Laboratoire International Associé
LIA-MONOCL
MONsoon, Ocean and CLimate

2014 Annual Meeting

September 4-6, 2014, Gif-sur-Yvette, France

Event organized as part of France-Chine 50 - www.france-chine50.fr

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- Centre National de la Recherche Scientifique – LIA funds
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MGLAB

Institute of Geology and Geophysics

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Other laboratories/institutes participating to the meeting :

PEKING UNIVERSITY 1898

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MONOCL

AGENDA

September 03rd

Arrival of participants

September 04th - Morning session in the « Grand salon » of the château

Institutions and Laboratories represented:

CNRS-DERCI :	Patrick NEDELLEC (Director International Affair Division)
Chinese Embassy :	CHEN Ming (Minister Advisor)
	WU Haijun (2nd Secretary Service S&T)
CEA-DSM :	Maria FAURY (Deputy Director)
University Paris-Sud :	Etienne AUGE (Vice President Research)
	Séverine FOGEL- Jean-Pierre FAUGERE (International Division)
CNRS-INSU :	Philippe BERTRAND (Director section Ocean-Atmosphere)
French Ministry of Foreign Affairs :	Mme BLAZY (Scientific Relations with China, Research and Scientific Exchanges Direction)
LSCE (CEA/CNRS/UVSQ):	Elsa CORTIJO (Director)
GEOPS (Paris-Sud):	Eric CHASSEFIERE (Director)
Univ. Tongji, Shanghai	Pinxian WANG (Academician, Chinese Academy of Sciences)
IGG - CAS, Beijing :	Rixiang ZHU (Academician, Chinese Academy of Sciences - Director IGG)
IPEV :	Hélène LEAU (Responsible for Naval resources department and embedded instrumentation)
Campus Paris-Saclay :	Yves CARISTAN (Director of International Division)

9:30 -10:00 Welcome of the Participants with coffee

10:00 - 10:50 Patrick NEDELLEC
CHEN Ming
Maria FAURY
Etienne AUGE
Philippe BERTRAND

10:50 - 11:10 Yves CARISTAN
Mme BLAZY

11:10 - 11:35 History of the collaboration between MONOCL laboratories
LSCE & ENS: Carlo LAJ
Univ. Tongji, Shanghai : Pinxian WANG,
Institute of Geology and Geophysics, CAS, Beijing : Rixiang ZHU

11:35 - 11:50 Catherine KISSEL
State of art and future of LIA-MONOCL

11:50 - 12:30 Carlo LAJ « Teachers at Sea activities on CIRCEA cruise within the activites of MONOCL » - Video projection

12:30 - 14:00 Buffet Lunch

September 04th - Afternoon session in the « Grand salon » of the château

Chair : Franck Bassinot

14:00 - 14:30 JIAN Zhimin p.1
Late Quaternary deepwater paleoceanographic change and its impact on carbon cycle in the South China Sea

14:30 - 15:00 GAO Pan p.2
Radiocarbon evidence for water exchange across the Luzon Strait

15:00 - 15:30 HUANG Baoqi p.3
Changes in assemblages of benthic foraminifera in MD12-3432 and their significance in paleoceanography

15:30 - 15:45 General Discussion

15:45 - 16:15 Coffee Break

16:15 - 16:45 LIU Zhifei p.4
Deepwater sediment transport processes in the northeastern South China Sea

16:45 - 17:15 KISSEL Catherine p.5
Magnetic properties of the rivers feeding the South China Sea: a critical step for understanding paleo-marine records.

17:15 - 17:30 General Discussion

19:30 Dinner (Restaurant « Jardins de l'Yvette »)

September 05th - Morning session in the « Grand salon » of the château

Chair : Qingsong Liu

8:30 - 9:00 BASSINOT Franck p.6
Rapid variability during MIS3 and Termination I from the Western Pacific Warm Pool: new geochemical and sedimentological data

9:00 - 9:30 DANG Haowen p.7
Precessional hydro-climatic changes in the tropical Indo-Pacific and their interactions with the bi-hemispheric summer monsoons

9:30 - 10:00 COLIN Christophe p.8
New insights into the current- and past hydrology of the north-western subtropical Pacific Ocean Over the past 25 kyr, based on investigations of the Nd isotopic composition of seawater and deep-sea sediments from the northern South China Sea.

10:00 - 10:30 Coffee Break

Chair : Christophe Colin

10:30 - 11:00 TIAN Jun p.9
Synchronous mid-Miocene upper and deep ocean $\delta^{13}C$ changes in the east equatorial Pacific linked to ocean cooling and ice sheet expansion

11:00 - 11:30 LIU Qingsong p.10
Interhemispheric comparison of the Holocene Paleosecular variations of the geomagnetic field

11:30 - 12:00 SAINT-LU Marion p.11
West Pacific SPCZ and teleconnection with ENSO in different climatic contexts from PMIP and IPSL simulations.

12:00 - 14:00 Buffet Lunch

September 05th - Afternoon session in the « Grand salon » of the château

Chair : Zhifei Liu

14:00 - 14:30 ZHENG Weipeng p.12
Analysis of monsoon variability in the paleoclimate simulations.

14:30 - 15:00 BRACONNOT Pascale p.13
ENSO in PMIP simulations compared to a new pan Pacific reconstruction of holocene variability and ITCZ, monsoon and variability in two versions of the IPSL model.

15:00 - 15:30 YU Yongqiang p.14
Impacts of External Forcing on the Decadal Climate Variability in CMIP5 Simulations

15:30 - 15:45 General Discussion

15:45 - 16:15 Coffee Break

Chair : Zhimin Jian

16:15 - 16:45 LIU Chuanlian p.15
Late Quaternary coccolith records and their palaeoceanographic significance of MD12-3428 and MD12-3433 in the northern South China Sea

16:45 - 17:15 WANG Tingting p.16
How did the Surface Seawater of the Tropical Western Pacific Exchange CO_2 with the Atmosphere over the Last Glacial Cycle?

17:15 - 17:45 HUANG Xiangtong p.17
Tracking past terrestrial and oceanic changes in the South China Sea sediments using inorganic geochemical tracers

17:45 - 18:00 General Discussion

19:00 Dinner (Restaurant « l'île O'Crêpes »)

September 06 - Morning session at LSCE

Chair : Pascale Braconnot

9:00 - 9:30 CHEN Quan p.18
Variability of the detrital input to the site of core MD12-3432 during the last 410 kyr.

