

**Minutes of the CMTT Taipei Workshop**  
**Taipei, Taiwan**  
**27-29 September 2001**

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## **Present**

Kon-Kee Liu (Chair), Gregg J. Brunskill (Vice chair), Xavier Durrieu de Madron (Rapporteur), Chen-Tung Arthur Chen, Giuseppe Civitarese, Nicolas Dittert, Chuan-Min Hu, Tim Jennerjahn, Kyung-Ryul Kim, Hong-Bin Liu, Temel Oguz, Brad Opdyke, Janusz Pempkowiak, Olivier Ragueneau, MM Sarin, Helmuth Thomas, Shizuo Tsunogai, George T.F. Wong

**Regrets:** Laura David, Shu Gao, Geoffrey Val Klump, Brent McKee, Frank Muller-Karger, Anond Snidvongs

(see **Appendix A** for participant addresses)

## **Thursday 27 September 2001**

Presentation of the different study sites by the participants of the International Symposium on Carbon and Nutrients in Marginal Seas and Tropical Coastal Zones held in the Taipei International Convention Centre. A total of 18 oral presentations (**Appendix B**) were made.

## **Friday 28 September 2001**

### **The CMTT Global Synthesis**

After a presentation of the meeting schedule, K.K. Liu gave an overview of the CMTT and the primary issues to be addressed:

- The terms of references on the quantification of vertical and horizontal carbon and nutrients fluxes in different types of continental margins (boundary current, polar, sub-polar, tropical and marginal systems), where nutrients are used as proxies.
- The definition of the chapters for the marginal and tropical margins, the sample matrix (terms) of the flux inventory, the timetable, the format (*i.e.*, number of pages per chapter) and support (data and reference banking).

It was mentioned the future publication of the volume on the interactions of physical, chemical, biological and sedimentological processes in coastal oceans edited by A. Robinson and K. Brinks that makes unnecessary to insist on those topics in the different chapters of the CMTT synthesis book.

### **The current work on continental margin biogeochemical fluxes**

CTA. Chen presented results on the fluxes in the East and South China Seas emphasizing:

- The different behaviour of C and N;
- The variability of the N/P ratio that is very different from the Redfield ratio;
- The importance of dissolved organic nutrient, in particulate DON to calculate the nutrient fluxes. DOC, DON and DOP are exported to the open sea;
- The steadiness of the system.

Then, he showed schematic diagrams of flow patterns and CO<sub>2</sub> sinks on various marginal seas. He concluded by showing the summary budget of the global continental margins constructed for the chapter on “continental margin exchanges” in the JGOFS synthesis book he wrote with two co-authors.

## **The LOICZ approach**

X. Durrieu de Madron presented the guidelines of the LOICZ biogeochemical budgeting approach. He pointed that this box-model approach could be valid only if strong gradient of properties between the shelf water and the adjacent open-sea water were expected, and that sensitivity analyses were to be performed to assess the robustness of the results.

The following issues were mentioned during the discussion that ensues:

- The necessity to clearly define the time scale appropriate to the budgets;
- The necessity to perform uncertainty tests;
- The possibility to measure total dissolved nitrogen by photo-oxidation;
- The role of hyperpycnal flows.

## **Discussion: The CMTT approach**

K.K. Liu redefined then the objectives and issues that should be addressed in each chapter of the synthesis book:

- quantification of fluxes (inputs and outputs)
- role of the coastal zone (shelf) as a filter
- information on the shelf functioning
- temporal variation

A complete list of the input and output fluxes and the chemical elements to be considered was drawn up (see figure)

## **Report on Si database within the EU SINOPS project**

N. Dittert made a presentation on the World Data Centre for Marine Environmental Sciences (WDC-MARE) database, which was used to compile most of the available data on silica. This database is interactively accessible at [http://www.pangae.de/wdc\\_mare](http://www.pangae.de/wdc_mare). N. Dittert proposed to provide the participants of the meeting with the standard Excel data format. He also mentioned the possibility to set up a retrievable database for bibliography.

