



## **AGU Chapman Conference on the Biological Carbon Pump of the Oceans**

**Brockenhurst, Hampshire, England  
1–4 September 2009**

### **Conveners**

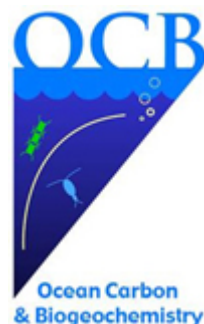
Richard Lampitt, National Oceanography Centre, Southampton, U.K.  
Richard Sanders, National Oceanography Centre, Southampton, U.K.  
Ken Buesseler, Woods Hole Oceanographic Institution, Massachusetts, U.S.

### **Program Committee**

Robert Armstrong, State University of New York, U.S.  
David Billett, National Oceanography Centre, Southampton, U. K.  
Phillip Boyd, NIWA, Dunedin, New Zealand  
Roger Francois, University of British Columbia, Canada  
Mario Hoppema, AWI, Bremerhaven, Germany  
George Jackson, Texas A&M University, U.S.  
Christine Klaas, Alfred Wegener Institute, Bremerhaven, Germany  
Rachel Mills, National Oceanography Centre, Southampton, U. K.  
Uta Passow, University California Santa Barbara, U.S.  
Tammi Richardson, University of South Carolina, U.S.  
Jorge L. Sarmiento, Princeton University, U. S.  
Reiner Schlitzer, Alfred Wegener Institute, Bremerhaven, Germany  
Debbie Steinberg, Virginia Institute of Marine Science, U.S.  
Tom Trull, University of Tasmania, Australia  
George Wolff, University of Liverpool, U. K.

### **Financial Co-Sponsors**

The conveners would wish to gratefully acknowledge the National Oceanography Centre, Southampton and the Ocean Carbon & Biogeochemistry for their generous support of this conference.



**AGU Chapman Conference on the Biological Carbon Pump of the Oceans  
Brockenhurst, Hampshire, England  
1–4 September 2009**

**MEETING AT A GLANCE**

**Tuesday, 1 September**

0700h – 0830h	Breakfast
0830h – 0945h	Session I
1000h – 1115h	Session II
1130h – 1245h	Session III
1245h – 1530h	Lunch and Free Time
1530h – 1700h	Poster Session
1830h – 1945h	Session IV

**Wednesday, 2 September**

0700h – 0830h	Breakfast
0830h – 0945h	Session I
1000h – 1115h	Session II
1130h – 1245h	Session III
1300h – 1900h	National Oceanography Centre, Southampton

**Thursday, 3 September**

0700h – 0830h	Breakfast
0830h – 0945h	Session I
1000h – 1115h	Session II
1130h – 1245h	Session III
1245h – 1530h	Lunch and Free Time
1530h – 1700h	Poster Session
1830h – 1945h	Session IV
2000h	Conference Dinner at the Balmer Lawn Hotel

**Friday, 4 September**

0700h – 0830h	Breakfast
0830h – 0945h	Session I
1000h – 1115h	Session II
1130h – 1245h	Session III
1245h – 1530h	Lunch and Free Time
1530h – 1700h	Poster Session
1830h – 1945h	Session IV

# Program Overview

Sessions and events will take place at the Balmer Lawn Hotel, Brockenhurst, Hampshire, UK. The Registration/Information Desk will be inside the Beaulieu Room foyer throughout the conference.

## TUESDAY, 1 SEPTEMBER 2009

0830h – 0945h  
Beaulieu Room

### Export from the Upper Ocean – Session I

**Smetacek** *Plankton Evolution and the Biological Carbon Pump: Moving from How Much, to Why*

**Wassman** *Principle Aspects of the Particulate Carbon Flux Through and From the Upper Layers*

**Briggs (EC)** *Can Optical Sensors "See" Sinking Particles? - Interpreting in-Situ Spikes in Fluorescence, Backscatter and Attenuation as Sinking Aggregates*

0945h – 1000h  
Beaulieu Room Foyer

### Break

1000h – 1115h  
Beaulieu Room

### Export from the Upper Ocean – Session II

**Emerson** *Determining the Net Annual Biological Carbon Pump and the CaCO<sub>3</sub>: Organic Carbon Production Ratio Using in Situ Measurements of O<sub>2</sub>, N<sub>2</sub>, pCO<sub>2</sub> and pH*

**Mohler (EC)** *Molecular Time Series of Phytoplankton Export from the Upper Water Column at the Bermuda Atlantic Time-Series Station (BATS)*

