

REPORT OF WG 22 ON IRON SUPPLY AND ITS IMPACT ON BIOGEOCHEMISTRY AND ECOSYSTEMS IN THE NORTH PACIFIC OCEAN

The Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22) held its first meeting on October 25, 2008 from 11:00 to 18:00 under the co-chairmanship of Drs. Fei Chai and Shigenobu Takeda. Members who attended the meeting are listed in *WG 22 Endnote 1* and the meeting agenda can be found in *WG 22 Endnote 2*. The planned schedule and timeline of the Working Group is summarized below:

October 2007

PICES XVI (Victoria, Canada)

- Disbandment of the Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean* (IFEP-AP)
- Establishment of a new Working Group (WG 22), under the direction of Biological Oceanography Committee (BIO)

October 2008

PICES XVII (Dalian, China)

- first WG 22 meeting

October 2009

PICES-2009 (Jeju, Korea)

- second WG 22 meeting (Workshop)

October 2010

PICES-2010 (Seattle, U.S.A)

- third (final) WG 22 meeting (PICES Scientific Report)

AGENDA ITEM 2

Review of WG 22 Terms of Reference

Terms of reference for the Working Group were examined and adopted without revision (*WG 22 Endnote 3*).

AGENDA ITEMS 3 AND 4

Overview on atmospheric deposition of iron in the North Pacific and on vertical and horizontal supplies of iron in the North Pacific

Dr. Chai presented an overview on the atmospheric deposition of iron in the North Pacific Ocean on behalf of Dr. Natalie Mahowald; Dr. Jun Nishioka talked about horizontal iron supplies in the western subarctic Pacific; Dr. Mark Wells discussed the effects of mesoscale eddies in transporting iron in the eastern subarctic Pacific.

AGENDA ITEM 5

Review of national and international, past and ongoing activities on iron biogeochemistry

National reports were given by Canada (Maurice Levasseur), China (Zhongyong Gao) and the U.S.A. (Mark L. Wells). International reports and activities discussed at the meeting consisted of:

- SCOR working group on synthesizing previous ocean iron fertilization data (Shigenobu Takeda),
- Chinese SOLAS project and Asian Dust and Ocean EcoSystem (ADOES) (S. Tan),

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- IOC/WESTPAC (Mitsuo Uematsu),
- Natural Fe Lagrangian Experiments (FeLEX) in the Southern Ocean (Meng Zhou),
- London Convention on Ocean Iron Fertilization (Patricio Bernal and Fei Chai).

Dr. Chai attended the London Convention Scientific Meeting on Iron Fertilization (May 19–23, 2008) where he provided a brief description of PICES and its function to the meeting Scientific Groups. He noted that:

- PICES scientists had been involved in 6 out of 12 iron fertilization experiments during the past 15 years and that PICES has provided a platform to facilitate research activities on ocean iron fertilization (OIF) experiments in the North Pacific. The Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean* was formed under the PICES, and had been responsible for coordinating three OIF experiments in the subarctic Pacific. The Advisory Panel not only helped to coordinate the field experiments, but also facilitated data synthesized and publications.
- The newly established Working Group (WG 22), *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean*, co-chaired by Drs. Shigenobu Takeda (Japan) and Fei Chai (U.S.A.) will focus on two primary goals for the next three years: a) to promote better understanding of natural and anthropogenic iron supplies to the North Pacific and their impact on biogeochemistry and ecosystems; and b) to facilitate closer ties among various research communities (aerosol, physical oceanography, biology, chemistry and modeling) to better integrate new findings and to provide needed feedback to help coordinate research activities.
- In regard to future OIF experiments, PICES can act as an independent scientific organization, and is willing to provide scientific expertise on future OIF experiments in the North Pacific Ocean, including independent evaluation and assessments. The review process will be for the interests of advancing scientific knowledge and potential impact on marine ecosystems in the North Pacific.

AGENDA ITEM 6

Work plan for implementing the Terms of Reference

A work plan, consisting of the following points, was discussed for implementing the Terms of Reference:

- Develop a North Pacific Fe database (Takeda and Wells),
- Determine the natural supplies of iron to the North Pacific (atmospheric dust transport; movement of iron-enriched waters),
- Examine the linkages between iron supply and ecosystem responses,
- Plan national and international scientific programs,
- Set basic questions and make a hypothesis for future iron-related activities in the North Pacific,
- Plan international scientific programs for testing the hypothesis,
- Perform joint cruises,
- Conduct modelling studies (Chai and Yamanaka).

