

International Mine Water Association Symposium 2016 (IMWA 2016)

**Mining Meets Water – Conflicts and
Solutions**

**Leipzig, Germany
11-15 July 2016**

Volume 1 of 2

Editors:

Carsten Drebendstedt

Michael Paul

ISBN: 978-1-5108-2714-1

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2016) by International Mine Water Association - IMWA
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact International Mine Water Association - IMWA
at the address below.

International Mine Water Association - IMWA
c/o Itasca Denver, Inc.
143 Union Blvd. Suite 525
Lakewood, CO 80228
USA

Phone: +1 303 969-8033
Fax: +1 303 969-8357

Secretariat@IMWA.info

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

Rehabilitation of Water Resources induced by Large Scale Mining in Germany	4
<i>K. Zschiedrich, E. Scholz, F.-C. Benhaus</i>	
Progress and Prospects of Mine Water Management in the Former East German Uranium Mining Province.....	6
<i>M. Paul</i>	
Waste or Resource? Extraction Potential from Acid Mine Drainage for Useful Resources.....	7
<i>D. Nordstrom</i>	
Mine Water As a Resource - Innovative Solutions and Concepts for the Mine Water Management in Modern Mining and Mineral Exploration.....	9
<i>M. Worsa-Kozak, M. Czop</i>	
Latest Development in Water Management of Eastern-german Lignite Industry	11
<i>M. Struzina, T. Koch</i>	
Simulating Mining-related Reactive Transport Processes Across Multiple Length and Time-scales.....	14
<i>H. Prommer</i>	
Stable Isotope Tools for Assessing Flow Dynamics and Contaminant Degradation in Mining Landscapes	15
<i>K. Knoller, M. Schubert, C. Jeschke, N. Hoth</i>	
Mine Water Discharge Quality – A Review of Classification Frameworks.....	17
<i>J. Opitz, W. Timms</i>	
Pulling Together Mine Water Management Across Site & Business for Performance: Principles, Business Role & Inclusive Governance, Strategic & Practice Framework.....	27
<i>T. Kennedy</i>	
Climate Change and Mine Closure – A Practical Framework for Addressing Risk	35
<i>A. Baisley, S. Pearce, M. O'Kane</i>	
Cumulative Groundwater Impact of Mining in the Kalahari Manganese Field and the Need for a Strategic Environmental Assessment Approach	43
<i>M. Zingelmann, A. Bittner, F. Winker, M. Muresan, J. Ellerton, T. Harck</i>	
1000 Years of Mining: What Means Geogenic Background of Metals in the Rivers of the Harz Mountains?	45
<i>P. Schneider, U. Nilius, A. Lammel, A. Schmitt, A. Schmitt</i>	
Financial Calculation of Long Term Tasks in Mine Water Management	54
<i>C. Drebendstedt</i>	
Recogniton and External Reporting of Mine Water Treatment Costs According to IFRS Standards	63
<i>J. Bongaerts</i>	
Environmental Risk Mitigation Resulting from Implementation of Mine Water Treatment Technologies Developed Within Project Manager	64
<i>M. Wiesner, A. Zgorska, P. Zawartka, C. Klinger</i>	
Mine Water Issues Addressed in the Project train@mine	72
<i>F. Werner, J. Meber, U. Seeger, M. Struzina</i>	
Waters of Deep Ground – Mine Water and Emotions	78
<i>G. Ruhland, C. Wolkersdorfer</i>	
Environmental Risk Caused by High Salinity Mine Water Discharges from Active and Closed Mines Located in the Upper Silesian Coal Basin (Poland)	85
<i>A. Zgorska, L. Trzaski, M. Wiesner</i>	
Kenyan-German Centre of Excellence for Mining, Environmental Engineering and Resource Management (CEMEREM)	93
<i>K. Too, A. Ndegwa, H. Boga, U. Feistel, T. Grischek, J. Bongaerts</i>	
The Waves of Change in Water Resource Management & the Rising Challenge for Water Professionals: Calling Time for a Water Resource Classification & Reporting Code (WRCRC).....	99
<i>T. Kennedy</i>	
Earthquakes and Groundwater and Surface Water Management at Mines Sites.....	102
<i>G. Touche</i>	
Mechanisms on Mine Water Loss Based on a Theory of Mining-Fractures Development Pattern.....	108
<i>D. Xu, S. Peng, S. Xiang, Y. He, L. Xu</i>	
Can natural Stratification Prevent Pollution by Acid Mine Drainage?	115
<i>C. Wolkersdorfer, L. Shongwe, C. Schmidt</i>	
The Progress of the Mine Water Prevention and Control on Basic Principles in China	122
<i>Q. Wu, S. Liu, Y. Zeng</i>	
Stable Isotope Techniques as a Tool in Hydrogeological Conceptualisation of Ayazmant Mine Site (NW Turkey).....	127
<i>M. Ekmekci, S. Acikel, U. Sumer</i>	
Investigations in a Closed Mining Area in China – Challenges of Limited Datasets and Understanding of Hydraulic Behaviour	135
<i>L. Pu, N. Hoth, C. Freese, C. Drebendstedt</i>	
Integrated Mine Water Management: Innovative Design to Address Challenging Environments	141
<i>M. Goode, E. Hayes</i>	
How Does Salinisation of Running Waters Affect Aquatic Communities? Answers from A Case Study.....	144
<i>C.-J. Schulz</i>	