**Daly** *The Biological Pump in the Eastern Tropical Pacific Oxygen Minimum Zone*

1115h – 1130h  
Arden Room

### Break

1130h – 1245h  
Beaulieu Room

### Export from the Upper Ocean – Session III

**Richardson** *Food Web Dynamics and Carbon Fluxes from the Surface Ocean: Primary Producers and Their Protozoan Predators*

**Sanders** *A New Estimate of Sinking Carbon Export From the Photic Zone*

**Hickman** *Modelling Phytoplankton Distributions in the Ocean: a Novel Multi-Species Approach*

1245h – 1530h  
Savernake/Beresfords Room

### Lunch and Free Time

1530h – 1700h  
Hamble & Avon Rooms

**Poster Session**

1700h – 1830h  
Arden Room

**Break**

1830h – 1945h  
Beaulieu Room

**Export from the Upper Ocean – Session IV**

**Schlitzer** *Quantification of Downward Carbon Fluxes and Remineralization Rates by Assimilation of Water Column Data*

**Hoppema** *Chemical Mass Balance of the Surface Layer in the Southern Ocean for Obtaining Export Production*

1945h – 2000h  
Arden Room

**Break**

**WEDNESDAY, 2 SEPTEMBER 2009**

0830h – 945h  
Beaulieu Room

**Flux Through the Twilight Zone – Session I**

**Steinberg** *Biological Controls on Flux Through the Twilight Zone: What Do We Know, and What Do We Need to Do Next?*

**Van Mooy (EC)** *Assessing Rates of Bacterial Carbon Demand in the Twilight Zone: Results from VERTIGO and Future Approaches*

**Saito** *Vertical and Horizontal Carbon Transport through the Ontogenetic Vertical Migration of Copepods*

0945h – 1000h  
Beaulieu Room Foyer

**Break**

1000h – 1115h  
Beaulieu Room

**Flux Through the Twilight Zone – Session II**

**Lamborg (EC)** *A Brief Review of Recent Advances in Twilight Zone Sinking Particle Collection*

**Kadko** *Rapid Oxygen Utilization in the Ocean Twilight Zone Assessed with the Cosmogenic Isotope  $^{10}\text{Be}$*

**Guidi (EC)** *Sub-mesoscale Variability of Particle (>100  $\mu\text{m}$ ) Export Around Station ALOHA: The OPEREX Cruise*

1115h – 1130h  
Arden Room

**Break**

1130h – 1245h  
Beaulieu Room

### **Flux Through the Twilight Zone – Session III**

**Ragueneau** *A Low Global POC Export Controlled by Seasonality*

**Klaas** *Relation Between POC and Mineral Composition of Sinking Particles in the Water Column: Causes and Consequences*

**Bianchi (EC)** *Quantifying the Biogeochemical Impact of Zooplankton Daily Vertical Migrations*

1300h – 1900h

### **National Oceanography Centre, Southampton**

(Tour, Lecture, and Reception)

1630h

**Trull** *Phase Lags, Sinking Rates and the Transport of Organic Carbon to the Ocean Interior*

## **THURSDAY, 3 SEPTEMBER 2009**

0830h – 945h  
Beaulieu Room

### **Flux to the Deep Ocean Burial – Session I**

**Smith** *Abyssal Ecosystems and the Biological Carbon Pump: Food Limitation, Climate Warming and Iron Fertilization*

**Wenzhoefer** *Benthic Carbon Mineralization: Importance for the Regional and Global Carbon Budget*

**Martin (EC)** *Export Flux and its Transfer Efficiency During the North Atlantic Spring Bloom*

0945h – 1000h  
Beaulieu Room Foyer

### **Break**

1000h – 1115h  
Beaulieu Room

### **Flux to the Deep Ocean Burial – Session II**

**Wolff** *Organic Matter Fluxes and the Response of the Deep-sea Benthos. Clues From the Southern Indian Ocean*

**Wilson (EC)** *Contribution of Zooplankton Fecal Pellets to Carbon Flux in the Deep Ocean at Station M, an Abyssal Time-series Site in the California Current Region of the Eastern North Pacific Ocean*

**Marchetti** *The Morphometrics of Pennate Diatom Frustules in the Sediments are Potential Indicators of Iron-limited Growth in Past Oceans*

1115h – 1130h  
Arden Room

### **Break**

1130h – 1245h  
Beaulieu Room

### **Flux to the Deep Ocean Burial – Session III**

**Gehlen** *The Ocean's Biological Pump in Times of Global Climate Change: Is There a Potential for Significant Feedbacks to Atmospheric CO<sub>2</sub>?*

**Mills** *Quantifying past carbon export and burial in the Southern Ocean*

**Kriest** *Parameterisation of Export, Sinking and Remineralisation and its Effect on Simulated Tracers in Large-scale Models of Marine Biogeochemistry*