9:30 - 10:00 ZHAO Shaohua p.19
High-resolution variations in terrigenous flux and sediment sources since 70 ka BP in the northern South China Sea

10:00 - 10:30 YU Zhaojie p.20
Evolution and variability of the East Asian summer monsoon over the last 2.36 Ma: Evidence from clay mineral records of the West Philippine Sea

10 :30 - 11 :00 LE MEZO Priscilla p.21
Changes in primary production between the beginning and the end of isotopic stage 4

11:00 - 11:30 Coffee Break

11:30 - 12:30 Discussion about renewal and work on the final version of the project to be submitted

12:30 Lunch

September 06th -Afternoon

15:45 Meeting time for Dinner and excursion

16 :00 Departure of the bus

Scientific Participants

LSCE *(Laboratoire des Sciences du Climat et de l'Environnement), France*

- Catherine Kissel
- Franck Bassinot
- Pascale Braconnot
- Carlo Laj
- Quan Chen
- Camille Wandres
- Aurélie Van Toer
- Aline Govin
- Priscilla Le Mezo

GEOPS - *Université de Paris-Sud*

- Christophe Colin
- Qiong Wu
- Zhaojie Yu

Institute of Geology and Geophysics - CAS, *China*

- Rixiang Zhu
- Qingsong Liu

LASG, *Institute of Atmospheric Physics, China*

- Yongqiang Yu
- Weipeng Zheng

Peking University

- Pan Gao
- Baoqi Huang

Tongji University

- Pinxian Wang
- Xiangjun Sun
- Zhimin Jian
- Zhifei Liu
- Jun Tian
- Chuanlian Liu
- Haiyan Jin
- Xiangtong Huang
- Haowen Dang
- Tingting Wang
- Shaohua Zhao
- Jiangnan Shi
- Yanli Li


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ABSTRACTS

Late Quaternary deepwater paleoceanographic change and its impact on carbon cycle in the South China Sea

Zhimin JIAN, Haiyan JIN, Sui WAN

State Key Laboratory of Marine Geology, Tongji University, Shanghai 20092, China

Recent and late Quaternary benthic foraminiferal geochemistry has been studied in order to monitor the deepwater paleoceanographic change in the South China Sea (SCS). Based on the AMS ^{14}C ages of benthic and planktonic foraminifers from 16 surface sediment and 3 core-top samples of the SCS, it has been revealed that in the modern SCS along the flow direction the deep water becomes younger from north to south while the intermediate water oppositely changes due to strong ventilation, making the modern SCS to be a weak "source" of atmospheric CO_2.

However, during the last glacial and deglacial periods the deepwater was older in the southern SCS (~2050 yr and ~1800 to 1200 yr, respectively) than in the northern SCS (~1600 yr and ~670 yr, respectively), based on the AMS ^{14}C ages of benthic and planktonic foraminifers from 18 samples of Core MD05-2904 (water depth of 2066 m) in the northern SCS and 15 samples of Core MD05-2896 (water depth of 1657 m) in the southern SCS. This indicated that the deep ventilation was remarkably reduced and probably caused the SCS to become a "sink" of atmospheric CO_2 at that time. The deepwater carbonate ion concentration ($[CO_3^{2-}]$) since the last glacial period were first reconstructed in the SCS using *Cibicidoides wuellerstorfi* B/Ca ratios from Core MD05-2904 and MD05-2896. The two curves of paleo-$[CO_3^{2-}]$ demonstrated the typical "Pacific carbonate cycle", implying that *C. wuellerstorfi* B/Ca ratios can be used to indicate the deepwater dissolution. Generally, the deepwater paleo-$[CO_3^{2-}]$ follow the $\Delta pCO_{2(\text{seawater-atmosphere})}$ changes based on *Globigerinoides ruber* B/Ca analysis in MD05-2896, suggesting the deepwater $[CO_3^{2-}]$ may have a key impact on the CO_2 flux of the upper ocean.

Moreover, the northern SCS deepwater was significantly younger during the last deglaciation than during the Holocene and the last glacial period, implying the existence of the "northern-sourced" newly formed and relatively young North Pacific deepwater (NPDW) and its southward intrusion into the SCS. This inference was also supported by the obviously increased deepwater $[CO_3^{2-}]$ during the last deglaciation.

Radiocarbon evidence for water exchange across the Luzon Strait

Pan GAO[1, 2], Liping ZHOU[1], Xiaomei XU[2], Kexin LIU[3], Xingfang DING[3]

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2 : Keck Carbon Cycle AMS Laboratory, Department of Earth System Science, University of California, Irvine, CA 92697-3100, USA
3 : State Key Laboratory of Nuclear Science and Technology and Institute of Heavy Ion Physics, School of Physics, Peking University, Beijing 100871, China

Systematic measurements of $DI^{14}C$ in seawater samples collected from Luzon Strait and the northeast South China Sea (SCS) during March 2013 were made with a high precision headspace-extraction preparation method using only 30 mL samples. Our results reveal the bomb carbon penetration level and intermediate-deep water circulation structure of the study area. Compared to the 1994 WOCE P09 cruise, bomb carbon penetration signal has dropped to 37.3~ 53.5‰ and the penetration depth is reduced to 500-650m. An average decrease of $DI^{14}C$ values is observed at a rate of about 3-4‰ per year between 1994 and 2013. Our $DI^{14}C$ data point to a strong vertical mixing of the North Pacific Deep Water (NPDW) inside Luzon Strait within the range of 1500-2500m. Relatively old deep water is found in the west of Luzon Strait below 1500m, while water mass in the continental slope of northeast SCS between 1500-2000 appears younger, which may indicate the upward flow of the NPDW in this area and its mixing with the overlying water mass. These new radiocarbon data allow us to compare with the recent oceanographic observations and results of numerical experiments across the Luzon Strait.

Key words: South China Sea; Dissolve Inorganic Carbon; Radiocarbon; Bomb Carbon; Ocean circulation

Changes in assemblages of benthic foraminifera in MD12-3432 and their significance in paleoceanography

Baoqi HUANG, Na WANG, Yiting DONG, Wenbo JIA, Yanxi ZHOU

Department of Geology, Peking University, Beijing, China

The South China Sea (SCS) as the biggest marginal sea in the western Pacific, which ventilation of deep water is significant in the global climate change. Assemblages of benthic foraminifera is an important method to reconstruct deep water circulation. Bashi Strait, water depth about 2500, is the only way which deep water of Pacific enters the South China Sea. Presents studies showed that structure of water in the northern of SCS just like sandwich, surface and deep water (deeper than 1500m) enter the SCS, however the middle water come out from the SCS to the western Pacific. MD190 Site MD12-3234 located in 19°16.88'N, 116°14.52'E, Water depth 2125m, is an ideal area to trace the evolution of the deep water in western Pacific. 1016 samples were collected in MD12-3432 and 95 samples were identified on benthic foraminifera since last 12ka. Changes of assemblage of benthic foraminifera show that changes abundance of benthic forams are consistent with that of $\delta^{18}O$. Abundance of high productivity species was increased in warm periods. Results of Benthic Foraminiferal Oxygen Index (BFOI) show that MD12-3432 bathed in the high dissolved oxygen waters during the two Terminations since 12ka which indicated good ventilation.

Key words: the South China Sea, deep water circulation, assemblage of benthic foraminifera

Deepwater sediment transport processes in the northeastern South China Sea

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3 : UMR 8148 CNRS-GEOPS, Université de Paris-Sud, Orsay 91405, France

Sediment transport process in the deepwater environment is significant for understanding deep-sea hydrodynamics and various sedimentary proxies, which are used for paleoclimatic and paleoenvironmental implications. The northeastern South China Sea is an ideal region for the deepwater sedimentary dynamics study because of its huge amount of terrigenous sediment input and abundant bottom current activities. Here for the first time we observed deepwater sediment transport processes driven by contour currents, turbidity currents, and mesoscale eddies via two full-water column mooring systems, respectively, both located at 2100 m water depth in the northeastern South China Sea. Acoustic Doppler current profiler (ADCP), recording current meter (RCM), and sediment trap systems are equipped to obtain current velocity, temperature, turbidity, and suspended sediments. We observed relatively stable contour currents with flow directions of 230-250° and velocities of 2-5 cm/s occurring in depths of 1700-2100 m at the Mooring TJ-A-1, about 100 km southeast of the Dongsha Island. Under the background of contour currents with low near-bottom turbidity, a few enhancements of suspended sediment concentration with full-water column velocity and temperature anomalies at this station during January to March 2012 and November 2012 to January 2013, respectively, were interpreted to be driven by deep-reaching anticyclonic mesoscale eddies. However, a sudden increase of suspended sediment concentration at the Mooring TJ-G at the lower reach of the Gaoping Canyon during September to October 2013 was interpreted as turbidity events driven by local earthquakes. Our observations on deepwater sediment transport processes greatly enrich our knowledge of deep sedimentary dynamics processes.

