

NSFC/RGC Joint Research Scheme
Joint Completion Report

(Please attach a copy of the completion report submitted to the NSFC
by the Mainland researcher)

Part A: The Project and Investigator(s)

1. Project Title

Eutrophication and Associated Hypoxia in Lingding Bay and Adjacent Coastal Waters: Biogeochemical Processes and Sedimentary Records
伶仃洋及邻近海域与富营养化和水体缺氧有关的一些生物地球化学过程及其沉积记录

2. Investigator(s) and Academic Department/Units Involved

	Hong Kong Team	Mainland Team
Name of Principal Investigator (<i>with title</i>)	Dr Liu Zhonghui 柳中晖 博士	Dr Jia Guodong 贾国东 博士
Post	Associate Professor	Professor
Unit / Department / Institution	Dept. of Earth Sciences, The University of Hong Kong	Guangzhou Institute of Geochemistry, CAS
Co-investigator(s) (<i>with title</i>)	N/A	Dr Wei Gangjian Guangzhou Institute of Geochemistry, CAS

3. Project Duration

	Original	Revised	Date of RGC/ Institution Approval (<i>must be quoted</i>)
Project Start date	01/01/2011		
Project Completion date	31/12/2013		
Duration (<i>in month</i>)	36		

Part B: The Completion Report

5. Project Objectives

5.1 Objectives as per original application

- 1. To better understand temporal and spatial patterns of nitrogen cycling process, phytoplankton community structure, and bottom water redox conditions within the coastal waters near Hong Kong, through investigations of water and sediment samples using multiple geochemical tools.*
- 2. To evaluate various geochemical (including isotopic) tools as tracers for coastal eutrophication and associated hypoxia.*
- 3. To reconstruct climatic (temperature, precipitation etc) changes in this region over the last several hundred years.*

(Revised 07/09)

4. *To understand the history of coastal eutrophication and hypoxia in this region and their potential relation with past climatic changes.*
5. *To assess current state and possible future trend of coastal eutrophication and hypoxia and to provide scientific bases to policy-makers for coastal environment management.*
6. *To facilitate collaborating research in marine and environmental sciences between Hong Kong and the mainland.*

5.2 Revised Objectives

Date of approval from the RGC: No revisions

Reasons for the change: _____

- 1.
- 2.
3.

6. Research Outcome

Major findings and research outcome

(maximum 1 page; please make reference to Part C where necessary)

For the mainland team, three research results are briefly highlighted here: 1. We have found that anthropogenic N input from land has induced obvious changes in marine ecosystem and carbon cycle in the nearshore areas of South China. 2. We investigated the SST implications of sedimentary UK'37 and TEX86 proxies in the nearshore areas, which forms a basis for the subsequent paleo-SST reconstructions in the area. 3. We have obtained seasonal nutrient concentration and isotopic data in the Pearl River Estuary, which is valuable for the following research on the N cycle in the area.

For the HK team, we have found:

1. Cooler sea surface temperature in the coastal regions, as compared to open oceans, is only a phenomenon of the late Holocene period. The development of coastal cooling is probably related to increased Asian Winter Monsoon (See the attached Kong et al.).
2. The sea surface temperature in the Mirs Bay over the last 2-3 centuries has been cooling, opposite to the global warming trend. This phenomenon is similarly reported in the Yellow Sea (See the attached He et al.), but not in the nearshore areas of HK (outside of the Lingding Bay). We suspect that the surface temperature changes in the Mirs Bay likely reflect increased summer upwelling.

(Revised 07/09)

3. We have obtained nitrogen isotopic results from three cores in the Mirs Bay. There is some indication of increased nutrient loading into the bay toward the present. However, whether such increase is due to anthropogenic or natural input needs further investigation because the modern nitrogen isotopic values do not exceed the range of nitrogen isotopic variability in the past. In one core drilled from the Tolo Harbor Channel, nitrogen isotopes might record the ecological disturbance due to the construction of the Plover Cove Reservoir in 1960s.
4. Spatial and temporal changes of nitrogen isotopic changes in the Mirs Bay, outside of the Lingding Bay and nearshore areas over the last few hundreds of years need to be carefully evaluated. Although relevant nitrogen results have been obtained, the uncertainty in core chronology largely limits our assessment. We are currently refining chronologies in order to further pursue this research.

