Mechanism of recalcitrant dissolved organic matter production revealed by model marine bacterial strains
（モデル海洋細菌単離株による難分解性溶存有機物の生成機構の解明）

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Marine dissolved organic matter (DOM) constitutes one of the largest reduced organic carbon pools on the earth's surface. The recalcitrant DOM (RDOM) has been considered to be a major fraction of marine DOM and plays an important role as a slow cycling carbon reservoir. However, source and production mechanism of marine RDOM have not been fully understood. Bacteria have been considered to be major producers of marine RDOM, and bacterial production of RDOM has recently been proposed as a carbon sequestration process. The concept of this process called microbial carbon pump (MCP) was derived from the previous studies of *in vitro* culture experiments, in particular using natural microbial community. Since it would be difficult to identify that the specific species as well as key physiology that contribute to MCP from incubation experiments with natural microbial community, it is still unclear whether differences in bacterial species and/or physiology can affect RDOM production. In this study, to compare mechanisms of RDOM production among bacterial species, I conducted batch culture experiments in which glucose was added as sole carbon source using three model marine bacterial strains, namely *Alteromonas macleodii* (*A. macleodii*) and *Vibrio splendidus* (*V. splendidus*) and *Phaeobacter gallaeciensis* (*P. gallaeciensis*). Furthermore, incubation experiments of natural bacterial community with DOM produced by a bacterial strain were carried out to evaluate degradability of bacterial DOM. Dissolved organic carbon (DOC) concentrations were drastically decreased

during the exponential growth phases and relatively stable during the stationary phases, irrespective of differences in bacterial strains. While, bacterially derived DOM from glucose, namely residual DOC concentration at the end of incubation was considerably high for *V. splendidus* compared with the other two strains. Excitation-emission matrix (EEM) during/after incubations showed that all bacterial strains used in this study produced fluorescent DOM (FDOM) including refractory humic-like FDOM. Interestingly, the EEM patterns of bacterially derived FDOM were different among the three strains. Furthermore, four production processes of humic-like FDOM by bacteria were suggested; (1) production during active growing of bacteria, (2) production with reutilization of bacterial DOM, (3) production with consumption of reserves in bacterial body, and (4) release from the lysis of bacteria. The efficiency of humic-like FDOM production through mineralization of organic matter was different among bacterial species as well as production processes, namely bacterial physiology. Although a part of the DOM derived from bacterial strains were degraded, major part of the DOM (60–80%) was not degraded during incubation using the natural bacterial community. The results of two types of incubation experiments indicated that the efficiency of RDOM production depended on bacterial species and suggested that composition of bacterial species in natural community regulates MCP. All humic-like FDOM derived from bacterial strains was recalcitrant to natural bacterial community. Furthermore, spectral characteristics of the humic-like FDOM were similar to those derived from bacterial strains, suggesting the presence of precursor of humic-like FDOM in DOM derived from bacterial strains.