Magnetic properties of the rivers feeding the South China Sea: a critical step for understanding paleo-marine records.

Catherine KISSEL[1], Zhifei LIU[2], Camille WANDRES[1], Carlo LAJ[2,3], Zhimin JIAN[2], Pinxian WANG[2].

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3 : now at Departement des Géosciences, Ecole Normale Supérieure, 24 Rue Lhomond, 75005 Paris

In order to use the magnetic properties of marine sediments as a tracer for past changes in the precipitation rate on land, and to understand the contribution of the changes in the sea-level and in the oceanic in the South China Sea in the paleo-records, we first identify and characterize the different sources of the detrital fraction among which the magnetic particles.

Thanks to the Westpac project, we had access to sediments collected in the deltas of the main rivers feeding the South China Sea from about 25°N to the equator. This is represented on the Asian continent by the Pearl river, the Red River, the Mekong river and by minor rivers in Malaysia, Sumatra and Borneo regions, Luzon and Taiwan. The geological formations contributing to the river sediment discharges are different from one catchment basin to another as well as the present climatic conditions.

The magnetic results presented at the 2013 LIA-MONOCL meeting in Hangzhou have been completed this year by the two new locations of Taiwan and South Borneo and the analyses of the samples from all the studied area have also been completed by new analyses of the coercivity and thermal spectra. The latter allowed to quantify the respective contribution of high and low coercivity magnetic assemblages in each region.

Some degree of variability is observed at the river mouths, illustrating different geological sources at the local/regional scale. At the scale of the South China Sea, it appears that the Southern basin of the South China Sea is surrounded by regions richer in high coercivity magnetic minerals than the northern basin. This mineral is identified as hematite and can reach up to 76% of the magnetic fraction. Magnetites (and sulfides) are more abundant in the north. These results are complementary to the clay mineral assemblages previously determined on the same samples.

The first steps of a similar study conducted on marine core-tops well distributed in the South China Sea and collected during the Marco Polo (2005) and CIRCEA (2012) cruises on board the R.V. *Marion Dufresne* in the South China Sea will also be illustrated.

Rapid variability during MIS3 and Termination I from the Western Pacific Warm Pool: new geochemical and sedimentological data

Luli GUSTIANTINI[1,2,3], Franck BASSINOT[1], Catherine KISSEL[1], Haowen DANG[4], Yadhi ZAIM[2], Rina ZURAIDA[3], Zhimin JIAN[4]

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2 : Institute of Technology of Bandung, Bandung, Indonesia
3 : Marine Geological Institute, Bandung, Indonesia
4 : State Key Lab of Marine Geology, Tongji University, Shanghai 200092, China

Giant piston core MD10-3339 (39m) was retrieved in the Halmahera basin at ~ 1920m of water depth. It provides a ~50 kyr-long, high-resolution record that makes it possible to decipher the imprint of sea level, deep currents and monsoon/ENSO variability on sedimentation at the south-easternmost entrance of the Indonesian Archipelago, at the heart of the Western Pacific Warm Pool. Our multiproxy study combines (i) stable O and C isotopic analyses and Mg/Ca analyses on planktonic foraminifers, (ii) high-resolution XRF-derived elemental composition, (iii) laser-granulometry and (iv) magnetic anisotropy. The age model is based on mono-foraminifer ^{14}C dates and extrapolated (constant sedimentation rate) before ~ 42 ka.

The XRF profiles are dominated by millennial-scale variability, with no evidence of glacial/interglacial changes, suggesting the lack of long-term climate impact or sea-level control on sedimentation at site MD10-3339. A clear G/IG imprint is readily seen, however, on the decarbonated silt record, suggesting a reduction of current activity during the Holocene (finer material) relative to the last glacial (coarser material). This change in current activity is not reflected in direction of the current measured by magnetic anisotropy

Elemental profiles associated to terrigeneous inputs (eg. Fe, Ti,..) show a strong co-variance with planktonic $\delta^{18}O$ over the 35-45 ka interval and across the last deglaciation. This strong in-phase relationship degrades, however, at the end of MIS3 and during MIS2. We used paired $\delta^{18}O$-Mg/Ca data to infer past changes in local $\delta^{18}Osw$ (i.e. advection, local evaporati11n/precipitation) and explore the hypothesis that could explain the evolution of $\delta^{18}O$ -XRF data relationship through time.

Precessional hydro-climate change in the tropical Indo-Pacific and its interactions with the bi-hemispheric summer monsoons

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On the precessional time-scale, variations in the seasonal insolation provide the primary forcing to drive the climate change. An in-phase linkage between intra-hemisphere summer rainfall and precessional insolation changes, as well as an anti-phase correlation between inter-hemisphere summer monsoons, are the general characteristics of the mid- to low-latitude climatic feedbacks, supported by speleothem $\delta^{18}O$ records. However, uncertainties still remain in our understanding on the phase relations of local hydro-climate relative to insolation forcing at certain latitudes.

The sediment composition of core MD10-3340 (0.5°S, 128.7°E, 1094 m water depth) and also the sea-surface water $\delta^{18}O_{sw}$ of several cores from the Indo-Pacific Warm Pool (IPWP) were analyzed. The results show: (1) Terrigenous sediment in core MD10-3340 is locally derived from the Halmahera Island, and can be used to indicate the changes of the local riverine run-off and rainfall. The characteristic terrigenous elements, including Fe, Ti and Zr, show clear variations on glacial-interglacial and precessional cycles. Their precessional variations lag the boreal summer insolation by ~60°, indicating that the convective activity of the equatorial western Pacific could be in-phase associated with the August-September insolation change. This finding is consistent with the $\delta^{18}O$ record of speleothem from the northern Borneo. (2) $\delta^{18}O_{sw}$ mainly show precessional changes, and anti-phase correlate to the boreal summer insolation, i.e., higher boreal summer insolation coincided with heavier excursions of $\delta^{18}O_{sw}$ and thus larger evaporation than precipitation. This is a common pattern over a large area of IPWP, suggesting the consistency of the changes in the evaporation-precipitation balance over the entire tropical Indo-Pacific. The stronger evaporation anomaly over the IPWP on the precessional band may provide the major moisture source for the boreal summer monsoons.

This study has revealed the relative independency of the equatorial convective activity in the sense of its unique phase relation comparing with bi-hemispheric summer monsoons, and also the control of precessional insolation change on ocean-land moisture distributions. However, age constrains with more accuracy is needed to better verify our findings, and numerous simulations with high resolution is necessary to examine the dynamic mechanisms.

New insights into the current- and past hydrology of the north-western subtropical Pacific Ocean Over the past 25 kyr, based on investigations of the Nd isotopic composition of seawater and deep-sea sediments from the northern South China Sea.

