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Geochemical and mineralogical characterization of tailings in Namibia – unveiling future resources of critical metals

STEPHANIE LOHMEIER[1], RAINER ELLMIES[2], ESTER SHALIMBA[3] AND BERND LOTTERMOSER[4]

[1]Clausthal University of Technology
[2]Gecko Namibia
[3]University of Namibia
[4]RWTH Aachen University

Despite being described as a country rich in poor resources, Namibia hosts several well-known ore deposits. Many of these mining operations saw decades of activity and are now closed or mothballed. There are more than 200 abandoned mine sites in Namibia which have been mined for specific commodities only, while other minerals were regarded as gangue. Some of the mining operations bear a certain potential for critical raw materials in their gangue mineralogy. The Okorusu tailings dump, resulting from former fluorite mining, contains significant amounts of relict fluorite and apatite as well as minor amounts of REE fluorocarbonates. Due to their complex mineralogy and intense intergrowth with other minerals, REE extraction seems not feasible. In contrast, reprocessing for fluorite is promising and utilization of apatite will push Namibia forward on its way to more independence from fertilizer imports. Tailings at Uis, resulting from former tin mining, contain still noteworthy contents of Sn, Nb-Ta, and Li. While extraction of relict cassiterite and Nb-Ta minerals from the tailings is likely feasible, extraction of Li-minerals is challenging. This opened the way to consider other possible uses of the tailings material, including the production of bricks for the local market as these tailings are rich in clays. Tailings of the historic Namib Lead Mine (Dublin Mine) are a potential resource of Zn and Pb. Although base metal ores can be rich in critical metals, the Namib Lead tailings are not known to contain highly critical metals such as Ge, Ga and In in appreciate amounts. While tailings are often only considered as an environmental impact, some of them contain valuable resources of (critical) metals, which would allow for reprocessing and safe final disposal. Therefore, it is worthwhile to apply modern geochemical and mineralogical analytical methods to reveal potential raw material resources from historic wastes for the future.