Biogenic Fe-oxyhydroxide nodules encrusted iron-oxide bacteria in reducing sediments

H.YOSHIDA [1*], K.YAMAMOTO[1], Y.MURAKAMI[2], M.TAKEUCHI[1], Y.HOTTA[3] & K.MATSUOKA[4]

[1] Nagoya University, Nagoya University Museum / Graduate School of Environmental Research, Nagoya 464-8601, JAPAN; *dora@num.nagoya-u.ac.jp

[2] Japan Atomic Energy Agency (JAEA), Tono Geoscience Center, Gifu, Mizunami, JAPAN

[3] Ashahi University, School of Dentistry, Hozumi, Gifu 501-0296, JAPAN

[4]Toyohashi Museum of Natural History, Oiwa,Toyohashi JAPAN

Fe-oxyhydroxides are naturally formed at the surface of the Earth where they influence element accumulation as well as contaminant migration. It is less well known that there is also a mechanism for the long-term persistence of Fe-oxyhydroxides in subsurface reducing geological environments. Buried Fe-oxyhydroxide nodules (*takashikozo*) containing bacteria occur in the reducing subsurface environment of clayey to silty Quaternary lacustrine sediments. They are cylindrical in shape and range from a few mm to 2-3 cm in diameter by up to several tens of cm long. Detailed geological and geochemical investigations show that Fe-oxyhydroxide nodules are formed by a redox reaction and that they can persist in a reducing sedimentary environment for at least 0.3Ma. Phylogenetic analysis based on microbial 16S rDNA shows that iron-oxidizing bacteria contribute to the formation of *takashikozo* and to the preferential accumulation in them of Fe and other elements. Direct microscopic observations revealed the formation of biogenic Fe-oxyhydroxides film, which may well encrust microbial colonies, in the pore spaces. *Takashikozo* can be seen as analogues of high level radioactive waste (HLW) iron canisters' degradation products. Thus the observations made here have profound implications for understanding the role of microbial consortia in long-term nuclide retardation in reducing geological environments through the formation and preservation of Fe-oxyhydroxides.