Qiong WU[1,2], Christophe COLIN[1], Zhifei LIU[2], Francois THIL[3], Eric DOUVILLE[3], Giuseppe SIANI[1]

1: GEOPS, Univ. Paris-Sud
2: State Key Lab of Marine Geology, Tongji University, Shanghai 200092, China
3: Laboratoire des Sciences du Climat et de l'Environnement, CEA-CNRS-UVSQ, 91198 Gif-sur-Yvette, France

The aim of this study is to reconstruct the evolution of the hydrology of the western subtropical North Pacific Ocean by using εNd proxy analysed on foraminifera and dispersed authigenic ferromanganese oxide precipitates in sediments from deep-sea cores collected in the northern SCS. Before using the eNd proxy on deep-sea sediments of the SCS, Nd isotopic compositions (Nd) of 16 seawater profiles collected in the northern South China Sea (SCS) and the Philippine Sea were investigated to establish the distribution of the Nd isotopic composition of water masses along the tropical western Pacific and the SCS that, until now have not been documented. εNd values for mid- and deep-water masses of the Philippine Sea and the SCS range from -2.3 to -4.4 and generally increase slightly as water depth increases. In the Philippine Sea, εNd values for the North Pacific Intermediate Water (NPIW) reach -2.7±0.4 at mid-depths (500 to 1400 m). Below ~1800 m, the Pacific deep-water (PDW) is characterized by less radiogenic Nd (-4.1±0.5) indicating the intrusion of southern sourced water masses. For most of the stations in the Northern SCS, water masses below 1500 m (PDW) display homogenous εNd values (~ -4.1) similar to those of the PDW in the Philippine Sea. εNd values for the South China Sea Intermediate Water (SCSIW - 500-1500 m) vary from -3.0 to -3.9 as a result of the vertical mixing of the NPIW with the PDW in the SCS. Seawater εNd values for the SCS (~5.3 to -7.0) display local modification in areas where the water lies above significant sediment drift deposit systems. This implies that ‘’boundary exchange’’ with unradiogenic sediments (around -11) may occur temporally and spatially and does not modify the Nd isotopic composition of the PDW in the Northern SCS.

In a second step, seawater εNd extracted from cleaned planktonic foraminifera *G. ruber* has been investigated on core MD05-2904, collected at a depth of 2000 m on the north-western margin of the South China Sea (SCS). This study was undertaken in order to reconstruct hydrological variations since the LGM in the western subtropical North Pacific. The εNd records obtained from foraminifera spanning the past 25 kyr, display a wide range of values, ranging from -4±0.2 to -6.7±0.3, suggesting important changes in the contribution of the NPDW (εNd = -4) and the UCDW (εNd -6 to -8) in the subtropical western Pacific. During the period of deglaciation, εNd records indicate a relative decrease in the proportion of the SSW in the deep-water component of the western subtropical Pacific, interrupted by two negative excursions of the εNd implying a higher proportion of SSW during the time intervals 17 - 15 cal kyr BP and 10 - 8 cal kyr BP; these intervals are coeval with the HS1 and the early Holocene. The negative shifts centered on the HS1 coincide with an enhanced upwelling in the Southern Ocean, associated with a polewards shift of the southern westerlies, inducing an enhanced formation of the SSW that propagates to the subtropical western Pacific. The negative excursion of the εNd during the Early Holocene (~10 - 8 cal kyr BP) indicates a higher relative proportion of SSW that could be associated with higher production of the SSW, as has been recently observed in the South Atlantic, and/or with a possible reduction of the NPIW. Our data suggest that the present modern circulation pattern in the western subtropical Pacific Ocean was fully established after 4.6 cal kyr BP.

Synchronous mid-Miocene upper and deep ocean $\delta^{13}C$ changes in the east equatorial Pacific linked to ocean cooling and ice sheet expansion

Jun TIAN[1*], Wentao MA[1], Mitchell W. LYLE[2], Julia K. SHACKFORD[2]

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We present mid-Miocene (~12.0-16.0 Ma) high resolution (~3.8 kyr) deep thermocline planktonic foraminiferal $\delta^{18}O$ and $\delta^{13}C$ records at IODP Site U1337 from the eastern equatorial Pacific. The benthic and planktonic $\delta^{18}O$ records of Site U1337 not only show a similar long-term cooling trend in the mid-Miocene but also display obvious differences in the amplitudes of glacial/interglacial cycles after 13.9 Ma where the planktonic $\delta^{18}O$ are usually larger than 1.0 ‰, nearly 2 times those of the benthic $\delta^{18}O$. The differences are probably caused by intensified upwelling with ocean cooling, as well as upper ocean circulation changes after 13.9 Ma. Both the benthic and planktonic $\delta^{13}C$ records at Site U1337 reveal marked carbon maxima events with a cycle of 400 kyr during the MMCO (Middle Miocene Climate Optimum) and the long-term decreasing trend from 16.0 Ma to 12.0 Ma. The similarity in response between surface and deep carbon isotopes indicate that the mid-Miocene carbon excursions in the east equatorial Pacific involved the whole ocean basin water column and thus are global. Box model simulations reveal that the long eccentricity (400 kyr) paced weathering induced carbon input changed the burial ratio of carbonates to organic carbon and further gave rise to the significant 400-kyr cycles in oceanic $\delta^{13}C$, and that the increased weathering of carbonate, silicate and kerogen rocks are the major factors controlling the long-term decrease in oceanic $\delta^{13}C$ after 16.0 Ma.

Interhemispheric comparison of the Holocene Paleosecular variations of the geomagnetic field

Qingsong LIU

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The paleosecular variation (PSV) of the geomagnetic field bears great information of the dynamic processes of the Earth's outer core and has been further used to correlate the sediments at a large spatial scale or even interhemispheric scales to refine the stratigraphic chronology. However, due to the effects of the non-dipole field, such a comparison is not always straightforward. This study systematically compared the high-resolution PSV records from Europe and Eastern Asia. We put forward that the PSV curves exhibits different patterns in the magnetic lobe and non-lobe flux regions, but could show relatively consistent trends within each type of regions. Therefore, it is suggested that only PSV curves from the non-lobe regions could serve as a potential chronological tool for inter-hemispheric correlations because the dipole field dominates these regions.

West Pacific SPCZ and teleconnection with ENSO in different climatic contexts from PMIP and IPSL simulations.

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The hydrological context of the West Pacific Warm pool is a complex system where both the Intertropical convergence Zone and the South Pacific convergence have strong interannual variability that affect rainfall in the surrounding west Pacific Islands. Under modern conditions the El Niño/Southern Oscillation (ENSO) has a strong impact on the displacement of the SPCZ, suggesting that high resolution climate archives, such as coral, can be used to reconstruct past seasonal to multidecadal ENSO variability. However there are still lots of unknown on the relationship between the background climate state and short term variability. Using results of PMIP simulations for the last glacial maximum (21 ka BP) the mid-Holocene (6ka BP) the pre-industrial climate (1860) and abrupt $4xCO_2$ experiments, we show that changes in the background tropical state largely control the mean SPCZ location but that changes in SPCZ variability from one climate to another cannot be directly related neither to ENSO amplitude nor to mean state changes. This results call for a careful interpretation of west Pacific high resolution records in terms of ENSO variability.