Iron-Hydroxide-Removal from Mining Affected Rivers.....	151
<i>F. Bilek, F. Moritz, S. Albinus</i>	
Open Cast Mines As River Sediment and Pollutant Sinks. The Example Mulde Reservoir (East Germany)	159
<i>F. Junge, M. Schultze</i>	
Modelling pH and Alkalinity Changes in Rivers Impacted by Acid Mine Drainage.....	167
<i>C. Nhantumbo, R. Larsson, M. Larson, D. Juizo, K. Persson</i>	
Integrating Surface Water Load Modelling Into Mine Closure Performance Evaluation	169
<i>W. Schafer, J. Barber, M. Contreras, J. Tellez</i>	
Iron Removal from the Spree River in the Bühlow Pre-Impoundment Basin of the Spremberg Reservoir	177
<i>U. Uhlig, S. Radigk, W. Uhlmann, V. Preub, T. Koch</i>	
New Insights Into the Microbiology of Meromictic Acidic Pit Lakes in the Iberian Pyrite Belt (Spain)	187
<i>C. Falagan, J. Sanchez-Espana, I. Yusta, D. Johnson</i>	
Persistence of Meromictic Stratification in Post Mining Lakes.....	194
<i>K. Joehnk, W. Uhlmann</i>	
Findings from Flooding Residual Pits Remaining After Coal Mining in the Czech Republic	196
<i>I. Prikryl, M. Kabrna</i>	
Advanced Treatment of Pit Lakes Using Limestone and Carbon Dioxide	204
<i>M. Strzodka, R. Claus, V. Preuss, K. Thurmer, K. Viertel</i>	
Efficiency of In-lake Liming of Acidic Pit Mine Lakes	211
<i>B. Merkel, G. Scholz, W. Rabe, D. Claub, W. Gent</i>	
Estimation of the Qualitative Characteristics of Post Mining Lakes in Different Lignite Fields in Greece	214
<i>D. Dimitrakopoulos, E. Vasileiou, N. Stathopoulos, S. Dimitrakopoulou</i>	
On the Relevance of Meromixis in Pit Lakes – An Update.....	222
<i>M. Schultze, D. Castendyk, K. Wendt-Pothoff, J. Sanchez-Espana, B. Boehrer</i>	
Quantification of Acidity Deposition in the Sediment of a Former Lignite Mining Lake in the Wackersdorf Mining District (Eastern Bavaria).....	231
<i>W. Schafer, M. Alte, M. Bauer, T. Soll, S. Peiffer</i>	
Varve Formation in the Acidic (pH 2.7) Pit lake 111 (Lusatia, Germany)	239
<i>K. Wendt-Pothoff, B. Scharf, B. Boehrer, C. Volkner, J. Tittel, J. Merkt</i>	
Validation of Springer Pit Lake Water Balance and Water Quality Model, Mount Polley Mine, British Columbia, Canada	246
<i>P. Beddoes, M. Herrell, J. Vandenberg, J. Richards, R. Millar, K. McMahan</i>	
Causes of an Distinct Metalimnic Oxygen Gradient in the Pit Lake Senftenberger See in Summer 2013 As a Case Study	256
<i>W. Uhlmann, K. Zimmermann, S. Mix, B. Nixdorf, O. Totsche</i>	
Biogeochemical Processes Controlling Density Stratification in an Iron-meromictic Lake	264
<i>E. Nixdorf, B. Boehrer</i>	
Challenges of Pit Lakes from a Sociological Perspective	271
<i>X. Lopez</i>	
A New Technology of Pit Lake Treatment Using Calcium Oxide and Carbon Dioxide to Increase Alkalinity	279
<i>C. Koch, K. Mazur</i>	
Field Experiments on Subsurface Iron Removal in the Lusatian Mining Region	287
<i>T. Grischek, U. Feistel, J. Ebermann, F. Musche, S. Bruntsch, W. Uhlmann</i>	
Effects of pH on the Arrhenius Paradigm	294
<i>J. Dockrey, B. Mattson</i>	
Characterization of Acid Producing Potential of Spent Ore from Heap Leach Plant.....	301
<i>R. Gautama, G. Kusuma</i>	
Acid- and Base-neutralization Capacity in Mine Water and Brines	307
<i>B. Merkel</i>	
Geochemical Trends in Evaporative Tailings Ponds – An Experimental Study	308
<i>T. Kirchner, N. Marsh, B. Mattson</i>	
Advanced Customisable Leach Columns (ACLC) – A New Kinetic Testing Method to Predict AMD risks by Simulating Site-specific Conditions	316
<i>S. Pearce, J. Pearce</i>	
Estimation of Pyrite Weathering in Lusatian Lignite Open Cast Mines Using Geochemical Investigation Methods.....	324
<i>W. Uhlmann, Y. Lindig, T. Koch, I. Arnold</i>	
Effects of Scale of Kinetic Tests on Leachate Chemistry Prediction	332
<i>J. Dent, T. Rotting, M. Williams</i>	
REE-Enriched Mn-Oxide Precipitates in Water-Bearing Fractures in the Ytterby Mine, Sweden.....	341
<i>S. Sjoberg, B. Allard, J. Rattray, V. Sjoberg, S. Karlsson</i>	
Fine Ash Leaching in Tailings Dams – An Impact on the Underlying Aquifers?	348
<i>J. Zielke-Olivier, D. Vermeulen</i>	
Surface Paste Disposal of High-Sulfide Tailings at Neves-Corvo – Evaluation of Environmental Stability and Operational Experience	356
<i>R. Verburg, M. Oliveira</i>	
Control of Acid Mine Drainage by Managing Oxygen Ingress Into Waste Rock Dumps at Bituminous Coal Mines in New Zealand	363
<i>J. Pope, P. Weber, W. Olds</i>	
Identification of Major Point Sources in the Severely Contaminated Alum Shale Area in Kvarntorp, Sweden	372
<i>K. Ahlgren, M. Backstrom</i>	

