Your Yukon

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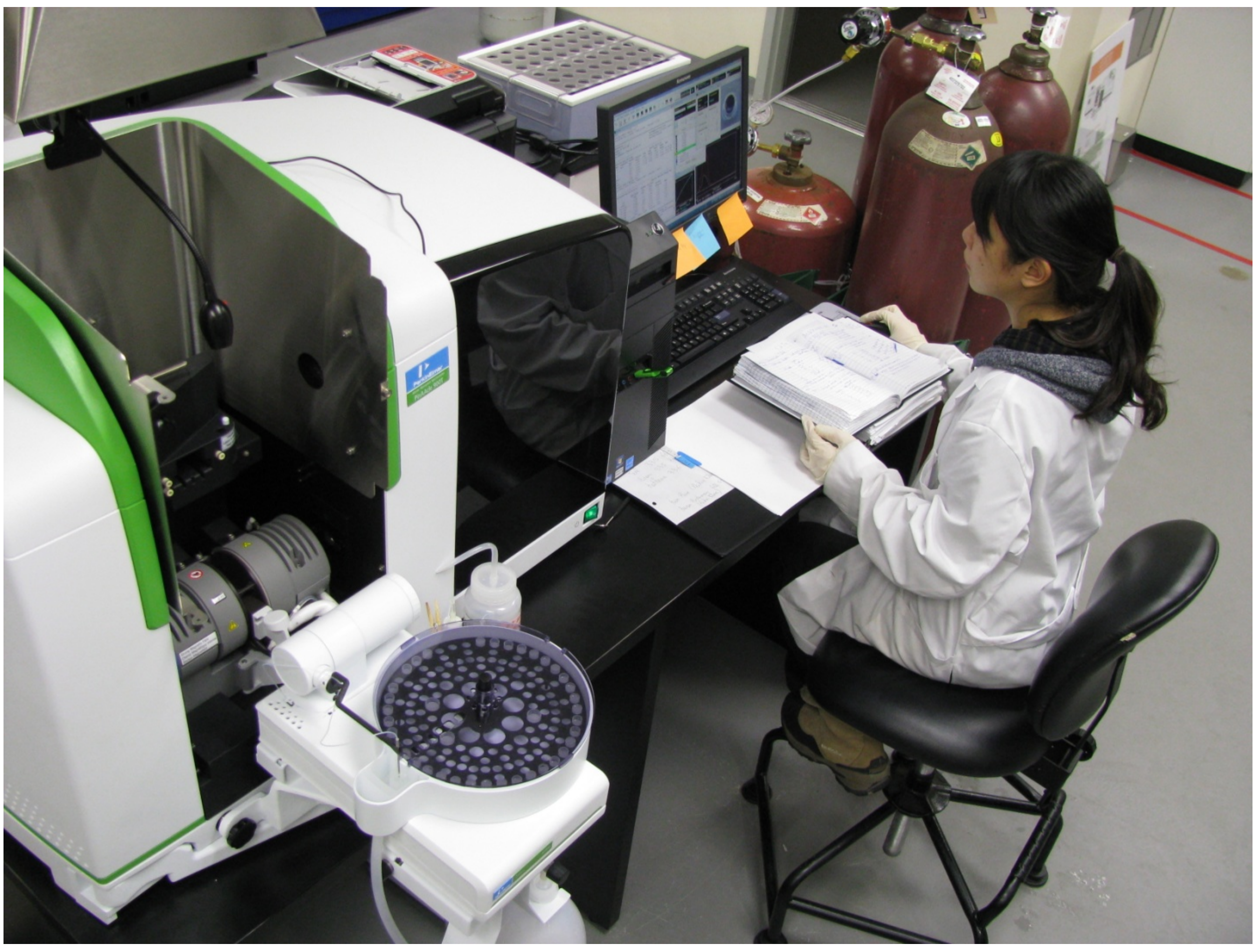
Versatile machine and happy bacteria serve science, education and mining at Yukon College



Student works with the new Atomic Absorption Spectrophotometer at Yukon College. Yukon College photo

Mining developments that make the news are often controversial. A casual glance at the media might well leave one thinking that good news for the industry must always be bad news for others who fear for the health of the environment.

