Advanced methods for optimized biomining and processing of REE from ion-adsorption clay deposits, Madagascar

LISZA ZEIDLER[1], MEINOLF STÜTZER[2], GOTTHARD KUNZE[3], SABINE KUTSCHKE[4], NORBERT JORDAN[5] AND MICHAEL HASCHKE[1]

[1]G.U.B. Ingenieur AG, Glacisstr. 2, 01099 Dresden Germany, lisza.zeidler@gub-ing.de
[2]GMBU, Erich-Neuß-Weg 5, 06120 Halle (Saale), Germany, stuetzer@gmbu.de
[3]IPK Gatersleben, Corrensstr. 3, 06466 Stadt Seeland, Germany, kunzeg@ipk-gatersleben.de
[4]HZDR, Helmholtz Inst. Freiberg for Resource Technology, Halsbruecker Straße 34, 09599 Freiberg, Germany, s.kutschke@hzdr.de
[5]HZDR, Inst. of Resource Ecology, Bautzner Landstr. 400, 01328 Dresden, Germany, n.jordan@hzdr.de

Rare Earth Elements (REE), especially heavy ones, are among the critical technology elements of modern developed countries. The bottleneck of REE supply is not abundance but the deficit in sophisticated, cost efficient and sustainable recovery technologies from sources such as ion-adsorption clays (IACs). Currently applied empirical IAC-leaching technologies include multiple leach cycles of ammonium sulfate or NaCl, but these entail severe environmental hazards. Further, separation of single REE and concentration to high-purity products required for high-tech applications is delicate, complicates the winning process and increases the price of the end-product. Bio-hydrometallurgical REE recovery is able to replace today's common recovery practice and provides a favorable approach for cost effective separation. Core elements of our new project are to: (1) Facilitate efficient *in-situ* leaching processes by geotechnical optimization of permeability of IAC (REE-rich laterite) using cryotechnology to reduce the environmental footprint by avoiding material transport to heap-leaching facilities, (2) Develop selective and environmentally benign bio-hydrometallurgical extraction techniques focusing on microbial metabolites for the leaching process and screening of plant and microbial biomass, and develop genetically engineered yeast cultures for selective bioaccumulation and -sorption of single REEs, (3) Integrate new and robust thermodynamic data to devise reliable predictive numerical simulation tools to evaluate and optimize technologies for extraction and separation of REE from IACs.