1245h – 1530h  
**Savernake/Beresfords Room**

**Lunch and Free Time**

1530h – 1700h  
**Hamble & Avon Rooms**

**Poster Session**

1700h – 1830h  
**Arden Room**

**Break**

1830h – 1945h  
**Beaulieu Room**

**Flux to the Deep Ocean Burial – Session IV**

**Buesseler and Benitez-Nelson** *What Goes Up Must Come Down...But When or Where?*

2000h  
**Savernake/Beresfords Room**

**Conference Dinner**

## FRIDAY, 4 SEPTEMBER 2009

0830h – 0945h  
**Beaulieu Room**

**Sensitivity to Change – Session I**

**Jokulsdottir (EC)** *Mechanistic Model of Sinking Biogenic Particles*

**Blain** *Carbon Export and Natural Iron Fertilization in the Southern Ocean, Large Uncertainties Subsist*

**Sarmiento** *The Status of Modeling Water Column Remineralization*

0945h – 1000h  
**Beaulieu Room Foyer**

**Break**

1000h – 1115h  
**Beaulieu Room**

**Sensitivity to Change – Session II**

**Primeau** *Controls on the Remineralization Profiles of Sinking Organic Matter*

**Passow** *Up or Down: The Biological Pump and Global Change*

**Somes (EC)** *Modeling Nitrogen Isotopes in a Global Marine Ecosystem Model: Constraints on the Coupling Between Denitrification and Nitrogen Fixation*

1115h – 1130h  
Arden Room

**Break**

1130h – 1245h  
Beaulieu Room

**Sensitivity to Change – Session III**

**Christian** *The Biological Pump in the Enhanced Greenhouse: Simulations with the Canadian Earth System Model CanESM1*

**Moore** *Interactions Between Large Scale Circulation and Iron Supply to the Atlantic Ocean: Implications for Nitrogen Fixation and the Biological Carbon Pump*

**Salisbury** *Diagnosing Phytoplankton Uptake of Dissolved Inorganic Carbon (DIC) From Space*

1245h – 1530h  
Savernake/Beresfords Room

**Lunch and Free Time**

1530h – 1700h  
Hamble & Avon Rooms

**Poster Session**

1700h – 1830h  
Arden Room

**Break**

1830h – 1945h  
Beaulieu Room

**Sensitivity to Change – Session IV**

**Lampitt** *The Biological Carbon Pump and Geoengineering: A Story Which is Neither Pure Nor Simple*

**Bopp** *Stimulating the Biological Pump to Mitigate Climate Change by means of Iron Fertilization and enhanced Vertical Mixing: A Review of Modeling Estimates*

**POSTER SESSIONS**

Poster Session will be held in the Hamble & Avon Rooms, Tuesday, Thursday, and Friday from 1530h to 1700h.

**TUESDAY, 1 SEPTEMBER 2009**

- TU101** **Benitez-Nelson** *Investigating the Role of Nitrogen Fixation in Exporting Particulate Carbon to Depth*
- TU102** **Boyd** *Putting the 'Bio' into Modelling the Biogeochemistry of the Twilight Zone*
- TU103** **Cavagna** *Biomarkers and Their  $\delta^{13}\text{C}$  Signature in Suspended Particles in the Open Ocean Water Column: The Case of BONUS-GoodHope Expedition (Southern Ocean)*
- TU104** **Ebersbach** *Impact of Minerals on Degradation of Sinking Aggregates Over the Course of Several Weeks*

- TU105** **Fay** *Using In-situ pCO<sub>2</sub> Observations to Evaluate and Improve Ocean Carbon Models: A North Atlantic Case Study*
- TU106** **Fones** *The Simultaneous Determination of in-situ Vertical Transitions of Color, Redox Sensitive Dissolved Metals and Infaunal Activity in Marine Sediments using G-SPI*
- TU107** **Forest** *Spatio-Temporal Phasing Between Primary Production and Vertical Particle Export in the Fram Strait (Arctic Ocean)*
- TU108** **González** *Export Flux of Biogenic Elements (carbon, carbonate) and Their Main Sources (faecal pellets, phytoplankton) to the Deep Sea Along the Humboldt Current System Off Chile (21°-37°S)*
- TU109** **Harrison** *Estimating Losses to the Radiative Forcing Benefit from Nitros Oxide Production Under Increased Flux in the Biological Carbon Pump*
- TU110** **Hill** *Phytoplankton Community Characterization Using Imaging Multivariate Optical Computing (IMOC) and Spectral Fluorescence Signatures*
- TU111** **Iriarte** *The Importance of Large Cell Size Diatoms to Export Flux of POC and Potential Indicators of Nutrient Change Scenarios in Patagonian Fjords System*
- TU112** **Jacquet** *Twilight Zone Carbon Remineralization Efficiency in the Southern Ocean*
- TU113** **Jiao** *Marine Microbial Carbon Pump*
- TU114** **Jonsson** *Comparison of O<sub>2</sub> Observations and Model Predictions in the Southern Ocean*