*Main collaboration : Mathhieu Lengaigne (LOCEAN), Julie Leloup (LOCEAN) and Olivier Marti (LSCE)

Analysis of monsoon variability in the paleoclimate simulations

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The variability of East Asia summer Monsoon (EASM) is analyzed in the pre-Industrial (PI, 0 ka) and mid-Holocene (MH, 6 ka) simulations from the third phase of Paleoclimate Modelling Intercomparison Project (PMIP3). The PMIP3 models capture well the large-scale features of the EASM, including the two distinct features of the Meiyu rainbelt and the stepwise meridional displacement of the monsoonal rainbelt. In the mid-Holocene, significant warming (cooling) during boreal summer (winter) is simulated over Eurasia continent, which is dominated by the changes of insolation. The PMIP3 models fail to simulate a warmer surface air temperature (TAS) over eastern China in the annual mean and winter time as that derived from proxy records. The EASM in MH are featured by the changes of large-scale circulation over Eastern China, however, the model spread is large for the precipitation, particularly in the Southern China and the lower reaches of Yangzi River. The inter-model differences for the monsoon precipitation can be associated with different configurations of the changes in large-scale circulation and the water vapor content, of which the former determines the sign of precipitation changes. The large model spread for the TAS over Tibetan Plateau has a positive relationship with the precipitation in the lower reaches of Yangzi River, yet this relationship does not apply to those PMIP3 models in which the monsoonal precipitation is more sensitive to the changes of large-scale circulation. The dynamic and thermodynamic impacts on the changes in EASM precipitation are then discussed in this study.

ENSO in PMIP simulations compared to a new pan Pacific reconstruction of Holocene variability and ITCZ, monsoon and variability in two versions of the IPSL model.

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There is still little agreement in the way different climate models project future changes in tropical climate variability. A careful evaluation of these models is required. Past climate offer good opportunities to test our understanding of the link between the characteristics of the mean climate and climate interannual to multidecadal variability. In particular, the increase number of high resolution proxy records makes it possible to provide a pan Pacific reconstruction of Holocene variability, using fossil coral, giant bivalves and shells. Results of the reconstruction and of the comparison with model results will be provided, together with different aspects that need to be considered to account for methodological uncertainties and noise. The presentation will also discuss different aspects of the comparison of model results while trying to decipher which of two of the IPSL model versions produce the more realistic results, considering both the Afro-Asian monsoon and ENSO/SPCZ variability. It shows in particular how model physics and model adjustments both contribute to alter the regional climate response to a given external forcing.

* This work is done in close collaboration with the French ANR ELPASO and PMIP (tropical variability) partners.

Impacts of External Forcing on the Decadal Climate Variability in CMIP5 Simulations

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Decadal climate variability is usually regarded as an internal variability in the climate system. However, using the coupled simulations from the Coupled Model Intercomparison Project Phase 5 (CMIP5), we have demonstrated that the external radiative forcing plays an important role in modulating decadal variability of the global mean surface air temperature (SAT). In historical runs, the standard deviations of the global mean SAT exhibit robust increases relative to pre-industrial runs, indicating that external forcing acts on decadal variability of the global mean SAT through enhancing amplitude and modulating phase. Every type of simulation (e.g., the pre-industrial, historical, natural forcing and anthropogenic forcing runs) from almost all the CMIP5 models exhibits a high correlation between the net shortwave (SW) radiative flux at the top-of-atmosphere (TOA) and the global mean SAT with a 13 month lag. However, after taking the multi-model ensemble mean for the TOA SW radiative flux and the SAT, respectively, the correlations from simulations with external forcing are much higher than those from pre-industrial runs. This is because that the decadal SAT anomalies from multiple models cancel each other out in the pre-industrial runs without external forcing, but generally follow decadal evolution of the external forcing with a 13 month lag. Additionally, the sea surface temperature (SST) of the tropical Indian Ocean shows a stronger response to TOA SW forcing than that in eastern equatorial Pacific SST due to the shallower ocean circulations in Indian Ocean.

Late Quaternary coccolith records and their palaeoceanographic significance of MD12-3428 and MD12-3433 in the northern South China Sea

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Coccolith analysis have been carried out on the late Quaternary samples from the MD12-3428 and MD12-3433 in the northern South China Sea. We reconstructed the last deglaciation to the Holocene primary productivity of the MD12-3428 by using coccolith records. We find that the primary productivity decreased from the last deglaciation to the Holocene. We also find that the primary productivity matched the records of East Asian Winter Monsoon strength in China Loess from 12ka to present, but the primary productivity seem to change with the oxygen isotope in China stalagmites before 12ka. We think that the nutrients inputs which controlled by Pearl River at lower sea level during the last deglaciation played a more important role than the strength of East Asian Winter Monsoon. With the sea level raising up and the Pearl River estuary receding, the EAWM became more important for the PP changes after 12ka. Moreover, we estimate the weight of *Geophyrocapsa oceanica* , and the result shows that there was an obvious decrease during 14.5-20ka in the weight of *Geophyrocapsa oceanica*. This result may relate to the decrease of salinity in surface water caused by Pearl River, and can also be interpreted by the changing of SCS mid-water Ω during that period.

The relative percentage of *Florisphaera profunda* obtained from the MD12-3433 showed low nutricline and high primary productivity in glacial periods and the reverse in interglacial periods. We also discussed the causes result in these changes.

Key words: coccolithophore primary productivity East Asian Monsoon Sea level weight of coccolith

How did the Surface Seawater of the Tropical Western Pacific Exchange CO_2 with the Atmosphere over the Last Glacial Cycle?

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Atmospheric CO_2 content, varying synchronously with temperature over glacial cycles, is considered as one of the most important mechanisms regulating climate change. The ocean is the dominant force driving atmospheric CO_2 changes by the "organic carbon pump", "calcium carbonate pump" and "solution pump". In modern times, seawater CO_2 content in the tropical western Pacific equilibrates with the atmosphere. However, how the surface seawater of the tropical western Pacific exchanged CO_2 with the atmosphere over glacial cycles is still unknown. Resolving this problem is helpful to understand the role of the ocean in the changes of the atmospheric CO_2 content and even the global climate.

Planktonic foraminifers *Globigerinoides ruber* and *Pulleniatina obliquiloculata* from cores MD05-2896 and MD10-3340 located in the southern South China Sea (SCS) and the Halmahera Sea, respectively, were measured for B/Ca ratios to reconstruct surface and subsurface seawater pH over the last glacial cycle, as well as for Mg/Ca ratios and $\delta^{18}O$ to reconstruct seawater temperature and salinity. The seawater partial pressure of CO_2 (pCO_2sw) were calculated from pH and alkalinity which was obtained from its relationship with salinity. Then, the difference of the partial pressure of CO_2 between surface seawater and atmosphere ($\Delta pCO_2sw\text{-}atm$) and between subsurface and surface seawater ($\Delta pCO_2tw\text{-}sw$) were calculated. When $\Delta pCO_2sw\text{-}atm$ value is positive, the sea was the source of atmospheric CO_2 and vice versa.

The results of B/Ca ratios, pH, pCO_2sw and $\Delta pCO_2sw\text{-}atm$ from the two cores all display glacial cycle trend. The $\Delta pCO_2sw\text{-}atm$ values of Core MD05-2896 were positive during Holocene and from MIS5.1 to MIS5.4, indicating that the southern SCS was the source of atmospheric CO_2 during that periods. The Holocene result coincides with the modern observation. During the last glacial period, the southern SCS became the sink of atmospheric CO_2, indicated by the negative $\Delta pCO_2sw\text{-}atm$ values. The difference between the Halmahera Sea and the southern SCS is that the Halmahera Sea was the source of atmospheric CO_2 all the time over the entire last glacial cycle. However, the source effect of the Halmahera Sea weakened in the glacial period compared with the interglacial time. Particularly, the $\Delta pCO_2sw\text{-}atm$, $\Delta pCO_2tw\text{-}sw$ and subsurface seawater temperature (TWT) from both cores have similar change trend, displaying obvious 20,000-year precession cycles. When the TWT decreased, the mixed layer was able to dissolve more CO_2, the difference of partial pressure of CO_2 between subsurface and surface seawater increased, and the surface water tend to absorb CO_2 from the atmosphere. Therefore, our results show that the TWT is one of the dominant factors regulating the tropical western Pacific to absorb or release CO_2.