## **Discussion: The CMTT database?**

K.K. Liu tackled the issues of data banking of PCO<sub>2</sub> data on continental margins. Different propositions arose:

- contact with other laboratories
- collection of meta-data and data among contributors
- collection of related web sites (*e.g.*, JODC)

## **More discussion on the CMTT approach**

The use of ocean colour images to perform some preliminary typology in terms of chlorophyll content and, possibly, primary production (using case 1 algorithm) for each site was addressed. It

was pointed out that seasonal or monthly maps were preferable to a single annual mean map. This point should be proposed to other continental margin task groups.

The specific objectives to be addressed for each study sites were listed and the participants were asked to write the outlines of their contribution. Contributions for the Mediterranean Sea were merged. Links between adjacent marginal Seas (*e.g.*, Baltic-North Sea, Black Sea-Mediterranean) were encouraged.

## **Saturday 29 September**

### **Short presentation**

Recent PCO<sub>2</sub> measurements in the East China Sea by Dr. Bing-Sun Lee of NCOR

### **Group discussion: geographic regions**

After a reminder of the decisions taken during the previous day, the participants divided in two groups, one on the marginal seas and the other on the tropical margins. Each workgroup provided a written description of their conclusions and recommendations (See **Appendix C**).

### **The future of continental margin studies**

H. Thomas presented the future work on the carbon cycle in the North Sea.

### **General discussion**

The whole assembly then discussed several points:

#### 1. On the synthesis approach

- As complete a budget as possible should be constructed for each basin (See Figure 1).
- The emphasis should be on the continental margin (from the estuary seaward to the slope). However, exchanges with the river-estuary systems or the deep sea should be considered.
- The discussion should cover not only what is already known but also temporal changes and what may happen in the future.
- There should be a sensitivity analysis of the budget. The factors that are uncertain and yet may affect the conclusions of the budget calculation significantly should be pointed out.
- Take into account what may be achievable, acceptable and what is the ideal in the budgeting exercise. The differences between these three levels of budgeting may help to set the tone for discussing the directions of future work.
- It is important that there is internal consistency, when values for exchange fluxes appear in more than one chapter.
- It is recommended to use the worldwide riverine loading data from the Biological Aspects of the Hydrological Cycle (BAHC), an IGBP Core Project, for the synthesis.

*ACTION: KK Liu will contact BAHC on the availability of the riverine load data.*

- Use of LOICZ typology for the consideration of human impacts (such as nutrient inputs) on the margins.
- Each lead author should provide a paragraph on future objectives and approaches. (See **Appendix D** for lead authors).

*ACTION: KK Liu will contact those (Aller, Gao, McKee, Smith/McManus) who are not present but are recommended as lead authors about their willingness to contribute.*

## 2. On the synthesis presentation

- Each chapter on each margin should be no more than 10 to a maximum of 15 pages long.
- Units to be used. A common agreement came on Moles  $\text{m}^{-2} \text{y}^{-1}$  or Moles  $\text{y}^{-1}$  for dissolved chemical element fluxes,  $\text{g m}^{-2} \text{y}^{-1}$  or  $\text{g y}^{-1}$  for sedimentary fluxes,  $\text{GT yr}^{-1}$  for the global synthesis;
- Symbol to be used for the input and output terms (LOICZ type)

*ACTION: KK Liu will contact other groups of the CMTT synthesis workforce about the convention recommended here.*

## 3. Support

- KK Liu of NCOR with assistance from Dr. C.M. Hu of USF will try to provide monthly composite of SeaWiFS images (chlorophyll content) for each site, if this practice is deemed useful by most of the CMTT workforce.

