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# U.S.-Korea Cooperative Research: Carbon Monoxide as a Substrate for Microbial Maintenance

Gary M. King

*Principal Investigator; University of Maine, Orono*

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**Annual Report for Period:**08/2006 - 07/2007

**Submitted on:** 12/04/2007

**Principal Investigator:** King, Gary M.

**Award ID:** 0342779

**Organization:** University of Maine

**Title:**  
U.S.-Korea Cooperative Research: Carbon Monoxide as a Substrate for Microbial Maintenance

**Project Participants**

**Senior Personnel**

**Name:** King, Gary  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Post-doc**

**Graduate Student**

**Name:** Weber, Carolyn  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Ms. Weber has participated in several fundamental aspects of the project, including basic field and lab research and development of a field course that included two foreign partners.

**Undergraduate Student**

**Technician, Programmer**

**Other Participant**

**Research Experience for Undergraduates**

**Organizational Partners**

**Ibaraki University**

**Fukushima University**

**Other Collaborators or Contacts**

Collaborators have included Dr. K. Nanba (Fukushima University) and Dr. Hiroyuki Ohta (Ibaraki University) plus their students (graduate and undergraduate).

**Activities and Findings**

**Research and Education Activities:**

We have conducted field and laboratory research on the microbial biology of carbon monoxide oxidation on various volcanic deposits of Mount Oyama, Miyake Island. In the field studies, rates of carbon monoxide uptake at atmospheric and elevated levels were obtained

for sites of a variety of ages relative to a 2000 eruptive event. In addition, we also measured rates of methane oxidation and a suite of related microbial-ecological variables.

Lab studies have involved extractions of genomic DNA and development and analysis of clone libraries based on the large sub-unit CO dehydrogenase gene, *coxL*. We have also undertaken an effort to isolate and characterize novel CO-oxidizing bacteria from selected field sites.

#### **Findings:**

We observed substantial CO uptake activity even on organic poor deposits from 2000. Greatest potential activity occurred on old (800 yr) deposits supporting a forest. These and most other deposits also consumed significant rates of atmospheric CO. Activity across sites was not correlated with variables such as organic content, water content, or pH. Rates among the Miyake sites were similar to rates observed for comparable Kilauea.

Clone libraries revealed that CO-oxidizing communities were largely comprised of novel taxa for which we know of no cultured representatives. We observed some representatives of the Proteobacteria and Firmicutes, but far less relative to the novel groups than we have observed from Kilauea deposits.

We have obtained two isolates from Miyake, both Proteobacteria- a Mesorhizobium and a Burkholderia spp. Though novel as CO oxidizers, these are relatively common soil and plant-associated bacteria.

#### **Training and Development:**

The project provided extensive field experience for Ms. Weber and importantly, contacts with foreign collaborators with whom longer-term relationships have been established. In addition, results from the project have contributed to a Ph.D. dissertation.

#### **Outreach Activities:**

I have developed a taught a field course in microbial biology that include participation by our foreign partners.

### **Journal Publications**

Gary M. King, "Chemolithotrophic bacteria: distributions, functions and significance in volcanic environments.", *Microbes and Environment*, p. , vol. , (2007). Accepted,

### **Books or Other One-time Publications**

### **Web/Internet Site**

### **Other Specific Products**

### **Contributions**

#### **Contributions within Discipline:**

We have developed new results documenting the role of CO-oxidizing bacteria in the successional development of volcanic deposits.

#### **Contributions to Other Disciplines:**

**Contributions to Human Resource Development:**

We have trained a U.S. graduate student, provided new techniques for 3 foreign grad students and a course in microbial biology for a foreign undergrad student.

**Contributions to Resources for Research and Education:**

We have developed a field course in microbial biology and will provide details of the course for implementation in other systems through our website: [www.kilaueamicrobes.lsu.edu](http://www.kilaueamicrobes.lsu.edu).

**Contributions Beyond Science and Engineering:**

We have enhanced relationships between U.S. and Japanese scientist through bilateral exchanges.

**Special Requirements**

**Special reporting requirements:** None

**Change in Objectives or Scope:** None

**Animal, Human Subjects, Biohazards:** None

**Categories for which nothing is reported:**

Any Book

Any Web/Internet Site

Any Product

Contributions: To Any Other Disciplines