



# Mining and Metallurgical Society of America

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## **Critical Minerals as By-Products of Production and Criticality in Intellectual Capital**

**November 20, 2020 -- Time: 1pm**

**Presented by: Dr. Philip C Keller and Dr. Corby G. Anderson, Colorado School of Mines.  
Webinar via Zoom**

This issue of material criticality has been receiving much attention recently from governments all over the world. Net import reliance can hint at the supply-based risk for materials. Current efforts to increase supply stability of critical materials through by-product or co-product production alongside more common elements is summarized. A metal can be defined as a by-product if the revenue gained from the sale of that metal is not enough to cover the full cost of the mine. On the other hand, if the full costs of the mine can be covered solely by the sale of the minor metal, then it is considered a co-product.

Minor metals not economically viable to mine as a primary material are mined as a by-product to materials that are able to produce enough revenue to cover mine expenses. This allows increased quantities of critical materials to be recovered and can help to relieve supply risks and shortages.

As Mining and Metallurgy Departments in the US, Canada and Australia continue to erode, new and existing Intellectual Capital is at risk.

Video - <https://youtu.be/MMH0q8NdCtA>

### **Q&A**

Mark Bowron 01:34 PM - Wow, you've pointed out the problem, what is the solution?

Bruce Moyer 01:37 PM - Industry must create a demand for a work force that then generates the population of students wanting to major in mineral processing and extraction. Is there a big enough industry in the USA to create this demand?

Brett Carlson 01:43 PM - Hey Dr. Anderson, Any advice for an incoming faculty member?

Bruce Moyer 01:44 PM - I am still confused. If there are jobs, why aren't there students with their wallets out to pay tuition to the few US schools in mineral processing and extraction?

Miranda Hendrix 01:47 PM - Which countries would you say are modeling an effort similar to China? (Maybe not the same scale, but similar.)

Mark Bowron 01:48 PM - From a mineral econ perspective, as soon as the US develops / invests in domestic capacity or processing, the Chinese cut the price because they subsidize it, rendering the US efforts uneconomic. Thoughts?

Paul Hampton 01:49 PM - What is the best strategy for processing REs. It seems that companies are basing economics on 20 products. Is that practical? Marketing seems to be big issue. Also waste products can be difficult such as uranium. These are not easy projects.

## Chat

From Dr. Corby Anderson to Everyone: 01:03 PM - The stamp mill (in the background picture) is the Lexington stamp mill in Butte, America. It is now a park. It was part of the Lexington Mines started in 1875 to mine silver. AJ Davis sold it in 1881 and became Montana's first millionaire.

From Betty Gibbs to Everyone: 01:07 PM - These slides are available on the MMSA Web site from the main page.

From Amy Tuzzolino to All Panelists: 01:07 PM - Thanks!

From Art Ibrado to All Panelists: 01:21 PM - Thanks Phil. Good presentation.

From Amy Tuzzolino to All Panelists: 01:34 PM - Great talk! I'm an Economic Geologist and our academic opportunities are decreasing as well.

From Kadri Dagdelen to All Panelists: 01:35 PM - Hello Corby, Great presentation. I have one question: Is Western Europe sleeping on the wheel as well?

From Walter Weinig to All Panelists: 01:36 PM - Where are the metallurgists entering industry today (outside China) coming from? Seems like I see more coming from chemical/process engineering.

From Ann Carpenter to All Panelists: 01:38 PM - In order to compete with, out compete the Chinese, shouldn't we be mirroring what they are doing? Their gov't provides 'incentives' to capture students, research, etc.

From Antonio Pucci to All Panelists: 01:38 PM - How to use looming circular economy emergence with respect to leverage the wealth of already mined tailings facilities present and past which do contain these elements and how to make it economically viable.

From [Bill Wilson](#) to Everyone: 01:39 PM - Should we have more collaboration with our Canadian colleagues in all of these areas?

From [Francisco Sotillo](#) to All Panelists: 01:43 PM - The Cerro de Pasco Copper Co. created a great complex, the La Oroya Metallurgical Complex in Peru producing, Cu, Zn, V, In, Ge, Au, Ag, etc. Now, it is not working, why we do not invest in re-starting the complex and used it as an American School of Metallurgy as was done by Cerro de Pasco? Should we only based on USA or could we get tied with friendly countries that could be our source of this critical minerals? Could we get students from other countries to be trained in USA including professors by this way?

From [Lee Gochmour](#) to Everyone: 01:45 PM - Those tails also represent considerable liability to weigh against their potential...

From [Francisco Sotillo](#) to All Panelists: 01:47 PM - In Peru the mines around La Oroya are active.

From [Nick Myers](#) to All Panelists: 01:48 PM - Phoenix Tailings is currently developing tech in an economical and environmentally feasible way to recover value from tailings. We've developed the tech to refining REE concentrate in-house domestically.

From [Ben Parrish](#) to All Panelists: 01:48 PM - Could cleanup costs be offset by processing for critical minerals at those tailings projects mentioned? Something like a superfund site that will require investment of funds - could additional processing kill two birds with one stone? Clean up, but also an additional supply chain of critical minerals and cost offset for the remediation? Depends on concentration of those metals, I guess.

From [Ross Bhappu](#) to All Panelists: 01:48 PM - Phil and Corby, Thanks for the insights. I have been involved historically in the critical minerals space and have struggled with the lack of industry support for non-Chinese critical minerals. The issue for me was that western industry consumers would not step up and enter into long term offtake agreements to ensure the viability of these western producers. Do you think the government should take a more active role to ensure viability? Thanks, Ross Bhappu

From [Erik Spiller](#) to Everyone: 01:49 PM - In reality, tailings are tailings for a reason. To rely on reprocessing to recover value is expensive, often because of the energy required for additional liberation.

From [Ben Parrish](#) to Everyone: 01:51 PM - Certainly, those tailings projects would never be economic as just critical minerals recovery projects. They'd probably have to be remediation first, by product collection second.

From Mark Bowron to All Panelists: 01:51 PM - From a mineral econ perspective, as soon as the US develops / invests in domestic capacity or processing, the Chinese cut the price because they subsidize it, rendering the US efforts uneconomic. Thoughts?

From Nick Myers to Everyone: 01:53 PM - Actually Erik - it depends on the tailings site - Phoenix Tailings is working on developing tech to recover a portfolio of products economically from tailings. Some sites can be quite valuable if you recover material in the right ways.

From Ben Parrish to Everyone: 01:53 PM - Phil is spot on there - Mining has bad PR and hasn't done much to make it better.

From Bruce Moyer to Everyone: 01:54 PM - Yes, great point, Phil. There is an image problem that needs to be worked on.