*ACTION: KK Liu will contact Frank Muller-Karger and C.M Hu about the SeaWiFS images.*

- Recommendations on the role of WDC or data and bibliography banking. (Dr. Nicolas Dittert, Breast offers to manage and display the data sets and bibliography used in the CMTT synthesis book. He has already set up the CMTT Synthesis Book web-page at the World Data Centre for Marine Environmental Sciences:  
<http://www.pangaea.de/wdc-mare/Projects/CMTT/>  
<http://www.pangaea.de/wdc-mare/Projects/CMTT/Biblio/>)

*ACTION: N. Dittert will provide information on submission of data and bibliography.*

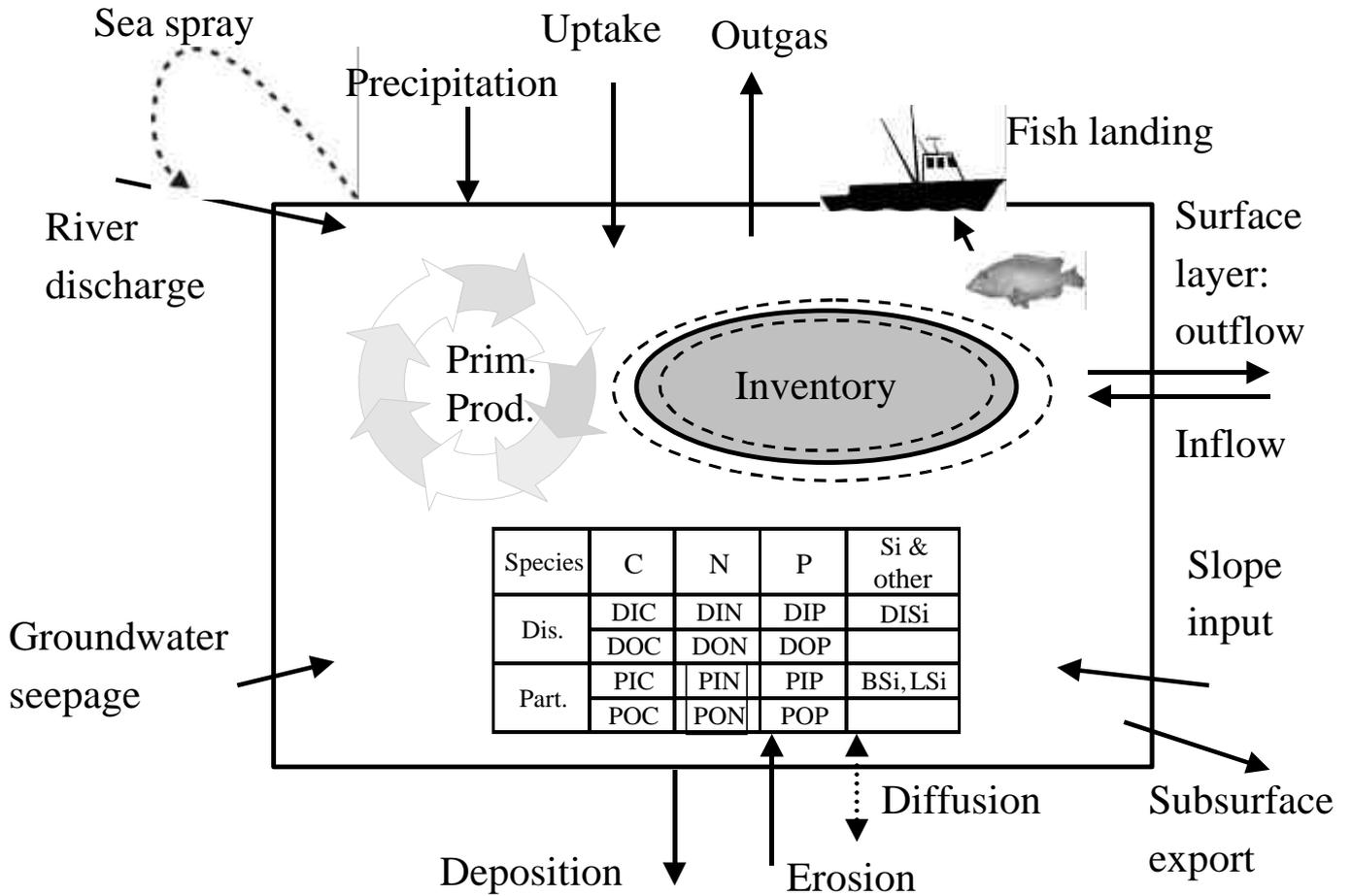
*ACTION: KK Liu will contact Bob Chen to get DIC and DOC data obtained by Doug Wallace in the Mid Atlantic bight.*

