



The mineral treasure that almost got away: Re-evaluating yesterday's mine waste

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Rare metals and semi-metals such as In, Ga, Se, Te and rare earth elements (REE) are increasing in demand for use in “new” and “green” technology. Yet, before the end of the 20th century the applications and thus the markets for these elements were limited. In many mines, the exploration paradigms and current knowledge as well as contemporary analytical methodology likely resulted in minerals hosting these metals to end up as waste, that is, on the mine dumps. In other cases, they were identified, but considered as mineralogical “exotica”. Even extremely well-known and traditionally valuable metals such as gold went undetected on the dumps in some mine fields. This is due to a combination of factors such as that the deposits were “of the wrong type”, assays were expensive, and suitable laboratory capacity sparse. This implies that in many regions, this old mine waste is a potential resource for several sought-after metals and semi-metals, including the ones increasingly used in modern high-tech applications. Admittedly, many older dumps and dump fields host only minor to moderate total amounts of material, but in today's society – increasingly focused on sustainability and related needs for recycling – this is likely to become an asset.

In Sweden, many mine dumps date back hundreds of years or more as mining has been documented to go back at least 1000 years. Before the 20th century, only a single or, at best, a couple of metals were extracted from any given mine. Due to modern development in analytical techniques, the concentrations of trace elements, including highly sought-after metals and semi-metals can be obtained at moderate costs today. The presence of variable amounts of precious and rare elements along with the main ore commodity has now been documented in several cases. A recently started project in the classic, Palaeoproterozoic Bergslagen ore province in central Sweden is aimed at resolving the potential for finding and utilising these “unknown treasures”. A conservative estimate based on SGU databases is that in this province alone, there are over 6500 mineralisations/deposits. A majority of these have associated mine dumps and in the case of more recently mined deposits, different types of tailings. Initial results highlight the high average contents of REE's and identify their mineralogical and textural distribution in apatite-iron oxide ore present in both dumps and tailings. In addition, we report the occurrence of previously undetected mineralisation of indium and tungsten in different mine dumps in the western part of the province.