Tracking past terrestrial and oceanic changes in the South China Sea sediments using in-organic geochemical tracers

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The elemental composition of marine sediments contains a wealth of information on sediment sources, transport mode and strength, climate change, oceanic circulation and production. Therefore, geochemical data can be used to study ocean systems and complement and strength paleoclimatic and environmental interpretations derived from other tracers, such as microfossils, magnetic parameters and isotopic compositions. Thanks to the frame of French-Chinese LIA MONOCL, the Circulation in East Asian Seas (CIRCEA) cruise retrieved a series of marine sediment cores in the Northern South China Sea in 2012. Here, we present the first results of geochemical analysis on the core MD12-3428, aiming to trace terrestrial input history and its linkages to climate changes on glacial-interglacial and millennial time scales. The geochemical analyses were conducted by methods of conventional XRF and high-resolution XRF core scanner. First, we discuss how to calibrate XRF core scanner data using quantitative results of conventional XRF. Then, we illustrate how to un-mix terrestrial and marine information mixed in the sediments using statistical methods. Finally, some relatively independent geochemical variables or ratios are used to trace terrestrial and oceanic changes in the South China Sea sediments. Obviously, our interpretation mainly based on geochemical data must be referred to other evidences, such as microfossils, isotopic and magnetic parameters. This implies the importance of collaboration between different disciplines and further efforts are needed in this direction.

Variability of the detrital input to the site of core MD12-3432 during the last 410 kyr.

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Clay and magnetic mineralogy of Core MD12-3432 taken at 2125 m water depth (CIRCEA cruise on board the R.V. Marion Dufresne, IPEV) in the northern South China Sea was investigated in order to reconstruct the history of terrigenous sediments input and climatic evolution.

Age model is derived from both carbonate and magnetic stratigraphy. Although dissolution of magnetic particles is observed under 10 m, the remaining magnetic minerals still document the variations in geomagnetic paleointensity and polar position. Two known geomagnetic excursions, Laschamp and Iceland Basin events, are identified. Coupled with the earth magnetic field paleointensity and the carbonate content record calibrated from XRF core scanned calcium intensity, we established a reliable age model, indicating that core MD12-3432 covers the last 400 kyr.

The clay mineral assemblage is dominated by smectite (23-59%) and illite (22-43%), with minor chlorite (13-27%) and kaolinite (4-13%). The provenance analysis of these clay minerals suggests three end-member sources: all smectites derive from Luzon, all kaolinites originate from the Pearl River, and illite and chlorite are coming from both the Pearl River and Taiwan. Using the linear separation method of illite crystallinity, a time series of the clay mineral contribution from the three major provenances to the northern South China Sea was reconstructed. Combined with spectral analyses, we suggest the clay mineral contribution from Pearl River was mainly influenced by sea level change, while the East Asian summer monsoon controlled the contribution from Luzon.

All magnetic parameters have been analysed continuously (every 2 cm) using u-channel samples and they have been completed by hysteresis measurements on discrete samples. The top part of the core is characterized by mainly magnetite in pseudo-single domain range. Below 10 m, almost all the magnetic proxies decrease due to dissolution effect. However, coercivity changes are illustrated by coeval changes in S-ratio and medium destructive field of IRM. Hysteresis parameters indicate that in that portion of the core, the magnetic fraction is relatively coarse (pseudo-single to multidomains). Magnetic grain size parameter measured continuously (ARM/IRM ratio) has a general inphase down-core change with coercivity. Several intervals of coarse grains and high coercivity are observed. The measurements of selected discrete samples indicate that the coercivity changes result from variations in relative concentration of high coercivity mineral. Coupled with the co-variation of clay mineral contribution from the Pearl River, we suggest that the sea-level change is the factor that controlled both magnetic mineral assemblage and grain size in these intervals by changing the distance between river mouth and the site of core MD12-3432 and increasing the material contribution of the Pearl River.

High-resolution variations in terrigenous flux and sediment sources since 70 ka BP in the northern South China Sea

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Terrigenous sediments in marginal seas of the low-latitude western Pacific provide excellent materials for paleoenvironmental studies because of their high sedimentation rate resulting from massive detrital input of Asian large rivers. A high-resolution temporal series study on terrigenous sediments and their accumulation history will help for understanding how terrigenous materials respond to climate and environment changes in low latitudes. In this study, high-resolution (2 cm) clay mineralogy and grain-size distribution, combined with low resolution (20 cm) dry bulk density, carbonate, total organic carbon, and opal content, were analyzed at a Casq Core MD12-3428 (20°08.48'N, 115°49.80'E, water depth 903 m, 10.15 m long). This core was retrieved on the upper continental slope (off the Pearl River delta) of the northern South China Sea during the Cruise MD190-CIRCEA in June 2012.

Our results show that the core sediment spanning the last 70 kyr mainly consists of terrigenous clastics (69%) and biogenic $CaCO_3$ (28%), with minor opal (2.0%) and total organic carbon (0.9%). The clay mineral assemblage includes smectite (41%), illite (32%), chlorite (18%), and kaolinite (9%). The mean total mass accumulation rate (MAR) is 14 g/(cm^3·ka), among which the terrigenous MAR is 10 g/(cm^3·ka) with the clay MAR of 2.4 g/(cm^3·ka). Both total and individual component MARs reach the highest value duirng 15-19 kyr BP, which is attribuated the sea level change driving. While prior to and after the period, grain size rario (36-70)/(6.2-13) μm and clay mineral ratio smectite/(illite+chlorite) show increase variations that we interpret the strong summer monsoon climate. More details of time series variations in terrigenous flux and sediment source change will be presented.

Evolution and variability of the East Asian summer monsoon over the last 2.36 Ma: Evidence from clay mineral records of the West Philippine Sea