## 4. Time table

- December 2001: extended abstract of paper
- March 2002 first draft to be distributed among contributors
- June 2002 submission of manuscript for peer review process
- Synthesis meeting - December, 2002 (Should be completed before the termination of JGOFS.)
- Book published - July, 2003

**Meeting adjourned at 3 p.m.**

# Continental Margin Fluxes



**Figure 1.**

The schematic diagram of continental margin fluxes to be considered in the synthesis. Carbon is the most important element for consideration; N and P are secondary. Other elements, such as Si, may be considered, if they help to constrain the carbon fluxes. DON and DOP could be important. PIN and PON may be combined as PN. The riverine fluxes should be corrected for recycled materials from sea spray.

## **Appendix A. Participant List**

### **Participants**

<b>Surname</b>	<b>Given name</b>	<b>Affiliation</b>	<b>Email</b>
Brunskill	Gregg J.	Australian Institute of Marine Science, Australia	g.brunskill@aims.gov.au
Chen	Chen-Tung Arthur	Inst. of Marine Geol. & Chem., National Sun Yat-Sen Univ., Taiwan	ctchen@mail.nsysu.edu.tw
Civitarese	Giuseppe	Istituto Talassografico di Trieste, Consiglio Nazionale delle Ricerche, Italy	g.civitarese@itt.ts.cnr.it
Durrieu de Madron	Xavier	CNRS - UMR 5110, Université de Perpignan, France	demadron@univ-perp.fr
Dittert	Nicolas	UMR 6539, Institut Universitaire Européen de la Mer, 29280 Plouzané, France	Nicolas.Dittert@univ-brest.fr
Gong	Gwo-Ching	Dept. of Oceanography, National Taiwan Ocean University	gcgong@mail.ntou.edu.tw
Hu	Chuan-Min	College of Marine Science, University of South Florida, USA	hu@seas.marine.usf.edu
Huh	Chi-An	Institute of Earth Sciences, Academia Sinica, Taipei	huh@earth.sinica.edu.tw
Jennerjahn	Tim	Centre for Tropical Marine Ecology, Germany	tjenner@uni-bremen.de
Kim	Kyung-Ryul	Department of Oceanography, Seoul National University, Korea	krkim@tracer.snu.ac.kr
Liu	Hong-Bin	Louisiana Universities Marine Consortium, USA	hliu@lumcon.edu
Liu	Kon-Kee	National Centre for Ocean Research, Taipei, Taiwan	kkliu@ccms.ntu.edu.tw
Oguz	Temel	Institute of Marine Sciences, Middle East Technical University	oguz@ims.metu.edu.tr
Opdyke	Brad	Department of Geology, The Australian National University	bno@geology.anu.edu.au
Pempkowiak	Janusz	Institute of Oceanology, Polish Academy of Sciences, Poland	pempa@iopan.gda.pl
Ragueneau	Olivier	Institut Universitaire Européen de la Mer, 29280 Plouzané, France	olivier.ragueneau@univ-brest.fr
Sarin	MM	Physical Research Laboratory	sarin@prl.ernet.in
Shiah	Frank	Institute of Oceanography, National Taiwan University	fkshiah@ccms.ntu.edu.tw
Thomas	Helmuth	Netherlands Institute of Sea Research, NL	hthomas@nioz.nl
Tsunogai	Shizuo	Graduate School of Environmental Earth Science	mag-hu@ees.hokudai.ac.jp
Wen	Liang-Saw	National Centre for Ocean Research, Taipei, Taiwan	lswen@odb03.ncor.ntu.edu.tw
Wong	G.T.F.	Dept. of Oceanography, Old Dominion University, USA	gwong@odu.edu