Potential for further development of the research and the proposed course of action
(*maximum half a page*)

Over the past years, we have obtained more than 10 short sediment cores around HK, from the Pearl River Estuary to the Mirs Bay, as well as open ocean regions off the Hong Kong coast. These cores are excellent materials for studying spatial and temporal changes of regional climate, marine environment and marine ecosystem. They can be potentially used to assess anthropogenic impacts on HK environment as we also have cores from open sea regions to represent natural conditions. Thus we have not only achieved major scientific objectives in this project, but also set a solid ground to move forward. For instance, we plan to examine organic pollutants in HK coastal regions, using these sediment cores.

7. The Layman's Summary

(*describe in layman's language the nature, significance and value of the research project, in no more than 200 words*)

Eutrophication and its induced hypoxia in estuaries and coastal waters can cause a series of environmental issues. Although the current occurrence of hypoxia in Lingding Bay and adjacent coastal waters is less severe as compared to some severe regions, the likelihood of future development of such conditions due to increased human activities in this region requires our great awareness. In order to further understand the occurrence of eutrophication and hypoxia in this region, we propose to conduct systematic studies of modern biogeochemical processes and historical (sedimentary) records. We plan to choose geochemical indicators which are present in both waters and sediments and can address specific scientific problems. These geochemical indicators, including elemental, isotopic, and organic geochemical analyses, will be assessed with modern processes and then applied to reconstruction of sediment records. We aim to better understand temporal and spatial patterns of nitrogen cycling process, and to reconstruct the history of coastal eutrophication and hypoxia in this region and their potential relations with past climatic and environmental changes, and to assess current state and possible future trend of coastal eutrophication and hypoxia. We hope this study could provide scientific bases to policy-makers for coastal environment management.

(Revised 07/09)

Part C: Research Output

8. Peer-reviewed journal publication(s) arising directly from this research project
(Please attach a copy of each publication and/or the letter of acceptance if not yet submitted in the previous progress report(s). All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

The Latest Status of Publications				Author(s) (<i>bold the authors belonging to the project teams and denote the corresponding author with an asterisk*</i>)	Title and Journal/Book (<i>with the volume, pages and other necessary publishing details specified</i>)	Submitted to RGC (<i>indicate the year ending of the relevant progress report</i>)	Attached to this report (<i>Yes or No</i>)	Acknowledged the support of this Joint Research Scheme (<i>Yes or No</i>)
Year of publication	Year of Acceptance (<i>For paper accepted but not yet published</i>)	Under Review	Under Preparation (<i>optional</i>)					
2013				Zhao, G., Chang, Y.-P., Chen, M.-T, Liu. Z.*	Possible reverse trend in Asian summer monsoon strength during the late Holocene. <i>Journal of Asian Earth Sciences</i> , 69, 102-112.	No	Yes	Yes
	2013			Kong D., Zong Y., Jia G., Wei G., Chen M.-T. & Liu Z.*	The development of late Holocene coastal cooling in the northern South China Sea. <i>Quaternary International</i> , DOI: 10.1016/j.quaint.2013.08.055	No	Yes	Yes
	2013			He Y., Zhou X., Liu Y., Yang W., Kong D., Sun L.* & Liu Z.*	Weakened Yellow Sea Warm Current over the last 2-3 centuries. <i>Quaternary International</i> , DOI: 10.1016/j.quaint.2013.09.039	No	Yes	Yes

(Revised 07/09)

9. Recognized International conference(s) in which paper(s) related to this research project was/were delivered *(Please attach a copy of each delivered paper)*

Month/Year/Place	Title	Conference Name	Submitted to RGC <i>(indicate the year ending of the relevant progress report)</i>	Attached to this report <i>(Yes or No)</i>	Acknowledged the support of this Joint Research Scheme <i>(Yes or No)</i>

10. Student(s) trained *(Please attach a copy of the title page of the thesis.)*

Name	Degree registered for	Date of registration	Date of thesis submission/graduation
KONG Deming	PhD	01/09/2009	02/2014

**CLIMATIC CHANGES IN THE NORTHERN
SOUTH CHINA SEA SINCE THE
LAST GLACIAL MAXIMUM**

DEMING KONG

Ph.D. THESIS

**THE UNIVERSITY OF HONG KONG
2014**

(Revised 07/09)

11. Other impact (*e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, etc.*)

The PI was awarded with “Outstanding Young Researcher Award” by the University of Hong Kong in March 2014 and “Liu Tungsheng Prize for Young Earth Scientists” by Chinese Association for Quaternary Research (第三屆劉東生青年地球科學家獎, 中國第四紀科學研究會) in December 2013.