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1999.2.16-4.12

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East Asia Monsoon

2017.2.7-4.9

2017.4.9-6.11

IODP 367/368

South China Sea Rifted Margin

2014.1.26-3.30

IODP 349

South China Sea
Tectonics

Sponsored by

IODP-China Scientific Committee

State Key Laboratory of Marine Geology (Tongji University)

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Ocean Drilling in China: Quo Vadis?

—— The Three-Step Strategy of IODP-China

On 25 May 2017, the Annual Meeting of the IODP-China Scientific Committee (SciCom) was held in Beijing. Prof. DING Zhongli, Chair of the Committee, presided over the meeting. The committee highly appreciated the successes and scientific findings of the recent IODP Expeditions 367/368 to the South China Sea, and expressed its great praise to participants of the expeditions.

It was four years ago, at its 2014 Annual Meeting, the IODP-China SciCom adopted a three-step development strategy for China's participation in IODP. After discussions at the annual meeting this time, the SciCom reiterated that the three-step strategy should be continued in the coming years, in order to enhance China's role in the international collaborative research of the deep-sea. The strategy, which was initially implemented in 2013 and coincided with the onset of the new phase of IODP has the following steps:

The 1st step: China increases its financial contributions to IODP and trains China's research teams largely through the implementation of IODP CPP (Complementary Project Proposal) expeditions.

The 2nd step: China enters the group of IODP platform providers, by providing mission-specific platforms (MSP) together with ECORD, and establishing the fourth IODP Core Repository.

The 3rd step: China builds a third-generation ocean drilling vessel, to meet the research demands of the long-term science plan for the new international ocean drilling.

In June 2017, with the *JOIDES Resolution* (JR) port-call in Shanghai after IODP Expeditions 367/368, the 1st step of IODP-China strategy was completed (Figure 1). Within the past four years (2014-2017) three CPP expeditions of JR were implemented in the South China Sea, greatly improved our understanding of the opening history of the marginal basin and brought a very new vision on tectonics of the Western Pacific margin. Meanwhile, China has seen an unprecedentedly rapid development of the deep-sea research groups, with a total of 71 scientists sailing onboard of JR within the 4-year period.

Now IODP-China has entered into the 2nd step of its strategy. China will provide drilling facilities to implement the IODP MSP expeditions. To expand the capability of the existing three

core-repositories in College Station, Bremen, and Kochi (Figure 2), China is building the 4th IODP Core Repository in Shanghai. All these will significantly enhance China's role in IODP, and bring China into the group of platform providers.

There has an excellent tradition of long-range science planning in ODP/IODP/IODP. Usually an international conference would be held to prepare the new science plan four years before the new phase started (Figure 3). The current IODP will end in 2023(or 2024), and IODP-China proposed to host the next conference in 2019 (or 2020) to prepare the new ocean drilling science plan beyond 2023. A crucial component of the conference will be the technical session, to discuss what kind of new technology should be developed for the new science targets and to apply to the new phase of ocean drilling. IODP-China will be active in the discussions, as the results will lead to the 3rd phase of its strategy, i.e., to build the next-generation of ocean drilling vessel for the international community.