## Regrets

David	Laura	Marine Science Inst., University of the Philippines	ldavid@upmsi.ph
Gao	Shu	Department of Geo-Ocean Sciences, Nanjing University, China	shugao@nju.edu.cn
Klump	Geoffrey Val	Great Lakes Wisconsin Aquatic Technology and Environmental Research Institute, University of Wisconsin-Milwaukee, USA	vklump@uwm.edu
McKee	Brent	Tulane University, USA	bmckee@tulane.edu
Muller-Karger	Frank	College of Marine Science, University of South Florida, USA	cariaco@seas.marine.usf.edu
Snidvongs	Anond	Environmental Research Institute, Bangkok, Thailand	anond@start.or.th

## **Appendix B. Symposium program**

### *International Symposium on Carbon and Nutrient Fluxes in Marginal Seas and Tropical Coastal Zones*

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**Sept 27<sup>th</sup>**

**Thursday A.M.**

**Room 102**

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#### **Session FLUX-1**

*Presiding: George T.F. Wong*

0900~0920 **Challenges in Assessing Biogeochemical Fluxes in Continental Margins**

*Liu, K.K.*

0920~0940 **The Continental Shelf Pump: A Case Study in the North Sea**

*Thomas, Helmuth*

0940~1000 **Baltic Sea**

*Pempkowiak, Janusz*

1000~1020 **Shelf-Slope Nutrients and Carbon Fluxes in the Mediterranean Sea: Case of the Gulf of Lions**

*de Madron, Xavier Durrieu*

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**1020~1040** *Coffee Break*

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1040~1100 **The Eastern Mediterranean Basin and the Adriatic Sea: Biogeochemical Dynamics in A Changing Environment**

*Civitarese, Giuseppe*

1100~1120 **Eutrophication-Related Changes in the Black Sea Nutrient Cycling and Ecosystem Structure**

*Oguz, Temel*

1120~1140 **Long-term Observation and Research of the East China Sea**

*Gong, Gwo-Ching*

1140~1200 **Carbonate system of the Okhotsk Sea**

*Tsunogai, Shizuo*

1200~1220 **Japan/East Sea**

*Kim, Kyung-Ryul*

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**1220~1400** *Lunch (Lunch box provided for all participants)*

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**Session FLUX-2*****Presiding: Chih-An Huh*****1400~1420 Particle Removal and Deposition of Radionuclides in the Bay of Bengal****Sarin, MM****1420~1440 Relevance of Mangroves and Rivers For the Production and Sedimentation of Organic Matter Along the Continental Margin of Eastern Brazil (8°-24°S)****Jennerjahn, Tim****1440~1500 Carbon, Nitrogen, & Phosphorus Budgets For Tropical Coastal Seas of Australia and Papua New Guinea****Brunskill, Gregg J.****1500~1520 Carbon and Coral Reefs****Opdyke, Brad**

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***1520~1540 Coffee Break***

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**1540~1600 Bacterial consumption of organic carbon in the shelf sea: Patterns and Implications****Shiah, Frank****1600~1620 On the Necessity to Integrate Studies of Si Fluxes in the CMTT Synthesis****Ragueneau, Olivier****1620~1640 Air-Sea Exchange of Carbon and Nitrogen in the Marginal Seas****Chen, Chen-Tung Arthur****1700~1720 Distribution and abundance of picophytoplankton and bacterioplankton in the Mississippi River plume and adjacent waters in the Gulf of Mexico****Liu, Hongbin and Dagg, M. J.****1640~1700 The Cariaco Basin Time Series Study: CARIACO****Muller-Karger, Frank, et al. (Presented by Hu, Chuan-Min)**

## **Appendix C. Minutes of group discussion on marginal seas**

Minutes of the CMTT Taipei Workshop - Marginal Seas Work Group

Date: September 29, 2001.

