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Witwatersrand gold tailings as a possible uranium resource: opportunities and constraints

The Witwatersrand gold deposits in South Africa contain significant amounts of uranium (U) –a fact that is also reflected in the mineralogical and chemical composition of their tailings. In contrast to many other mine sites, the presence of uranium in the Witwatersrand tailings has not only been recognised for some time, but over the last few decades it has also been seized as an economic opportunity by several mining enterprises.

Consequently, re-mining for both gold and uranium has occurred at several historical tailings disposal sites in the Witwatersrand region. The aim of this case study is to demonstrate that uranium in tailings and other mine waste may constitute a significant resource. The project is part of a larger study to establish a global inventory and database on uranium in mine wastes. Such information is not only crucial from an environmental and human health perspective but also from a resource efficiency point of view –a topic that is of increasing relevance due to the world's ever-growing raw material demand.

This paper explores research and reclamation projects on uranium occurrence in gold mine tailings of the Witwatersrand basin as a case study from South Africa. Collected data includes spatial, geochemical, mineralogical and volumetric information on uraniferous mine waste. For the Witwatersrand tailings, we have been able to quantify associated uranium resources identifying opportunities and constraints in extracting uranium from reclaimed tailings.
Owing to comparably low uranium prices rendering uranium recovery often uneconomic, considerable quantities of uranium are left in the tailings. While the Witwatersrand tailings may represent exceptional mine wastes due to the high uranium content in the primary ore, the case study still highlights the resource potential that is associated with mine wastes in general.

Re-mining of Witwatersrand tailings for uranium and subsequent reclamation would not only provide short-term economic revenues, but it would also reduce the likelihood of uranium dispersion into the environment and associated pollution impacts. The presence of substantial uranium contents in wastes of non-uranium mines is an often-neglected fact. This study contributes to an increased awareness of uranium in mine wastes highlighting the potential economic and ecologic benefits of recovering uranium from mine waste.

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