“Mining and the environment are often seen as competing entities,” says Amelie Janin, NSERC Industrial Research Chair in Mine Life Cycle at Yukon College. But the chemist, her colleagues and their students are adapting some state-of-the-art research methods to the industry in the North, which promise to serve the hopes and needs of environmentalists *and* miners.

Recently, scientists at the college have honed their skills on a new Atomic Absorption Spectrophotometer and on contaminant cleanup techniques using a Bioreactor. These can be used to help locate new, rich sources of ore, remove toxic metal waste from the environment, and do both while serving the educational needs of future scientists and technicians.

The spectrophotometer, or “AA” as it’s called around the lab, is a very versatile piece of technology, says Janin. In fact, versatility was one of the most essential features when the device was being considered for the college. The researchers were also looking for reliability that is for something that would require very little maintenance up here, far from major centres.

Three mine sites in the territory employ a similar technology, says Janin, but the company machines are not available for student use. The college AA is also somewhat more complex. “We have different requirements,” she says. “When we talk about the environment, we are looking at very, very low concentrations. When we talk about ore concentrations for the company, then it’s very, very high concentrations. We wanted this machine to do both.” By “very low concentrations” of contaminants, such as arsenic, Janin is referring to amounts at the lowest level of detection.

The AA itself is a modern relative of the spectroscope, long used by astronomers to determine the makeup of stars, distant planets and other celestial bodies. A star's components, such as the gas helium, reveal themselves in characteristic lines within a spectrum of the star's light. Metals found in earthly soil, water and plant samples will give off light after being heated to incandescence in an AA. "We can process any sample until it is in liquid form and then it can be analyzed in this machine," says Janin.

The machine is not portable, she adds. Though only about .9 by .6 metres (roughly three feet by two feet) it presents its own large set of demands. The lab wiring at the college had to be reconfigured to accommodate the AA and a special ventilation system installed. As well, says Janin, "We only started to use it about two months ago. It takes time to get used to the software and yet another digital device."

Also being explored, in conjunction with the AA, are bioremediation techniques. Using live organisms, in this case bacteria, to help with contaminant cleanup has proven effective in the south, says Janin. "What works in the south may work in the North."

The chemist and her colleagues are studying the potential of a passive bioreactor, as opposed to an active bioreactor. An active reactor requires maintenance people to be present on the site. A passive reactor doesn't require attention "all day long" and this is especially attractive for an industry trying to maintain scattered and isolated operations.

In fact, friendly bacteria can do the job without constant supervision. The process is elegant. "I collect bacteria from sediments in a creek," says Janin. These sediments, or substrates, contain many different bacteria that specialize in different jobs. In this case the helpful organisms employ sulphates in a sample, e.g. mine waste water, to produce sulphides. The sulphides precipitate metals that have been floating freely in the water. Thus sequestered, the metals are easier to remove. “It’s a way to reduce metal concentrations to very low levels,” she says.

Climate is the big challenge when it comes to bioreactors. “Climate is the tough thing, the one we all think about when we think about bioremediation,” she stresses. The cold of the North results in different and fewer varieties of bacteria being available in substrates. As well, biological processes can be slowed down by cold. “They like it where it’s warm, so we’re looking at trying to find a recipe that we could put in in the Yukon to help nurture the bacteria and make them happy,” she adds.

At the lab, wood chips and biochar are also being employed to cheer up the bacteria. “In nature there are a lot of mechanisms to sequester contaminants in the environment,” says Janin. “Wood is good at this. Wood is porous and bacteria like that kind of environment.” Mixing metal with wood chips keeps the metal close by and makes it easier for the sulphide-producing bacteria to do their work. Running the results of their labour through the Atomic Absorption Spectrophotometer can reveal just how happy they are.

“We are working at solving northern challenges with local innovative solutions,” says Janin. “ A lot of great things are happening: in the Yukon we are starting to take ownership of the research.”

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