Aspects of the Environmental Monitoring on the Territory of Verhnekamskoye Potash Deposit (Russia)	378
<i>E. Khayrulina</i>	
Geophysical Electromagnetic Measurements for Mine Site Groundwater Monitoring.....	383
<i>P. Saksa, J. Sorsa</i>	
AMD Formation and Dispersion of Inorganic Pollutants Along the Main Stream in a Mining Area.....	386
<i>E. Fosso-Kankeu, A. Manyatshe, A. Muryai, F. Waanders</i>	
Persistent Secondary Contaminant Sources at a Former Uranium Mill Site, Riverton, Wyoming, USA	393
<i>R. Johnson, W. Dam, S. Campbell, V. Noel, S. Bone, J. Bargar, J. Dayvault</i>	
Waste Rock Characterisation Versus the Actual Seepage Water Quality.....	400
<i>T. Karlsson, P. Kauppila</i>	
Mine Water Approach Using Tracers in South African Abandoned Coal Mines	405
<i>T. Kgari, Y. Wyk, H. Coetze, M. Dippenaar</i>	
Modeling Cyanide Degradation in Heap Leach Systems: From Laboratory to Reality	412
<i>J. Declercq, D. Tait, R. Bowell</i>	
The Effects of a Plug of Alkaline Water in an Acid Stressed Watershed.....	420
<i>N. Kruse, A. Mackey</i>	
Assessment of the Influence of Coal Mining on Groundwater Quality: Case of Masisi Village in the Limpopo Province of South Africa.....	425
<i>A. Nephala, C. Muzerengi</i>	
Contamination Load in a River Affected by AMD Discharges: Odiel River (Huelva, Spain).....	434
<i>J. Riera, M. Olias, C. Ruiz-Canovas, F. Macias, L. Galvan</i>	
Reiche Zeche Mine Water Geochemistry	438
<i>V. Zhiteneva, J. Brune, H. Mischo, J. Weyer, A. Simon, D. Lipson</i>	
Magnesium and Aluminum Sulfates in Salt Efflorescences from Acid Mine Drainage in the Iberian Pyrite Belt (SW Spain).....	440
<i>T. Valente, J. Gande, M. Torrel</i>	
Characteristic Variation of Precipitate in Limestone Layer	446
<i>D.-K. Lee, Y.-W. Cheong</i>	
Optimized Dewatering Wells for Open Pit Mining to Prevent Well Loss from Ochre Formation	449
<i>T. Rude, M. Reich</i>	
Deploying Oil & Gas Drilling Techniques with Dewatering Well Placement Technology (DWPT) in Open Pit and Underground Mines	450
<i>M. Boland, A. Rowland, M. Bester, C. Cintolesi, J. Dowling</i>	
Ghaghoo Mine Dewatering and Injection of Excess Water	458
<i>A. Johnstone, D. Kriel, D. Vermeulen</i>	
Cut-off Wall Technologies in Mining	463
<i>S. Schwank</i>	
Wellbore Skin in Mine Dewatering and Drinking Water Supply: Field Observation, Mineralogy and Hydraulic Effect	473
<i>C. Weidner, G. Houben, M. Halisch, S. Kaufhold, J. Sander, M. Reich, C. Menz</i>	
Progressive Sinkhole Occurrence Induced By Dewatering Activities in a Large Lignite Mine (SE Turkey).....	481
<i>M. Ekmekeci, H. Yazicigil</i>	
Hydrogeological Exploration and Field Tests on Vacuum Wells in Overburden Sediments for Determination and Modelling of Process Parameters and Dewatering Construction	489
<i>B. Heinrich, M. Struzina, S. Knopke, S. Peine</i>	
Dewatering Challenges in an Large Scale Production Hard Rock Open Pit in Northern Sweden	498
<i>D. Hagedorn, N. Hoth, H. Mwagalanyi</i>	
The Significance of Ground Water Flow Modelling Study for Simulation of Open Cast Mine Dewatering and Assessing the Environmental Impact of Drainage	503
<i>J. Szczepinski</i>	
Linking Waste Rock Dump Construction and Design with Seepage Geochemistry: an Integrated Approach Using Quantitative Tools	507
<i>S. Pearce, B. Dobchuk, R. Shurniak, J. Song, D. Christensen</i>	
Modelling Approach to Predict Peak Inflows at the Argyle Block Cave Mine, Western Australia	515
<i>G. Beale, T. Syaifullah, D. Saepulloh, S. Daley</i>	
Mine Water Balances – A New Proposed Approach	523
<i>S. Swanson, L. Breckenridge, M. Leduc</i>	
Strategies to Avoid AMD in Active Lignite Mining	530
<i>A. Simon, N. Hoth, C. Drebenscht, P. Jolas</i>	
Mine Closure Wiki – Databank for Mine Closure.....	533
<i>P. Kauppila, T. Kauppila, K. Turunen, A. Pasanen, M. Wahlstrom, H. Punkkinen, T. Karlsson, M. Raisanen, L. Solismaa, A. Tornivaara, C. Larkins, E. Merta, E. Niemelainen, J. Laine-Ylijoki</i>	
Surface Water Management and Encapsulation of Mine Waste to Reduce Water Pollution from Frongoch Mine, Mid Wales.....	541
<i>P. Edwards, T. Williams, P. Stanley</i>	
Environmental Remediation of Abandoned Mines in Portugal – Balance of 15 Years of Activity and New Perspectives	549
<i>E. Carvalho, C. Diamantino, R. Pinto</i>	

