

## Formation of biogenic iron-oxide nodules in reducing sediments as an analogue of near-field redox reaction products

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Redox fronts are created in the Near-field (NF) by the rock-groundwater-microbial reaction with different oxidation environments. The development of redox fronts and oxide formation in the NF of high-level radioactive waste (HLW) repositories of all designs is usually unavoidable. The long-term behaviour of such oxides in the post closure of repository however is little known. An analogue of redox front formation and long-term behavior of secondary formed iron oxyhydroxide under reducing environment in sedimentary rock therefore have been studied. This iron-oxide as known as cylindrical aggregates from a few mm to cm in diameter named Takashikozo in Japan is commonly found in unconsolidated clayey to silty Quaternary lacustrine type sediments. Results of a detailed structural and geochemical characterization reveal that iron oxyhydroxide has been formed by a redox reaction and remained under reducing geological environment for last 300ka. During the Takashikozo formation, Fe, S, P, Mn and natural uranium have also been effectively accumulated in and around the aggregates. Microbial analysis with 16S RNA also shows that certain microbial consortium of iron-reducing bacteria (IRB) and iron-oxidizing bacteria (IOB) contributes to formation of its zonal structure and preferential some major and trace elemental accumulation. The remaining and its influence on nuclide retardation by sorption of iron oxyhydroxide for long geological time in reducing environment is presumably controlled by the microbial activity that can be generated in the post-closure NF geological environment.