

祖先型プロモーター配列推定に基づく大気酸素濃度進化とシアノバクテリア抗酸化酵素遺伝子発現量との関連性の解明
Understanding the relationship between rise of oxygen and gene expression of cyanobacterial antioxidant enzymes

原田 真理子^{1*}; 古川 龍太郎²; 横堀 伸一²; 田近 英一³; 山岸 明彦²
HARADA, Mariko^{1*}; FURUKAWA, Ryutaro²; YOKOBORI, Shin-ichi²; TAJIKA, Eiichi³; YAMAGISHI, Akihiko²

¹ 東京大学大学院理学系研究科, ² 東京薬科大学生命科学部分子生命科学科, ³ 東京大学大学院新領域創成科学研究科
¹The University of Tokyo, ²Tokyo University of Pharmacy and Life Science, ³The University of Tokyo

Though free oxygen (O₂) was absent from the atmosphere during the first half of Earth's 4.5-billion-year history, which is considered to have increased dramatically at the beginning and the end Proterozoic (~2.2 and ~0.6 billion years ago, respectively). Recent geochemical data suggest that such transitions to an oxic atmosphere were not unidirectional, but appear to have associated with an overshoot and/or a downshoot of the O₂ levels. Such dynamic changes in the redox conditions in the atmosphere must have posed severe environmental stresses to life on Earth. However, how the changes in the O₂ levels affected the biosphere has been poorly understood. Answering this question is of fundamental importance in understanding Earth's history.

Here we focused on the changes in the expression of genes encoding antioxidant enzymes of cyanobacteria through history. Changes in environmental O₂ levels must have affected the production of reactive oxygen species, which in turn affected antioxidant gene expression. Gene expression is regulated by the nucleotide sequence in the promoter regions. Thus we hypothesized that the ancestral promoter sequences of the antioxidant enzymes may reflect the environmental O₂ levels at the time the ancestor existed. In this study, we resurrected the ancestral promoter sequences of the antioxidant enzymes, and discuss its relationship to the O₂ evolution through time. In this presentation, we will first introduce recent models of the atmospheric O₂ evolution through Earth's history, then we will report our progress in resurrecting ancestral promoter sequences of cyanobacterial antioxidant enzymes.

キーワード: 大酸化イベント, 抗酸化酵素, シアノバクテリア
Keywords: rise of oxygen, antioxidant enzymes, cyanobacteria