Surface Water Monitoring in a Mining Impacted Drainage Basin with Particular Reference to Bio-monitoring of Protected Species	557
<i>T. Metsches, H. Muller, S. Skriewe, M. Paul, A. Nowak, R. Sieland</i>	
Innovative Monitoring Measures in the Phase of Post-mining	565
<i>P. Goerke-Mallet, C. Melchers, A. Muterthies</i>	
Implementation of the Rehabilitation Operational Strategy for the flooded Opencast Mine Tamnava-West Field	573
<i>V. Pavlovic, D. Ignjatovic, T. Subaranovic</i>	
Bio-physical Closure Criteria Without Reference Sites: Realistic Targets in Modified Rivers	581
<i>M. Blanchette, M. Lund, R. Stoney, D. Short, C. Harkin</i>	
Low Carbon After-Life – Overview and First Results of Project LoCAL	588
<i>G. Gzyl, D. Banks, P. Younger, M. Glodniok, N. Burnside, B. Garzon, A. Skalny</i>	
Risk-based Regional Scale Screening of Groundwater Contamination from Abandoned Mining Sites in Serbia - Initial Results	595
<i>N. Atanackovic, V. Dragisic, V. Zivanovic, J. Strbacki, S. Ninkovic</i>	
United Nations Development Programme (UNDP); Detailed Technical Design for Acid Mine Water Treatment in Novo Brdo Mine, Artana / Kososvo.....	603
<i>N. Linder, M. Mackenbach, J. Novak</i>	
Detection of Iron-rich Groundwater “Hot Spots“ Entering Streams in Lusatia	611
<i>F. Musche, S. Paufler, T. Grischek, W. Uhlmann</i>	
Water Drainage in the German Coal Mining After the Close-down in 2018	619
<i>M. Muller</i>	
Management of Water Levels in the Flooded Mines of the Witwatersrand, South Africa	625
<i>H. Coetze</i>	
Experience of Mine Water Quality Evolution at Abandoned Uranium Mines in Germany and the Czech Republic	631
<i>M. Paul, N. Rapantova, J. Wlosok, M. Licbinska, U. Jenk, J. Meyer</i>	
Pycnocline Dynamics in an Abandoned and Flooded MineStyle Template – How to Write a 6 Page Full Paper for IMWA2016	632
<i>G. Wieber, F. Enzmann, M. Kersten</i>	
Water Management Issues in an Abandoned Coal Mine District (Torre Del Bierzo, Spain)	637
<i>A. Ordóñez, R. Alvarez, J. Loredo</i>	
Comparing Acid and Metal Loading Before and After Stream Capturing Subsidence Closure	639
<i>N. Daniels, N. Sullivan, J. Bowman</i>	
Column Testing and 1D Reactive Transport Modeling To Evaluate Uranium Plume Persistence Processes	647
<i>R. Johnson, S. Morrison, S. Morris, A. Tigar, W. Dam, J. Dayvault</i>	
A 3D Numerical Model to Assess the Performance of the Reclamation Measures for an Abandoned Mine Site	655
<i>M.-P. Ethier, B. Bussiere, M. Aubertin, S. Broda</i>	
Long-Term Remediation of Acid Mine Drainage from Abandoned Coal Mine Using Integrated (Anaerobic and Aerobic) Passive Treatment System, in South Africa: A Pilot Study	663
<i>N. Novhe, H. Coetzee, B. Yibas, M. Atanasova, R. Netshitungulwana, M. Molebogang, M. Tlou</i>	
Impact of Fertilizer Effluent Disposed in Dolerite Quarries on the Groundwater Quality	671
<i>P. Lourens, D. Vermeulen, F. Fourie, J. Haumann</i>	
Investigation of the Effects of Groundwater Resurgence and Subsequent Exfiltration of Ferrous Groundwater from the Dump Site of the Witznitz Former Lignite Mine Into the Pleisse and Wyhra Rivers	679
<i>R. Schlottmann, H. Mansel, L. Luckner</i>	

