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NIST: 'Hard Rock' Standard Reference Material Makes Identifying Chemicals In Mine Waste Easier

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NIST News:

Across the American West's Rocky and Sierra mountains, miners dug for gold, silver, zinc and lead to make their fortunes in the Gold Rush of the 19th and early 20th centuries.

As they burrowed into the mountains seeking thick veins of valuable ore, they tossed tons of rock waste outside their mine entrances.

Now, beautiful mountain vistas are marred by mine waste dumps that have turned into eyesores of yellow, orange or white rock piles over time. This "hard rock mine waste" is not just ugly, it contains materials that can endanger the environment.

The National Institute of Standards and Technology (NIST) has released a Standard Reference Material (SRM) that not only helps evaluate the environmental challenges posed by the old waste piles, but gives today's mining companies a tool to help ensure efficient and environmentally sound mining practices.

Waste piles and the problems they cause are found in mining regions across the globe.

Steve Wilson, a chemist with the U.S. Geological Survey(link is external) (USGS), provided one example of how the piles can become dangerous. Water from rain or melting snow mixes with pyrite, known to many as "fool's gold," and turns the runoff into sulfuric acid that pulls metals such as lead, zinc and copper from the piles of waste. These metals are then carried down mountainsides and eventually into rivers, where they accumulate in the sediment.

The new SRM 2780a contains powdered waste from three hard rock mine piles near the former mining boom town of Silverton, Colorado. USGS scientists collected, ground, blended and bottled the waste for NIST.

SRM 2780a provides certified values for 35 elements from aluminum to zirconium that are commonly found in the waste rock material—double the number of certified elements that were in its popular predecessor (SRM 2780). SRM 2780a also provides values for all but one of the 15 rare earth elements in the lanthanide series (elements 57 through 71 on the periodic table).

"The more elements with reliable concentrations, the more useful the SRM will be," said NIST analytical chemist John Sieber, the project leader.

NIST researchers thoroughly evaluate materials for SRMs using a variety of in-house methods and technologies. Sieber worked with a group of Canadian and U.S. scientists to measure the values assigned to the elements in SRM 2780a.

As part of a NIST initiative to increase the number of laboratories that create certified reference materials, Sieber and his colleague, Robert Watters, also worked with the Center for Mineral Technology (CETEM) in Brazil. In parallel to the NIST process, CETEM brought together experts from Australia, Bulgaria, Canada, Ireland, Mongolia, Russia and South Africa to test the hard rock mine waste.

Combining results from the two projects meant a total of 11 diverse analytical methods contributed to the chemical characterizations and increased the accuracy of the SRM.

"The additional detailed results may also help geologists and mining engineers better understand the mineralogy and the chemistry involved in the weathering of the mine waste and aid in developing improved mitigation strategies for abandoned mine sites and the reclamation of valuable resources from mine waste material," Sieber said.

Scientists typically use SRMs to validate the accuracy of results from their analytical methods—typically a spectrometer calibrated to determine chemical composition. Environmental researchers can use SRM 2780a to learn the contents of hard rock mine waste to determine potential health hazards and to prioritize remediation plans.

Mining companies employ the SRM in a variety of ways, such as ensuring that they are accurately tracking and reporting their environmental impacts to regulatory agencies.

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