

BACKGROUND INFORMATION

Genomics to provide more effective treatment options for mining wastewater

PROJECT DESCRIPTION

This research can improve the passive treatment of water where naturally occurring biological processes are harnessed to detoxify contaminated water.

Metal mining effluents are potential sources of toxic compounds for many different receiving aquatic environments. This research group will characterize the complex microbial communities that are present during bioremediation of mining wastewater by obtaining their metagenomic¹ profiles. Current mine effluent treatment methods require large-scale chemical treatment of both metal leaching (ML) and acid rock drainage (ARD) in order for mining to be environmentally sustainable.

In some cases, bioremediation provides an alternative to chemical treatment because microbial consortia are effective in reducing metals to less toxic forms or to sequester metals as part of their detoxification mechanism. In particular, **sulfate-reducing bacteria** (SRB) are effective in bioremediation of mine drainage containing sulphate and metals. However, SRB rely on other members of a diverse microbial community to provide them with carbon compounds and other nutrients needed to survive. Therefore, understanding the complex interactions of the microbial community is essential to implement effective bioremediation and passive treatment systems. The research group will track existing populations of micro-organisms over time and in changing environmental conditions to monitor the effect of different variables on microbial community composition.

The social science and humanities (SSH) arm of this study seeks a more nuanced understanding of treatment decisions related to mine effluent treatment. The objective is to understand the processes through which the mining industry and its stakeholders make science-based decisions and the implications of those processes for the adoption of novel genomic technologies. Researchers will use field-based and 'mixed' research methods to collect and analyze data and fieldwork focuses predominantly at the level of local communities with field sites at the two locations selected for the main study, supplemented by a nearby site. Mixed methods offer a pragmatic and pluralistic mix of qualitative and quantitative approaches adaptable to different phases of a study. The SSH project will combine field-based ethnographic and case study techniques with survey methods, historical and content analysis, and systematic literature reviews.

PROJECT LEADER BIOGRAPHY

Dr. Susan Baldwin is an associate professor at UBC in the Department of Chemical and Biological Engineering and is currently studying the use of microbial communities in the bioremediation of mine drainage. She holds a doctorate from the University of Toronto in Biomedical Engineering and an MSc in Mechanical Engineering from the University of Cape Town, South Africa. Dr. Baldwin completed her postdoctoral training at McGill University in Montreal in the modeling of hydrometallurgical reactors and at Delft University of Technology in the Netherlands in hydrometallurgy with a focus on iron oxidation.

¹ Metagenomics combines molecular biology and genetics in an attempt to identify, and characterize the genetic material from environmental samples and apply that knowledge to reveal important characteristics of that particular microbial community.

ADDITIONAL INFORMATION

Project title: The Development of Genomic Tools for Monitoring and Improving Passive Mitigation of Mine Drainage

Project Value: \$1,554,985

Primary Project Funding: Genome British Columbia - \$777,435

Co-funding:

Mount Polley Mine	\$350,800
Teck Cominco Metals Ltd.	\$210,760
Natural Sciences and Engineering Research Council	\$165,990
NatureWorks Remediation Corp.	\$ 50,000

Project Leader: Dr. Sue Baldwin, Dept. of Chemical and Biological Engineering, UBC

Co-Applicants:

Dr. Steven Hallam, Dept. of Microbiology & Immunology, UBC
Dr. Janet Atkinson-Grosjean, W. Maurice Young Centre for Applied Ethics, UBC

Involved Research Institutions: The University of British Columbia (UBC)

Fields of Activity: Bioremediation, microbial ecology, mining

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