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East Asian summer monsoon controls the most amount of rainfall in the Asia continent and have a profoundly influence in the exchange processes between Asia land and Pacific ocean in Quaternary. However, the evolution of the EASM in the West Philippine Sea remains still unclearl and only little is known about the dynamics of the EASM during the Quaternary on orbital time scales. Clay mineral and scanning electron microscope combined with energy dispersive X-ray spectrometer (SEM-EDS), have been performed on the Core MD06-3050 in the West Philippine Sea in order to trace the sources of clay minerals and reconstruct evolution and variability of East Asia summer monsoon since 2.36 Ma. The clay mineral assemblage from Core MD06-3050 is mainly dominated by smectite (40~80%) and illite (10~55%), while chlorite (5~10%) and kaolinite (~5%) are present with minor and very scarce， respectively. Smectite in Core MD06-3050 mainly originated from Luzon Islands, whereas the illite, kaolinite and chlorite were most likely sourced by eolian transport from central Asia. The smectites/ (illite+chlorite) ratio in MD06-3050 was adopted as a proxy for East Asian monsoon variability in the past 2.36 Ma. The ratio was generally higher and more peaks during interglacials and lower during glacials. Our clay minerals record combined with published clay minerals record at ODP site 1146, stack weathering intensity in Asia and maine δ44Ca ratio at DSDP site 590, suggest a stronger EASM during 1.2-0.4 Ma and 2-2.36 Ma compared to the other timescales. Spectral analysis of the smectites/ (illite+chlorite) ratio in MD06-3050 displays a set of strong periods at 100 ka, 30 ka and 19 ka, with no clear obliquity-related signal, suggesting a strong low-latitude modulating. The relative good agreement cycle between our ratio and smectites/ (illite+chlorite) ratio at ODP site 1146 in 23 ka or 19 ka indicates a precession control on the EASM during the last 2.36 Ma. Evolutionary spectra of Smectites/ (illite+chlorite) ratio at MD06-3050 shows strong 100-kyr cycles in the intervals from 0.6 to 0.4 Ma, and 19-kyr cycles in 2.36 to 1.9 Ma and 0.8-0.4 Ma, suggests that the evolution of EASW in the past 2.36 Ma was forced predominantly by nonliner coupling of the ice volume activity and low-latitude drive.

Changes in primary production between the beginning and the end of isotopic stage 4

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Indian Ocean primary production has been reconstructed during isotopic stage 4 thanks to coccolithophorids assemblages (Beaufort, 1997, Nature). During this period, the precession index i.e. the eccentricity multiplied by the sinus of the longitude of the perihelion, which determines at which time in the year insolation is maximum or minimum, as well as the length of the seasons, has changed from a maximum (0.01496) in 72kyr BP to a minimum (-0.01785) in 60kyr BP. We are using two IPSL CM5A LR simulations at 72kyr BP and 60kyr BP to investigate the mechanisms behind the observed changes in primary production. Our objective is to examine whether the changes in precession are responsible for the changes in primary production or not, and determine the driving factors of these variations.

A first analysis has shown that winds are a key component of the production dynamics. Where winds are stronger, the mixed layer is deeper, resulting in more upwelled nutrients and consequently more primary production. This is consistent in almost the whole Indian Ocean except for the Arabian Coast where primary production cannot be explained by winds and mixed layer depth only. Further analysis on limiting nutrients, advection, and currents will be required to fully understand the mechanisms at stake in the Indian Ocean.

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L'échinococcose alvéolaire dans le Gansu

Projets

LIA MONOCL : quoi de neuf ?[13]

par Catherine Kissel, responsable française du LIA-MONOCL (Laboratoire des Sciences du Climat et de l'Environnement, LSCE, Gif-sur-Yvette)

Comme on le sait, le LIA-MONOCL s'est structuré en 2011 à la suite d'une collaboration déjà existante dans le domaine de la paléo-océanographie entre les laboratoires français et chinois. Le projet porte sur les aspects de ***la variabilité passée de la mousson sud-est asiatique et des échanges de masses d'eau dans les océans*** *de cette partie du monde.*

Dans le cadre de MONOCL, une campagne océanographique franco-chinoise de carottages sédimentaires (CIRCEA) a été organisée en 2012 à bord du navire océanographique français le Marion Dufresne. Les carottes prélevées dans la partie nord de la mer de Chine du Sud sont distribuées le long d'un transect en profondeur (500 à 3 900 m) qui permet d'étudier les échanges continent-océan et la dynamique passée de la circulation océanique le long de la marge nord-ouest de la mer de Chine du Sud. Les échantillons qui viennent compléter les échantillons prélevés antérieurement lors de campagnes précédentes ont été partagés pour des analyses complémentaires dans les divers laboratoires.

Après une réunion qui s'est tenue en 2012 à l'Institut de géologie et géophysique à Pékin (CAS), celle de 2013 du LIA-MONOCL a été organisée à Hangzhou par les scientifiques du Département géologie marine de l'université Tongji (Shanghai). Elle a été l'occasion d'échanges scientifiques très fructueux sur les différents sujets abordés, alimentant ainsi des discussions et débats.

Des résultats inattendus

Plusieurs présentations ont traité de la fraction terrigène du sédiment en tant que traceur pour reconstruire la variabilité spatio-temporelle de la circulation en mer de Chine du Sud. Elles se sont principalement focalisées sur la reconnaissance des régions source de ces particules et sur les processus de transport. Des profils obtenus à partir de stations de mouillage distribuées le long de transects E-W dans le nord de la mer de Chine du Sud (campagnes chinoises) ont permis d'obtenir des résultats tout à fait intéressants sur la situation actuelle. Un niveau très riche en particules terrigènes a notamment été identifié à environ 1 000 m de fond longeant le plateau continental depuis Taiwan jusqu'au sud de l'embouchure de la rivière des Perles. D'impressionnants tourbillons de grande échelle se sont également produits pendant la période d'observation, affectant l'ensemble de la colonne

[13] *Complément d'information à notre précédent numéro sur la coopération franco-chinoise en sciences marines (N°15, rubrique découverte du potentiel scientifique chinois p. 20-23) .*

d'eau, jusqu'à 1 800 m de profondeur. Ces résultats et observations sont importants pour mieux aborder les séries anciennes. De la même façon, la caractérisation des sédiments provenant des principales rivières alimentant actuellement la mer de Chine du Sud permettront ensuite de suivre leur concentration en mer (liée à la quantité de pluies sur le continent) et leur parcours et celui des courants associés en mer de Chine du Sud. D'autres présentations ont ouvert un débat sur la dynamique de la circulation profonde en mer de Chine du Sud et sa variabilité sur les échelles de temps glaciaires/interglaciaires. Des indicateurs aussi variés que le radiocarbone sous forme dissoute dans les eaux profondes et/ou intégré dans les coquilles de foraminifères, les isotopes du néodyme sont en cours d'analyse. Celles-ci sont faites en parallèle sur des échantillons actuels et sur des échantillons prélevés dans les carottes marines et apporteront ainsi des contraintes importantes sur cette masse d'eau qui échange plus ou moins activement selon les périodes avec l'océan Pacifique ouvert.

Les résultats de simulations du climat à l'aide de modèles de complexité variable examinant l'impact à ces basses latitudes des flux d'eaux douces en Atlantique nord, de la position variable du front de convergence intertropical et des taux de précipitation ont montré la dépendance des résultats par rapport à l'état de base considéré au départ. La modélisation des liens entre la circulation océanique et l'atmosphère à différentes échelles de temps dans les régions Asie/Pacifique ont également montré le besoin de simulation à haute résolution régionale pour mieux la distinguer de la variabilité locale et ainsi mieux comprendre les variations observées dans les données d'une carotte à l'autre suivant les régions.

Finalement, cette réunion a été jumelée avec la réunion post-campagne CIRCEA avec plusieurs présentations scientifiques d'étudiants qui ont fait le point sur les données préliminaires obtenues. Un nombre impressionnant de données ont été produites, un an à peine après la réalisation de la campagne. Celles-ci concernent notamment les modèles d'âge des carottes prélevées, base essentielle pour toute étude ultérieure détaillée des séquences. Des comparaisons ont été faites avec les carottes prélevées lors d'autres campagnes océanographiques, également organisées par les mêmes équipes antérieurement à l'établissement du LIA.

Quelles suites ?