Time: 10:00 am

Place: Institute of Oceanography, National Taiwan University, Room 215

Present: A.C.T. Chen (Discussion leader), G.T.F. Wong (Secretary), G. Civitarese, X. de Madron, K.-R. Kim, T. Oguz, J. Pempkowiak, H. Thomas, S. Tsunogai

### **1. Who writes on what?**

The lead authors have been designated. Lead authors are encouraged to invite co-authors to join in order to facilitate international collaboration.

The relationship with other parts of the book: At the minimum, the authors should refer to other relevant chapters. A given chapter may need input parameters from other chapters. It is important that there is internal consistency when values for exchange fluxes appear in more than one chapter.

### **2. How to approach the synthesis?**

- As complete a budget as possible should be constructed for each basin. The exchanges across all the interfaces (*e.g.*, air/sea, sediment/sea, etc) should be taken into consideration.
- The discussion should cover not only what is already known but also temporal changes and what may happen in the future.
- There should be a sensitivity analysis of the budget. The factors that are uncertain and yet may affect the conclusions of the budget calculation significantly should be pointed out.
- The emphasis should be on the continental margin (from the estuary seaward to the slope) and not on the rivers or the deep sea.
- Take into account what may be achievable, acceptable and what is the ideal in the budgeting exercise. The differences between these three levels of budgeting may help to set the tone for discussing the directions of future work.
- Whether a system should be divided into sub-systems will be left to the decision of the authors.
- The role of the lakes in the global carbon cycle may deserve a separate volume that is devoted solely to that subject. A chapter on the Great Lakes may not fit into the framework of the marginal seas well.

### **3. Time table**

- The present proposed schedule may need to be extended for about 6 months as follows:
- First draft to be circulated within the group - March, 2002.
- Final draft - June, 2002.
- Synthesis meeting - December, 2002 (Should be completed before the termination of JGOFS.)
- Book published - July, 2003

### **4. Format of the book**

- The format of Springer will be followed.
- The section on the marginal seas should be no more than about 100 pages long.
- Each chapter on each basin should be no more than 10 to a maximum of 15 pages long.

### **5. Support**

The World Data Centre offers to publish the data sets used in the chapters. Thus, the authors only need to make reference to this database.

**6.** The lead author of each system will write one paragraph on what will be covered in his chapter and turn it in to K.K. Liu before the conclusion of this meeting.

## **Appendix D. Potential contributions on marginal seas and tropical coastal zones**

Those chapters that are suggested but not yet committed, are indicated by an asterisk (\*).

### **Processes (0-1)**

Continental shelf pump\* (Tsunogai)

### **Marginal seas (7-8)**

Baltic Sea (Thomas/ Pempkowiak)

North Sea (Thomas)

Black Sea (Oguz)

Mediterranean Sea (Civitarese/de Madron)

Okhotsk Sea (Tsunogai)

Japan/East Sea (Kim)

South China Sea/Gulf of Thailand (KK Liu/Snidvongs)

### **Tropical margins (4-7)**

Cariaco Basin/Venezuelan shelf\* (Muller-Karger/Hu)

Brazilian shelf (Jennerjahn/Eduardo Marone/Bastiaan Knoppers)

Bay of Bengal (Sarin/Ittekkot)

Tropical Coastal Seas Of Australia And Papua New Guinea (Brunskill)

Coral reefs (Opdyke)

Amazon shelf\* (Aller)

Louisiana-Texas shelf/Mississippi Outflow\* (McKee/H. Liu)

### **Synthesis and outlook (2-3)**

Air-Sea Exchange of Carbon and Nitrogen (Chen/Kim/Wallace)

The land-ocean interface: input from LOICZ (Smith/Talaue-McManus)

Sediment Flux and Accumulation in Continental Shelf Seas\* (Gao)

Coupled watershed-shelf-ocean model\* (Ragueneau)

### **Polar margins (0-1)**

Antarctica margins\* (Ragueneau)