Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

BBG005-12 Room: 301B Time: May 23 14:10-14:25

Domain-level diagnosis and quantification of prokaryotic cell and abundance in extant microbial communities

Ken Takai[1*], Motoko Igisu[3], Manabu Nishizawa[1], Takuro Nunoura[2], Miho Hirai[2], Masanori Kaneko[5], Hiroshi Naraoka[5], Yuichiro Ueno[4], Yukio Isozaki[3]

[1]PEL, JAMSTEC, [2]SUGAR Project, JAMSTEC, [3]University of Tokyo, [4]GEI, TITEC, [5]Kyusyu Univeristy

Domain-level microscopic diagnosis of microorganisms and quantification of Bacteria/Archaea population and abundance in presently living prokaryotic communities are the most fundamental research step to elucidate natural microbial communities and their ecological and biogeochemical significance.
Domain-level diagnosis of microbial cell may be more crucial for geologists and paleobiologists investigating microfossils and evolution of life on Earth. Identification of ancient microfossils to potential modern microbial taxa is quite significant because not only existence of certain phylotypes of life but also occurrence of certain phenotypes and metabolisms could be deduced. Nevertheless, it is still based largely on the morphological traits and is not fully justified in many cases. Recently, in situ analytical techniques such as Raman spectroscopy and secondary ion mass spectroscopy (SIMS) have been applied to obtain chemical signatures of the micrometer-sized fossils for diagnosis of their phylogenetic and phenotypic traits. A micro Fourier transform infrared (micro-FTIR) spectroscopy is one of the non-destructive in situ analyses of chemical components preserved in the microfossils.
Igisu et al. (Precambrian Res., 173, 19-26, 2009) demonstrated that specific IR absorption peaks (~2925 and ~2960 cm-1 bands for aliphatic CH2 and CH3, respectively) would be a potential chemical indicator for domain-level identification of prokaryotic fossils. Indeed, several of the extant eukaryotic, bacterial and archaeal microorganisms and two bacterial lipid extracts were examined, and the R3/2 values represented the diagnostic potential for the domain-level identification of the extant and fossilized cells. Based on the R3/2 values obtained from the Proterozoic microfossils (~850 Ma and ~1900 Ma), it was strongly suggested that both the Proterozoic microfossils originated from the ancient Bacteria. Yet, the systematic standardization of domain-specific R3/2 values and the methodological configuration for extant microbial communities have been little established. In this study, therefore, we sought to establish the domain-level diagnosis and quantification of Bacteria/Archaea abundance ratio in the natural microbial community by micro FTIR spectroscopy.

Keywords: Archaea, Bacteria, Diagnosis, FT-IR