VOLUME 2

Geochemical and Microbial Conditions of a Lignite Coal Spoil and Overburden Area in Middle Germany and Environmental Impact Decades After Remediation	688
<i>S. Willscher, M. Schaum, J. Goldammer, D. Knippert, D. Kuhn, H. Ihling, T. Schaarschmidt</i>	
Municipal Sludge Ash for Abatement of ARD	694
<i>C. Nilsson, S. Karlsson, V. Sjoberg, T. Kronholm</i>	
Green Liquor Dregs in Mine Waste Remediation, from Laboratory Investigations to Field Application	701
<i>S. Siren, C. Maurice, L. Alakangas</i>	
Geochemical Evaluation of Cemented Paste Tailings in a Flooded Underground Mine	709
<i>W. Schafer</i>	
Preliminary Results from Experiments with Cement Slurries to Control Acid Mine Drainage in Waste Rocks from Brukunga Mine in South Australia	720
<i>M. Sephton, J. Webb</i>	
Trace Substances in Ascending Mine Waters – Environmental and Social Effects in Urban Areas	727
<i>A. Banning, P. Schutte-Bestek</i>	
Assessing Post-mining Risks in the Long Term: Ten Years of Hydrological Monitoring in Liège (Belgium)	731
<i>R. Benedicta, F. Christophe, D. Jean-Pierre, V. Mathieu, P. Daniel</i>	
Restoration, Governance and Regional Development in the South of Leipzig	735
<i>L. Hahnel</i>	
Water Resources Monitoring and Mine Water Control in Portuguese Old Uranium Mines	740
<i>C. Diamantino, E. Carvalho, R. Pinto</i>	

Derivation of Natural Background Values for Groundwater in Conjunction with the Remediation of a Sandstone-hosted Uranium Mine	748
<i>M. Frenzel, K. Nindel, S. Eulenberger, U. Jenk, M. Paul</i>	
A Conceptual Surface Model for Rehabilitation of Nyala Mine Terrain and Improvement of the Pit Lake Safety Status.....	754
<i>S. Mhlongo, F. Amponsah-Dacosta</i>	
The Kizel Coal Basin (The Western Urals, Russia): Environmental problems and Solutions.....	761
<i>E. Khayrulina, V. Khmurchik, N. Maksimovich</i>	
Reduction of Seepage Outflow from Potash Tailings Piles by Improvement of Greening: Results of a Hydrological Simulation.....	767
<i>C. Hildmann, L. Rosel, B. Zimmermann, D. Knoche, W.-D. Hartung, F. Benthäus</i>	
Results of Field Scale Phytoremediation Experiments on a Former Uranium Mining Site	775
<i>S. Willscher, L. Jablonski, D. Mirgorodski, D. Ollivier, D. Merten, J. Wittig, G. Buchel</i>	
Developing Sustainable Biotechnologies for Mine Water Treatment in the 21ST Century	777
<i>B. Johnson, A. Santos, C. Falagan, R. Jones, B. Grail, R. Holanda, S. Hedrich</i>	
Passive Biochemical Treatment of Ferriferous Mine Drainage: Lorraine Mine Site, Northern Quebec, Canada	785
<i>T. Genty, B. Bussier, M. Paradie, C. Neculita</i>	
Microbial Communities in Passive Remediation Systems at Three Abandoned Coal Mine Sites in the United Kingdom	791
<i>C. Falagan, I. Smail, B. Grail, D. Johnson</i>	
Performance Review of an Operational Reducing Alkalinity Producing System (RAPS) Treating Coal Mine Waters at Tan-y-Garn, Wales	799
<i>I. Smail, P. Thorn</i>	
Baffle Curtain Installation to Enhance Treatment Efficiency for Operational Coal Mine Water Treatment Schemes.....	807
<i>S. Chamberlain, A. Moorhouse</i>	
Passive Water Purification of Pit Lakes – A Case Study from the Closed Hammaslahti Cu-Zn-Au Mine	815
<i>M. Raisanen, M. Bomberg, J. Makinen</i>	
Field Trial of an Ion Exchange Based Metal Removal Technology in the Treatment of Mine Waters.....	823
<i>P. Upreti, G. Tangye, K. Huddersman, I. Smail</i>	
Extreme Recovery Membrane Process and Zero Liquid Discharge Low Temperature Crystallization for Treating Scaling Mine Waters	831
<i>M. Man, X. Yin, Z. Zhou, B. Sparrow, S. Lee, M. Frank</i>	
The Complicated Role of CO₂ in Mine Water Treatment	839
<i>R. Hedin, B. Hedin</i>	
Performance of Synthesized Hybrid Hydrogel Nanocomposite Applied for the Removal of Metal Ions from Aqueous Solutions	845
<i>E. Fosso-Kankeu, H. Mittal, F. Waanders, S. Ray</i>	
Feasibility Study on Seepage Water Treatment at a Uranium TMF Site by Ion Exchange and Ferric Hydroxide Adsorption	853
<i>A. Kassahun, J. Laubrich, M. Paul</i>	
Research and Development of Waste Waters Vibroacoustic Purification Methods for Mining Enterprises	854
<i>C. Drebendstedt, Y. Agafonov, G. Fedorov</i>	
Sorption of Arsenate on Ettringite Formed in Sulphate Removal from Mine Drainage Water	862
<i>E.-T. Tolonen, T. Luukkonen, H. Runtti, J. Ramo, U. Lassi</i>	
Iron and Arsenic Removal Rates in a Continuous Flow Reactor Treating As-rich Acid Mine Drainage (AMD)	869
<i>L. Fernandez-Rojo, C. Casiot, A. Desoeuvre, C. Braungardt, E. Torres, P. Le Pape, G. Morin, V. Tardy, E. Resongles, S. Delpoux, J. Boisson, G. Grapin, M. Hery</i>	
Passive Treatment of Radioactive Mine Water in Urgeiriça Uranium Mine, Portugal	876
<i>R. Pinto, Z. Oliveira, C. Diamantino, E. Carvalho</i>	
Treatment of Seepage Water from a Tailings Pond of Uranium Mining: Column Tests with a Novel Schwertmannite Adsorbent	884
<i>D. Burghardt, J. Richter, E. Simon, S. Reichel, E. Janneck, J. Laubrich</i>	
Advanced Chemical Oxidation for Arsenic Treatment at a Flooded Uranium Mine with a Bio-geochemically Reduced Mine Water Pool	889
<i>M. Paul, A. Kassahun, K. Sommer, J. Meyer, L. Braun</i>	
Cadmium Removal from Real Mine Water by Electrocoagulation.....	897
<i>E. Nariyan, M. Sillanpaa, C. Wolkersdorfer</i>	
Manganese Removal from New Zealand Coal Mine Drainage Using Limestone Leaching Beds	901
<i>H. Christenson, J. Pope, D. Trumm, B. Uster, N. Newman, M. Young</i>	
Development of a Low-tech Treatment for Neutral Mine Water – A Case Study	908
<i>L. Sartzi, M. Backstrom</i>	
Nitrate Reduction in Real Mine Water Using Zero-valent Iron (ZVI) and Iron Waste.....	914
<i>D. Lopes, M. Sillanpaa, C. Wolkersdorfer</i>	
FAMDT - A New Approach for Flexible AMD Treatment	920
<i>M. Gast, H.-J. Kochen, V. Zarach</i>	
Use of Alkaline Mine Waste As Treatment for Acid Drainage	926
<i>A. Gomez-Arias, J. Castillo, E. Heerden, D. Vermeulen</i>	