AGENDA ITEM 7

Proposal for a 1-day workshop at PICES-2009

WG 22 proposed a 1-day workshop on natural supplies of iron to the North Pacific to be held at PICES-2009 in Jeju, Korea (*WG 22 Endnote 4*). Recommended co-convenors for the workshop are: Shigenobu Takeda (Japan), Fei Chai (U.S.A.), and William R. Crawford (Canada). Travel support is requested for two scientists to attend the workshop, one scientist on iron biogeochemistry (Ken Bruland, U.S.A.) and another on ecological modelling (Yamanaka, Japan).

WG 22 Endnote 1**WG 22 participation list**Members

Fei Chai (U.S.A., Co-Chairman)
 William P. Cochlan (U.S.A.)
 Zhongyong Gao (China)
 Paul J. Harrison (Canada)
 Kyung-Ryul Kim (Korea)
 Maurice Levasseur (Canada)
 Jun Nishioka (Japan)
 Hiroaki Saito (Japan)
 Suzanne Strom (U.S.A.)
 Shigenobu Takeda (Japan, Co-Chairman)
 Charles Trick (Canada)
 Mitsuo Uematsu (Japan)
 Mark L. Wells (U.S.A.)
 Yasuhiro Yamanaka (Japan)

Observers

not available

WG 22 Endnote 2**WG 22 meeting agenda**

1. Welcome and introductions (Co-Chair), and adoption of agenda
2. Review of WG 22 terms of reference
3. Overview on atmospheric deposition of iron in the North Pacific
4. Overview on vertical and horizontal supplies of iron in the North Pacific
 - Jun Nishioka: Horizontal supplies of iron in the western subarctic Pacific
 - Mark Wells: Effects of mesoscale eddies in transporting iron in the eastern subarctic Pacific
5. Review of national and international, past and ongoing activities on iron biogeochemistry and its impact on marine ecosystems in the North Pacific Ocean
 - National: Canada [M. Levasseur]; China [Z. Gao]; Japan [S. Takeda]; U.S.A. [M.L. Wells];
 - International: SCOR working group on synthesizing previous OIF data [S. Takeda] Chinese SOLAS project and Asian Dust and Ocean EcoSystem (ADOES) [S. TAN] IOC/WESTPAC [M. Uematsu]
 - London Convention on Ocean Iron Fertilization [P. Bernal and F. Chai]
 - Natural Fe Lagrangian Experiments (FeLEX) in the Southern Ocean [M. Zhou]
6. Develop a detailed work plan for implementing the Terms of Reference
7. Proposal for a one-day workshop at PICES-2009

WG 22 Endnote 3**WG 22 Terms of Reference**

1. Compile and synthesize available iron biogeochemistry data in the North Pacific;
2. Review the past and ongoing laboratory, field and modeling studies on iron biogeochemistry and its impact on biological productivity and marine ecosystems in the North Pacific Ocean;
3. Determine the natural supplies of iron to the North Pacific, which includes atmospheric dust transport and movement of iron-enriched waters, and examine linkages between iron supply and ecosystem responses;
4. Identify gaps and issues related to experimental and modeling activities, encourage and plan national and international scientific programs on iron biogeochemistry and its impact on marine ecosystems in the North Pacific;
5. Elucidate the role of iron as a potential regulator of harmful algal bloom (HAB) in coastal ecosystems of the North Pacific.

WG 22 Endnote 4

Proposal for a 1-day workshop at PICES-2009 on

“Natural supplies of iron to the North Pacific and linkages between iron supply and ecosystem responses”

In the subarctic North Pacific Ocean, iron plays a central role in regulating phytoplankton productivity and pelagic ecosystem structure. There are several processes that supply iron from land, shelf sediment and deep waters to the upper ocean. The goal of this workshop is to examine key processes of these iron supply processes that includes atmospheric deposition of mineral Aerosols and combustion substances, lateral transport of coastal iron-enriched waters by eddies and boundary currents, and deep vertical mixing during winter or by strong tidal current at narrow strait. Such knowledge will be used to identify key biogeochemical pathway that should be introduced into the ecosystem models and to plan international scientific programs for better understandings of marine ecosystem responses to changing iron supplies in the North Pacific.