### THURSDAY, 3 SEPTEMBER 2009

- TH101** **Kwon** *The Impact of Remineralization Depth on the Air-Sea Carbon Balance*
- TH102** **Lampitt** *Developing PELAGRA: Advances in the use of A Neutrally-Buoyant Sediment Trap*
- TH103** **Lawrenz** *Spectral Fluorescence Approaches to Characterizing Phytoplankton Community Composition: Towards Continuous In Situ Observations of "Sinkers and Floaters"*
- TH104** **Le Moigne** *The Role of Calcite in Enhancing the Flux of Particulate Organic Carbon Into the Deep Ocean. CalMarO project RT12*
- TH105** **Lomas** *A Multi-year Increase in Shallow POC Export is Countered by Enhanced Mesopelagic POC Attenuation in the Sargasso Sea*
- TH106** **Mahaffey** *Seasonality of Bloom Formation in the Permanently Stratified North Pacific Subtropical Gyre*
- TH107** **Maiti** *Thorium-234 Excess and Particle Remineralisation below the Euphotic zone*



- TH108** **Marinov** *Sensitivity of Atmospheric pCO<sub>2</sub> to Changes in the Biological Pump: Does Anthropogenic CO<sub>2</sub> Matter?*
- TH109** **Martin** *Tracing the Biological Carbon Pump Through the Full Water Column: Insights from the Porcupine Abyssal Plain Site*
- TH110** **McDonnell** *Relating Stocks and Sinking Fluxes of Particles in the Mesopelagic Zone: Case Studies from the Subtropical North Atlantic and the West Antarctic Peninsula*
- TH111** **Miquel** *Biologically Mediated Carbon Export in Different Trophic Environments in the South-East Pacific*
- TH112** **Moriceau** *Si-OC Interactions in Diatoms and Their Impact on Diatom Degradation*
- TH113** **Morris** *Assessing the Influence of Biominerals, Calcite and Opal, on the Euphotic Zone Export of Particulate Organic Carbon*
- TH114** **Mouw** *Satellite Retrieval of Phytoplankton Community Size Structure in the Global Ocean*

#### **FRIDAY, 4 SEPTEMBER 2009**

- FR101** **Neuer** *Biological Carbon Pump Comparisons Across a Subtropical Gyre: What Have We Learned?*
- FR102** **Nielsdottir** *The Impact of Natural Fe Fertilisation to the Scotia Sea*
- FR103** **Owens** *A New Record of Particle Flux at the Bermuda Atlantic Time-Series Site From Neutrally Buoyant Sediment Traps*
- FR104** **Plancherel** *A Global Determination of Marine Stoichiometric Remineralization Ratios*
- FR105** **Planchon** *<sup>234</sup>Th, POC and PON Fluxes Along a Transect from Cape Basin to the Northern Weddell Gyre (BONUS-GOODHOPE)*
- FR106** **Planquette** *Trace Metal Distributions and Effects in One of the Most Productive Antarctic Polynyas: the Amundsen Sea*
- FR107** **Pondaven** *The Possible Contribution of Higher Trophic Levels to the Biological Pump*
- FR108** **Poulton** *Coccolithophores and the Efficiency of the Biological Carbon Pump*
- FR109** **Salter** *The Impact of Diatom Community Structure on the Biological Carbon Pump: Results from a Naturally Iron-fertilised Region of the Southern Ocean*
- FR110** **Soler** *Formation of SI-OC Interactions During Diatom Growth, Under Variable Limitations*
- FR111** **Statham** *Fe Recycling Relative to C From Particles Leaving the Upper Ocean in the Southern Ocean*

- FR112**      **Stinchcombe** *Diatoms and New Production: From the Tropics to Sub-polar waters*
- FR113**      **Torres-Valdes** *Distribution of Dissolved Organic Nutrients and Their Effect on Export Production Over the North Atlantic Ocean*
- FR114**      **Tweddle** *Sources and Sinks of Chlorophyll and Phytoplankton Carbon*
- FR115**      **Wang** *Interannual to Decadal Variations of Export Production in the Equatorial Pacific: A Basin-Scale Modeling Study of Climate Impacts*