Research on risk of metal contamination in inactive mine could help reclamation efforts

September 17 2020, by Katie Willis

U of A post-doctoral researcher Konstantin von Gunten conducts field work at the Cluff Lake uranium mine site in northwestern Saskatchewan. Credit: University of Alberta

New research by University of Alberta scientists on the risks for metal contamination at an inactive mining site in northwestern Saskatchewan

could help inform a strategy for a safe long-term reclamation of the site.

The research team examined two environments at the Cluff Lake uranium mine site: two industrial mine pits and naturally occurring wetlands. Their results suggest that dispersed, nano-sized particles in water, known as colloids, play an important role in understanding the long-term stability of the site—despite the fact they are not examined during traditional monitoring practices.

"Normal practice in consulting does not include looking at these particles, but skipping this step may cause us to miss some of the ways metals such as uranium and nickel may disperse at the site," said Konstantin von Gunten, a post-doctoral fellow in the Faculty of Science.

"Over time, these tiny particles containing metals may begin to collect and form into precipitating particles that could settle and accumulate, forming contaminated sediments."

The formation and stability of colloids were not only affected by the chemical composition of the corresponding environments, but were also tightly linked to microbiological processes—making it especially challenging to model and predict their behavior, von Gunten noted.

The Cluff Lake uranium mine has been inactive for nearly two decades. The U of A scientists worked to better understand the long-term stability of metals at the site and consult on best practices for remediation—an important consideration for Canada, which is the world's second largest producer of uranium.

"Uranium and nickel residue left over during the mining process are the main concern here," explained von Gunten, who conducted the research as part of his Ph.D. studies with associate professor Daniel Alessi. "We want to understand what will happen with these metals over time. Will

they stay in place? Or will they begin to affect surface and groundwater in the surrounding environment? The more data that can be obtained through monitoring and scientific work, the better the decisions that can be made about the reclamation of the mine."

Though extensive research is still needed, these studies contribute to building recommendations for testing and monitoring in the region, said Alessi, who holds the Encana Chair in Water Resources.

"For sites with similar environmental factors, this research could be an excellent model for building a strategy for testing and monitoring contaminants," he said.

For Cluff Lake, the research also feeds into a long-term monitoring plan, helping to identify the type of equipment and method of monitoring that might be useful in the region.

The research project was co-led by Alessi and professor Kurt Konhauser. Funding was provided by the Natural Sciences and Engineering Research Council of Canada and UAlberta North.

More information: Konstantin von Gunten et al. Biogeochemistry of U, Ni, and As in two meromictic pit lakes at the Cluff Lake uranium mine, northern Saskatchewan, *Canadian Journal of Earth Sciences* (2018). DOI: 10.1139/cjes-2017-0149

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