

Work Package 2

Natural Biogeochemistry of Cobalt: Biotic and Abiotic Constraints on Cobalt Mineral Formation and Transformation

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The focus of this work package is to further our understanding of the **natural biogeochemistry** of cobalt in **aerobic and anaerobic environments** by studying potential interactions with **prokaryotic and eukaryotic microbiota** and their effects on cobalt speciation and mobility using field samples and extant microbial communities.

The work will aim to: 1) increase our knowledge of trace element cycling and the formation of Co-rich ores and 2) provide underpinning information to help develop options for bioprocessing.

The fate of Co will be explored in a series of microcosm experiments constructed by the [Manchester Geomicrobiology Group](#) and [Dundee Geomicrobiology Group](#) partners using field samples collected and characterized in WP1. These experiments will use samples from mineralogically and lithologically contrasting horizons of laterite deposits. In addition to monitoring geochemical and microbial changes in these experiments, crucially we will also look at the evolution of Fe(III) mineral phases in the microcosms using a combination of XRF, EPMA, ESEM, HRTEM and dynamic, in situ XRD while the oxidation state and coordination environment of the Co (Fe, Mn, and Ni) will be assessed using X-ray spectroscopy and microscopy techniques at [Diamond Light Source](#).

The combination of geochemical, microbiological and mineralogical analyses will give a unique dataset illustrating the phase associations of Fe, Mn, and Co during microbial redox progressions catalysed by extant microbial communities and will complement more targeted experiments using high density pure cultures of the well-studied model laboratory Fe(III) and Mn(VI)reducing bacteria used for bioprocessing in WP3.