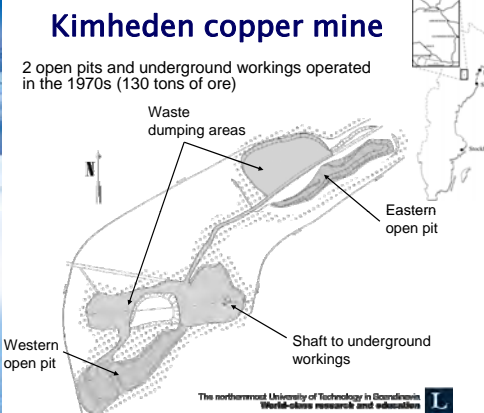


- Study the effects of the remediation performed at a small copper open-pit mine site in northern Sweden on the mine water quality
- Part of a larger project :
 - to evaluate the performance of the backfilling/sealing option
 - To test practical tools for site rehabilitation assessment

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Kimheden copper mine

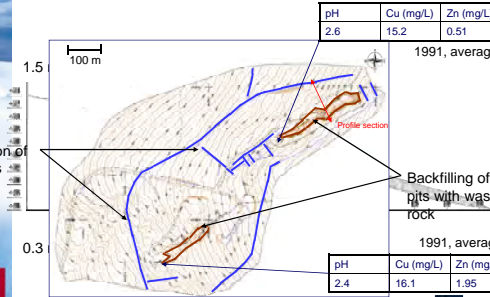
2 open pits and underground workings operated in the 1970s (130 tons of ore)



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Decommissioning at Kimheden

- Decommissioning in several stages
- In 1996, completion of the remedial activities: full backfilling of both pits and addition of a composite sealing-protective cover (0.3/1.5 m) on top of them




pH	Cu (mg/L)	Zn (mg/L)
2.6	15.2	0.51
1991, average		
pH	Cu (mg/L)	Zn (mg/L)
2.4	16.1	1.95
1991, average		

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Monitoring programme, summer 2009

- Water quality sampling May-Sept 2009 every 2-3 weeks
- Surface and groundwater sampling:
 - Measurements on site: pH, el. cond., redox, T°
 - Metal analyses
 - Sulphate, acidity, DOC
- Estimation of stream discharges at the sampling locations



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Monitoring programme, summer 2009

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Post-remediation concentrations

Average concentrations from the 2009 sampling sessions

	Cu	Zn	Cd	Pb	Ni	pH
G1	790	410	0.58	0.73	9.5	3.7
GB	9.1	5.7	0.017	0.018	0.56	4.6
Ref.						
SD	400	120	0.30	0.96	3.9	3.7
SB	2.3	7.2	0.013	0.14	0.38	4.6
Ref.						

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Mine water over the area

Sampling 7, beginning of September

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Time series

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Comparison Pre/Post-remediation

Decrease of copper and zinc concentrations since 1991

At SD, downstream of the mine

	(Cu+Zn) conc.	% decrease since 1991
Outlet Open pit 1	97	
Outlet Open pit 2	89	
Downstream	94	

84-85: partial backfilling of both pits, liming
88-89: additional backfilling of the western pit
96: complete backfilling of both pits, application of a composite cover

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Discussion/conclusions

- Still low pH (3.7) and poor Cu and Zn concentration values in the mine water in 2009
- This might be related to an on-going oxidation but other processes need further investigation
- Yet, favourable evolution of water quality since the beginning of remediation
- In-depth investigation of the groundwater pathways and quality is necessary (test with geophysics)

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Thanks to you all

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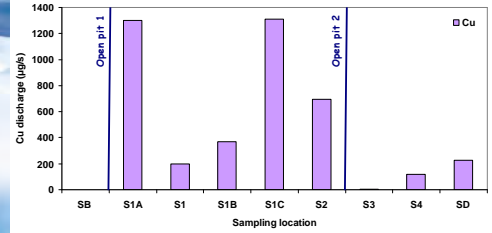


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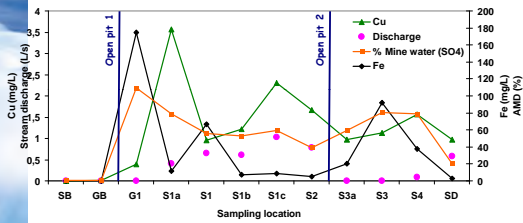
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