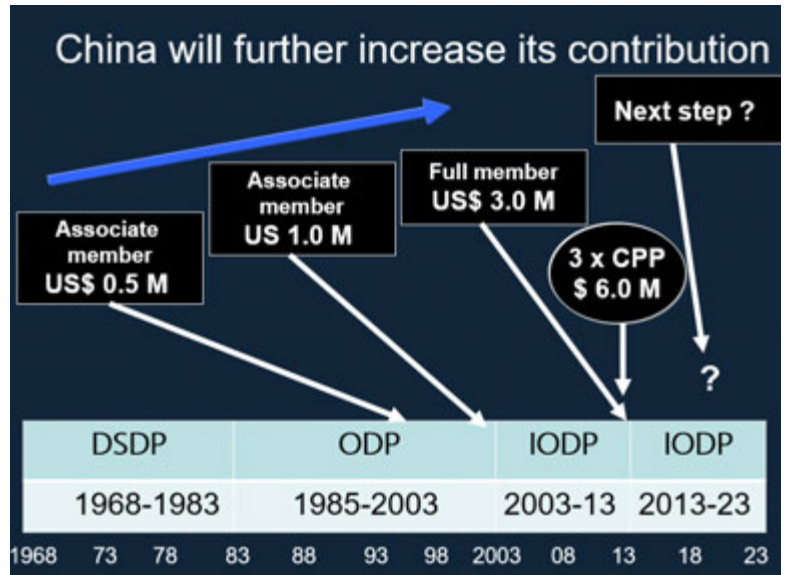
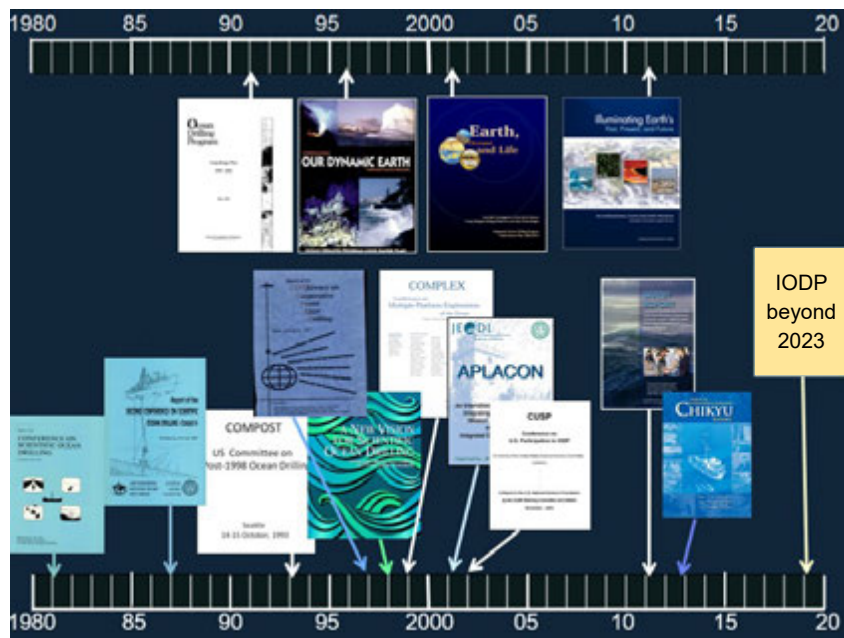


Figure 1. The enhanced contribution of China to IODP



Figure 2. The existing three IODP core repositories

Figure 3. Preparing long-term science plan of IODP over the past decades



50th Anniversary of Ocean Drilling: Celebration in China

According to its recent decision, IODP-China will organize ocean drilling celebration in Beijing, in early November of this year. The ceremony is designed to hit two birds with one stone: to commemorate the 50th anniversary of the very first DSDP expedition in 1968, and to celebrate 20 years since China officially joined ODP.

The word of DSDP came to China at the turn of 1970/1980, shortly after the so-called "Cultural Revolution". Oversea scientists such as Prof. Ken Hsu spread the news of DSDP together with the theory of plate tectonics. By the time when ODP launched in 1985, a group of Chinese scientists organized a committee to promote China's participation in ODP as an associate member, but a half million of US dollars of the annual membership fee then sounded as an astronomical number for the poor country 40 years ago. China finally, joined ODP as its first Associate Member in 1998 (Figure 1). Luckily enough, the Chinese drilling proposal entitled "East Asian monsoon history as recorded in the South China Sea and its global climate impact" was ranked highest in the science evaluation panel. As such, ODP Leg 184 was jump-scheduled in early 1999, marking the first ocean drilling expedition off the China's coast.