A Compact Passive Treatment Process for AMD Using Rice Husk and Rice Bran	932
<i>T. Hamai, Y. Sato, K. Kojima, T. Miura, K. Hayashi, T. Sakakibara, K. Hatsuya, M. Kobayashi, N. Masuda, K. Takamoto, M. Sowanaka, T. Sakata</i>	
Microbial Iron Retention in the Groundwater Upstream to a River	939
<i>C. Hildmann, R. Schopke, M. Walko, K. Mazur</i>	
Sulfate Reducing Bioreactor Longevity Estimates based on Substrate Characterization and Initial Carbon Release	947
<i>L. Figueiroa, L. Landkamer, D. Drennan, J. Sharp, I. Lee</i>	
Development of a Pilot-Scale Semi-Passive System for the Bioremediation of ARD	952
<i>R. Hille, N. Mooruth, T. Marais, N. Naidoo, G. Moss, S. Harrison, R. Muhlbauer</i>	
On Site Feasibility Study on Biotechnical Sulphate Reduction	960
<i>A. Gerth, A. Hebner, F.-C. Benthaus</i>	
Characteristics and Treatment of Mine Water from Three Historical Coal Workings in Yorkshire, UK: Interrelationships Between Rates in Geochemical, Environmental and Operational Processes	965
<i>R. Perry, A. Dudeney, B. Chan</i>	
Characterisation of Fly Ashes for Minimisation of Acid Mine Drainage from Coal Mining Waste Rocks	972
<i>A. Qureshi, Y. Jia, C. Maurice, B. Ohlander</i>	
The Use of Limestone as a Strategy to Remove Sulphate from Mine Waters with Suphate Concentrations Below the Limit Defined by Gypsum Solubility	982
<i>A. Silva, V. Leao</i>	
Reduction of Salinity and Hardness of Water Using Copolymerized Biopolymers	989
<i>E. Fosso-Kankeu, F. Waanders, E. Maloy, B. Steyn</i>	
Removal of Iron and Suspended Solids in Mine Water Treated by Vertical Flow Reactor	997
<i>Y. Cheong, G. Yim, S. Ji, C. Oh, J. Ahn, E. Seo</i>	
Removal of Oxoanions From Water: Comparison of a Novel Schwertmannite Adsorbent and an Iron Hydroxide Adsorbent	999
<i>E. Simon, D. Burghardi, J. Richter, S. Reichel, E. Janneck</i>	
Application of Biomass Ashes for Treatment of Acid Mine Drainage	1003
<i>A. Bogush, C. Dabu, V. Tikhova, L. Campos, J. Stegemann, G. Anoshin</i>	
Treatment of Chromate(VI) and Vanadate(V) Polluted Wastewaters Using Schwertmannite Adsorbents	1007
<i>M. Klug, E. Janneck, S. Reichel, S. Peiffer</i>	
Microbial Community Dynamics During the Biochemical Treatment of Acid Mine Drainage Under Three Different Hydraulic Retention Times	1011
<i>Y. Vasquez, M. Escobar, C. Neculita, Z. Arbeli, F. Roldan</i>	
Comparative Genomic Analysis of Acidophilic Iron Oxidizing Bacteria from a Pilot Plant for the Microbial Remediation of AMD Water: Insights into Strategies for Speciation and Metabolic Adaptation to Life at Low pH and under Low Nutrient Concentration	1017
<i>M. Muhling, S. Ullrich, A. Poehlein, M. Voitel, A. Drechsel, B. Erler, J. Tischler, C. Gonzalez, D. Holmes, M. Schlamann</i>	
Mineralogical Changes within Polish Weissliegend Sandstones During Bioleaching	1022
<i>J. Heim, K. Bachmann, A. Rahfeld, R. Mockel, S. Schopf, J. Gutzmer, M. Schlamann</i>	
Microbiology and Chemistry Interactions in a Biological Sulphate-Reducing Process	1029
<i>M. Arnold, J. Mäkinen, M. Salo, M. Bomberg</i>	
Sulfur Cycling in an Oil Sands Tailings Pond	1037
<i>S. Stasik, K. Wendt-Pothoff</i>	
Characterising Environmental Risks Associated with Sulfide-bearing Gold Wastes	1045
<i>A. Opitz, M. Becker, S. Harrison, J. Broadhurst</i>	
Bioleaching of Indium-bearing Sphalerite Under Underground Mining Temperatures	1053
<i>N. Eisen, M. Schlamann, S. Schopf</i>	
Acid Mine Water Treatment Using Novel Acidophilic Iron-Oxidizing Bacteria of the Genus "Ferrovum": Effect of Oxygen and Carbon Dioxide on Survival	1055
<i>R. Jwair, J. Tischler, E. Janneck, M. Schlamann</i>	
Environmental Parameters As Drivers of Bacterial Communities Responsible for Arsenic Removal from Acid Mine Drainage	1059
<i>V. Tardy, C. Casiot, L. Fernandez-Rojo, E. Resongles, A. Desoeuvre, M. Hery</i>	
Coupled Hydromechanical Model For Assessing Land Subsidence Due To Salt Layers Dissolution	1062
<i>S. Gourdier, C. Vong, B. Bazargan-Sabet</i>	
Graphic Methods for Judging Sources of Roof Water Inrush – A Case Study, China	1069
<i>C. Wang</i>	
Mine Water Outbreak and Stability Risks: Examples and Challenges from England and Wales	1073
<i>W. Mayes, A. Jarvis</i>	
Integrated Slope Stability and Dewatering Evaluation: Optimizing Slopes to Optimize Value	1079
<i>L. Breckenridge, B. Fisher, M. Leduc</i>	
Risk Assessment of Coal Mining under Sand Aquifers	1087
<i>W. Sui, B. Yang</i>	
Monitoring and numerical simulation of water inrush pathway caused by coal mining above karstic confined aquifer with high water pressure	1094
<i>Y. Sun, Z. Xu</i>	
Use of Tensiometers to Determine the Moisture Characterization Point in Ores	1099
<i>A. Wijdeveld, T. Evens, J. Pennekamp</i>	
Geogenic Caverns in Rock Salt Formations – A Key to Genetic Processes and Hazard Potential	1107
<i>S. Hontzsch, S. Zeibig</i>	

