

# Biometallurgy of Rare Earth Elements using Methylootrophs

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Rare Earth Elements (REEs, lanthanides) are a category of 15 metallic elements in the periodic table that have similar physical and chemical properties. These lanthanides are used in a variety of products, including nuclear reactor components, cell phones, magnets, camera lenses, and batteries, and as such are fundamental to industrialized cultures around the world. Lanthanides were supposed to be unrelated to biological processes until they were discovered in the active site of the XoxF-type methanol dehydrogenase of the methylootrophic bacteria. When lanthanides are present, this methanol dehydrogenase (XoxF) allows methylootrophs grow on one-carbon molecules. When lanthanides are not supplied, these methylootrophs utilizes the Ca-dependent methanol dehydrogenase i.e. MxaFI. In the presence of XoxF, REEs are transported into the periplasm and shuttled into the cytoplasm, where they are stored in crystalline deposits. Here we present, isolation and characterization of extremophiles from rocks collected from SURF, and lanthanides chelation using selected extremophiles. We also present genetic, phenotypic, and biochemical characterization of a gene cluster that enables growth of extremophiles on insoluble REEs. Investigation of the gene cluster will not only further our understanding of lanthanides biochemistry but will also generate sustainable methods for REEs recovery.

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