Deux thèses franco-chinoises sont en cours dans le cadre du LIA-MONOCL. La première, entre l'université Paris-Sud et l'université Tongji arrive à terme avec une soutenance sous peu. La doctorante WU Qiong a travaillé sur l'utilisation de la composition en isotopes du néodyme de l'eau de mer et des coquilles de foraminifères pour tracer les eaux intermédiaire et profonde en mer de Chine du Sud et reconstruire leur variabilité au cours des périodes glaciaires. La seconde, celle de CHEN Quan entre dans le cadre d'une cotutelle entre le LSCE et l'université Tongji. Cette thèse a pour but de reconstruire, à l'aide d'une carotte CIRCEA et au cours des 4 derniers cycles climatiques, la variabilité des apports terrigènes à partir du continent et de leur transport dans le bassin nord de la mer de Chine du Sud. Les résultats obtenus renseigneront donc sur la variabilité des précipitations à terre (via la reconnaissance des sédiments de la Rivière des Perles), l'impact des changements de niveaux marins et la structure de la colonne d'eau. Q. Chen est arrivé en France en janvier 2014 pour une période de deux ans, grâce à une bourse d'un organisme chinois (le « *Chinese Scholarship Council* »).

Le LIA-MONOCL arrive à une phase de renouvellement en 2015. Celui-ci permettra entre autres la concrétisation des thèses en cours notamment par des publications communes, et le démarrage d'autres thèses. Le LIA-MONOCL s'agrandira également puisque les scientifiques de l'université de Pékin, participant activement aux études des sédiments de CIRCEA, ont émis le souhait de rejoindre le projet. La stratégie scientifique qui sera développée dans les 4 années qui viennent sur les chantiers en cours et à venir sera discutée lors de la réunion annuelle de MONOCL qui se déroulera en France début septembre 2014. La participation à cette réunion d'une vingtaine de scientifiques chinois de Shanghai et Pékin est un témoin du succès de fonctionnement et de l'intérêt scientifique suscité par MONOCL au cours de sa première phase. ■

Pour plus d'informations sur le LIA-MONOCL (MONsoon, Ocean and Climate) :
https://monocl.lsce.ipsl.fr

Photo de groupe prise lors de la réunion annuelle du LIA-MONOCL (Novembre 2013 à Hangzhou)

项目

中法季风、海洋与气候国际联合实验室：新进展[13]

作者：Catherine Kissel，中法季风、海洋与气候国际联合实验室法方主任
(环境与气候科学实验室，Gif-sur-Yvette)

众所周知，在中法两国实验室在古海洋学领域开展合作后，中法季风、海洋与气候国际联合实验室于2011年正式成立。**项目涉及东南亚季风的演变历史以及该地区海洋水体交换。**

该地区是开展气候演变研究的关键区域，因为该区域不仅受低纬度季风气候影响，同时也是太平洋和印度洋的汇合之处。Catherine Kissel教授通过以下文章对我们开展的合作研究进展作一总结。

在中法季风、海洋与气候国际联合实验室的框架内，2012年，中法海洋科考团(CIRCEA)乘坐法国Marion Dufresne科考船进行了沉积岩心采样研究活动。提取的岩心采样分布于中国南海北部的深层断面(500至3900米)上，它有助于大陆和海洋水体交换的研究，以及中国南海西北边缘狭长地带环流的动态研究。此次采取的样本是对以前海洋科考活动中采样的补充，岩芯将被运送至国际联合实验室各个参与机构中进行全面的分析研究。

中科院地质与地球物理研究所于2012年举行研讨会后，上海同济大学海洋与地球科学学院的科研学者在杭州召开了中法季风、海洋与气候国际联合实验室2013年会议。会上就各项科研主题进行了富有成效的交流与探讨。

意外收获

研究学者们围绕作为示踪物的沉积物陆源做出了众多论述，旨在重建南海洋流时空多样性变化。这些论述主要聚焦于颗粒来源地区的勘测及搬运过程研究。在中国南海北部东西断面狭长地带分布的锚泊站位，所得的剖面图可以获得关于现状非常有意思的结果。从台湾延伸至珠江口南部的大陆架1000米深处发现了一个富含陆源颗粒的层。在观察期产生的巨大漩涡令人印象深刻，它影响了整个水柱，直达1800米深度。这些结果和观测对更好地探讨以前的研究系列很重要。同样，对目前流入南海的主要河流带来的沉积物进行特性研究，可以跟踪海洋浓度(与陆上降雨量相关)，研究其路径以及进入南海合流的路径。此外，会上还讨论了南海深层洋流的动力，及其冰期/间冰期的时间尺度。放射性碳分解在深水中或融于有孔虫类贝壳钕同位素内，如放射性碳一般多种多样的各种指数处于分析之中。研究人员针对目前已存样本和此次海洋岩心中提取的样本将以平行的方式进行分析研究，并带来严格的水体限制条件，根据不同时期，开发的太平洋水体平缓交换或积极交换。

不同复杂度模型用以检测北大西洋淡水洋流、热带交汇面多变位置、降水率对低纬度的影响。借助这些模型，获得的气候模拟结果显示了它与初期考量基本状态的相关性。亚太地区洋流与不同时段大气间建模还显示了区域性高分辨率模拟的需求，旨在更好地将其与区域变化相区别，并按照地区更好地理解在不同的岩心数据中观察到的变化。

[13] 关于中法海洋科学合作的补充信息，请查阅本刊第15期，中国科研潜力之探索，第20-23页

总之，此次会议与南海深部环流后续会议相呼应，多名学生所做的科学报告对初步获得的数据做出了总结。考察活动仅仅完成一年后，研究工作者就已计算出大量数据。这些数据主要涉及提取岩心的年代模型，这是对随后关于序列详细研究的关键基础。研究人员对此次采样和在国际联合实验室成立前的同一支团队组织的海洋科考活动中提取的岩心做了对比。

接下来做什么？

两篇中法联合监管论文正在中法季风、海洋和气候国际联合实验室的框架下准备。巴黎十一大与同济大学的第一篇论文已经完成，不久将进行答辩。博士研究生吴琼从事海水及有孔虫壳钕同位素组成使用的研究，以描述南海中层及深层水并重建冰期期间的变异性。第二篇论文是在法国环境与气候科学实验室和同济大学联合培养下陈全的论文。这篇论文的目标是借助CIRCEA科考任务和最近的四个气候周期，重建来自大陆的陆源变化性，以及流向中国南海北部海盆的运输变化性。获得的结果将使人们了解陆地降水的变化性(通过勘测珠江的沉积物)、海平面变化的影响，以及水柱的结构。在中国国家留学基金管理委员会的资助下，陈全于2014年1月抵达法国进行为期两年的研究。

中法季风、海洋和气候国际联合实验室2015年将到达续签期。这将可以使目前正在准备的论文，尤其是共同发表的论文得以落实，并启动其他论文。由于积极参与到南海深层环流沉积物的研究，北京大学科学家表达出加入该联合项目的意愿，中法季风、海洋和气候国际联合实验室的规模也将随之扩大。2014年9月初，在法国举行的联合实验室年度会议将讨论未来4年的科研战略，来自北京和上海的20多位科学工作者届时将参加会议。这是中法季风、海洋和气候国际联合实验室成功运作的见证，也侧面反映出了第一阶段法中科研人员的科学兴趣。

更多关于中法季风、海洋和气候国际联合实验室的信息，请登陆：https://monocl.lsce.ipsl.fr ■

2013年11月中法季风、海洋和气候国际联合实验室杭州年会合影