Vulnerability Analysis on Potash Mining Dumps Using Tomographic Measurements, Modeling and Petrophysical Investigations	1109
T. Schicht, K. Dunnbier, K. Thiemann, F. Borne	
Seismologic Long-time Monitoring of the Inner Burden Dump in Schlabendorf/south with Hazards of Soil-liquefaction Causing Deformations of the Terrain Surface	1110
T. Schicht, A. Gessert, H. Thoma, B. Lucke, H.-P. Schleubner, B. Duschka	
Forecasting the Water Disaster for Coal Mining Under Sea Area in the Beizao Coalmine, Shandong Province, China	1112
Z. Xu, Y. Sun	
Advances in Techniques and Equipment of Mine Water Prevention and Control in China	1119
S. Dong, Q. Liu, H. Wang	
Diagnosis of Operating Mine Dewatering Wells Efficiency through Groundwater Modelling	1121
H. Idrysy, L. Sultanov	
Adit Dewatering at a Proposed Gold Mine: Numerical Analysis of a Large-Scale Long-Term Pumping Test	1129
D. Paszkowski, C. Mendoza, T. Crozier, M. Holtby	
Open Pit Mine Flooding Prognosis Making use of Analytical Element Modelling in Fractured Hard Rock	1136
R. Dennis, I. Dennis	
From Catchment Hydrology to Dewatering at Mine Sites	1144
D. Graham, C. Tomsu, E. Martensson	
Modeling Groundwater and Heat Flow Subject to Freezing and Thawing	1145
V. Clausnitzer, V. Mirny	
Field Tests and Ecological Assessment of an Opencast Mine-Dewatering using a Horizontal Directional Drilled Well	1149
M. Nitz, R. Eichler, M. Biedermann, H. Mansel, C. Drebennstedt, M. Struzina, P. Jolas	
Best Practices Checklist for Modelling Mine Waters	1156
J. Vandenberg, K. Salzauer, S. Donald	
Prediction of Source Term Leachate Quality from Waste Rock Dumps: A Case Study from an Iron Ore Deposit in Northern Sweden	1165
J. Charles, J. Declercq, R. Bowell, A. Barnes, R. Warrender	
Coupled Reactive Mass Transport for the East Rand Basin (RSA)	1170
M. Eckart, C. Klinger, I. Dennis, R. Dennis	
Saltwater Injection Into a Fractured Aquifer: A Density-coupled Mass-Transport Model	1178
J. Luo, M. Beek, J. Plumacher, S. Seifert, B. Monninkhoff	
PCGEOFIM – Integrated Modelling of Mining specific Groundwater Dynamics and Soil Water Budget	1184
R. Blankenburg, F. Bruckner, H. Ceranski, H. Mansel	
Modeling the Changes in Water Quality of AMD Along the Flow Path	1190
R. Schopke, V. Preub, L. Zahn, K. Thurmer	
Reactive Transport Modelling of Iron-II and Sulphate in the Former Lusatian Lignite Mining Areas	1197
A. Weber, C. Koch, O. Totsche, F. Bilek	
Modelling the Hydrogeochemistry of Decommissioned Opencast Coal Mines	1205
A. Huisamen, C. Wolkersdorfer	
Decision Making For Sustainable Tailings and Water Management – A Dynamic Modelling Approach	1212
B. Sennerforss, P. Wallman	
Reactive Transport Modelling Based on Velocity Fields Obtained on Drill Core Scale	1219
J. Lippmann-Pipke, L. Karimzadeh, P. Blanc, S. Eichelbaum, S. Schymura, T. Fruhwirt, K. Rogoz, J. Kulenkampff	
AcquaTailings: A Tool for Streamlining Mining Water Budgets	1221
G. Pereira, H. Rocha, D. Hoffert, P. Paiva	
Reactive Transport Modelling of the Contaminant Release from Uranium Tailings Using PhreeqC/Excel-coupling	1229
R. Sieland, T. Metschies, S. Jahn	
Validating WRD Conceptual Models and Implications for Mine Closure in Semi Arid Environments: a High Level Assessment Using Field Data	1237
S. Pearce, J. Pearce	
3D Geological Modelling for Geo-environmental Characterization of Mineral Deposits and Pragmatic Management of Geochemical Risks	1241
J. Dent, T. Rotting, M. Williams	
Fate of Radium in River and Lake Sediments Impacted by Coal Mining Sites in Silesia (Poland)	1244
C. Courbet, M. Wysocka, L. Martin, I. Chmielewska, M. Bonczyk, B. Michalik, E. Barker, M. Zebracki, A. Mangeret	
Reducing Life-cycle Costs of Passive Mine Water Treatment by Recovery of Metals from Treatment Wastes	1250
M. Bailey, C. Gandy, A. Jarvis	
Metal Recovery from Mine WATERS: Feasibility and Options—An Example Assessment from the Colorado Mineral Belt, USA	1258
R. Bowell, K. Smith, G. Plumlee, P. Hageman, R. Kleinmann	
Long-term Minimization of Mine Water Treatment Costs Through Passive Treatment and Production of a Saleable Iron Oxide Sludge	1262
R. Hedin	
An Overview of the Use of Ion Exchange to Extract Wealth from Mine Waters	1269
E. Hardwick, J. Hardwick	
Membrane Electrolysis – A Promising Technology for Mine Water Treatment, Radionuclide Separation, and Extraction of Valuable Metals	1275
H.-J. Friedrich	

Experimental Determination of Process Parameters for Mine Water Treatment and Permissible Utilization of the Iron-rich Residues	1282
<i>K.-U. Ulrich, C. Nitsche, M. Struzina, P. Jolas</i>	
Recovery of Copper from Chilean Mine Waste Waters.....	1290
<i>K. Sole, A. Prinsloo, E. Hardwick</i>	
A Sustainable Approach to Managing the Treatment of Mine Waters Associated with Historic Mining.....	1298
<i>J. Crooks, P. Thorn</i>	
Membranes and Minewater – Waste Or Revenue Stream	1305
<i>S. Chesters, P. Morton, M. Fazel</i>	
Opportunities for Zinc Compound Recovery from Mining Influenced Water	1318
<i>L. Figueroa, K. Whysner</i>	
Integrating the Acid Mine Drainage Value Chain - Polluted Water Abstraction to Sustainable Environmental Conformance.....	1323
<i>A. Steytler, C. Munnik, H. Craukamp</i>	
REE Behavior During Evaporative Precipitation in a Severely Affected-AMD Creek (SW Spain)	1331
<i>M. Olias, C. Canovas, R. Perez-Lopez, F. Macias, J. Riera, J. Nieto</i>	
Advanced (Bio)Hydrometallurgical Methods for the Optimized Extraction and Beneficiation of Rare Earth Elements from Ion Adsorption Clays.....	1334
<i>R. Matthies, M. Stutzer, G. Kunze, S. Kutschke, N. Jordan, L. Zeidler, M. Haschke</i>	
Technologies for Sulphate Removal with Valorisation Options.....	1336
<i>M. Arnold, M. Gericke, R. Muhlbauer</i>	
Hydrological Characterization and Optimization of In-Situ Recovery	1340
<i>J. Krause, J. Nicolai, H. Marten</i>	
Geochemistry of In-Situ Recovery of Metals	1348
<i>J. Nicolai, H. Marten, J. Krause, H. Kalka, M. Zauner</i>	
Nanofiltration – A New Separation Pathway in Secondary Mining	1349
<i>K. Meschke, K. Gunnior, B. Daus, R. Haseneder, J.-U. Repke</i>	
Economic Potential for reprocessing Copper Mine Tailings in Chile	1357
<i>M. Drobe, A. Schippers, J. Vasters</i>	
Investigations on Heap Leaching Material and Potential Recovery of Strategic Elements	1359
<i>M. Ussath, M. Grimmer, N. Hoth, C. Wendler, F. Haubrich, U. Kelm</i>	
Specific Retention of Copper and Strategic Elements from Chilean Mine Water with Zeolites and Peat-Based Sorption Media	1363
<i>J. Günther, M. Ussath, N. Hoth, C. Drebendstedt</i>	
Application of a Peat-Humic Agent for AMD Remediation and Element Removal	1369
<i>A. Bogush, V. Voronin, V. Tikhova, G. Anoshin</i>	
Author Index	