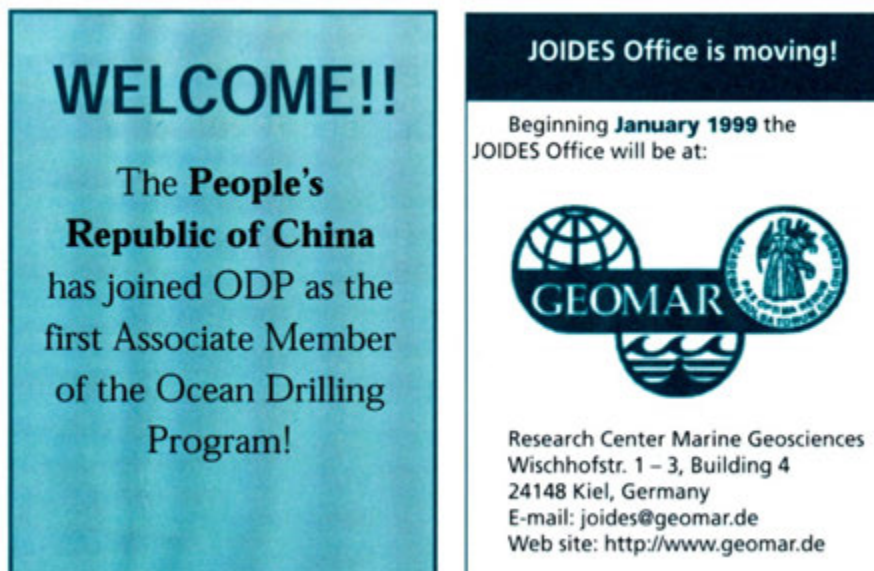


Figure 1. The announcement of China's participation in ODP (from JOIDES Journal, 1998, volume 24, no.1)

Over the past 20 years and with its rapid growth in economy, China becomes progressively more active in all phases of IODP activities. According to the preliminary statistics, there are a total of 137 Chinese scientists from 34 institutions (including universities and academic research institutes) to have sailed ODP/IODP expeditions, and 188 person-times have attended the various ODP/IODP science advisory panels since 1999. Meanwhile, about 100 graduate students used ODP/IODP cores and data for their master/PhD thesis studies. During the first half of the current IODP phase, China has greatly increased contributions to the JOIDES Resolution platform both for financial support and participation of scientists (Figure 2).

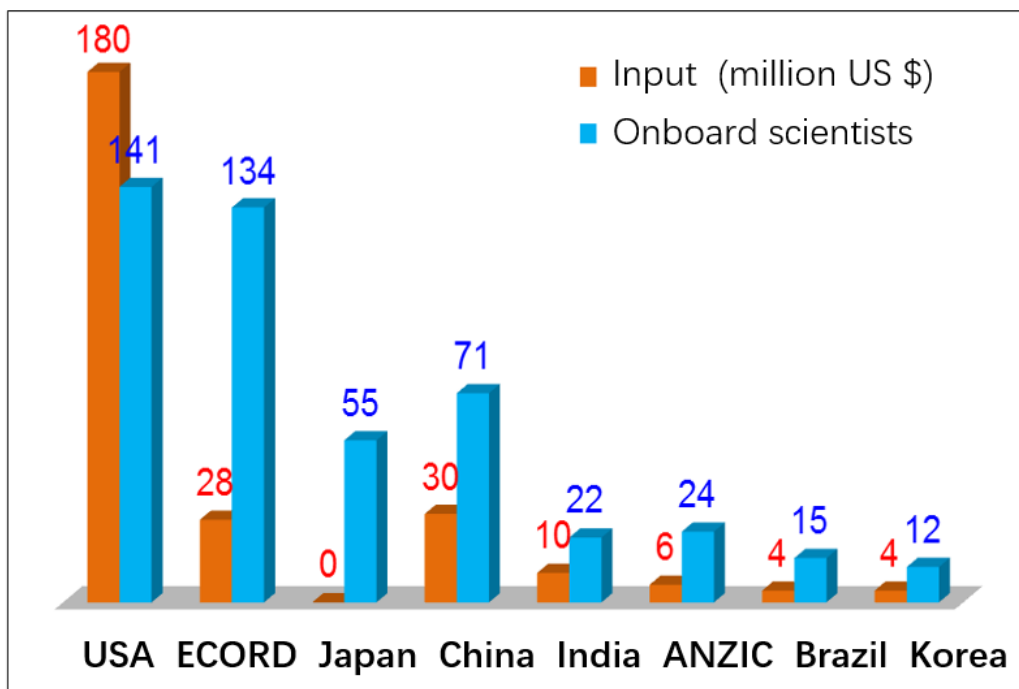


Figure 2. Contribution and participation of various IODP members in JR activities for the past 4 years (2014-2017)

In sum, the Chinese community of deep-sea research has grown up with its participation in ODP/IODP, and the forthcoming celebration will be a mobilization for further enhancement of ocean drilling activities in the country.

A Submerged Amazonia?

——Towards Ocean Drilling to the Sunda Shelf

A crucial and debatable issue in paleoclimatology is the change of terrestrial vegetation and the role of its carbon storage in glacial cycles. In the modern world, the Amazon Basin hosts the largest tropical rainforest and plays a major role of carbon sink, but during the glacial times another large tropical rainforest must have formed in the emerged Sunda Shelf, SE Asia, and significantly changed the global carbon cycling (Figure 1).

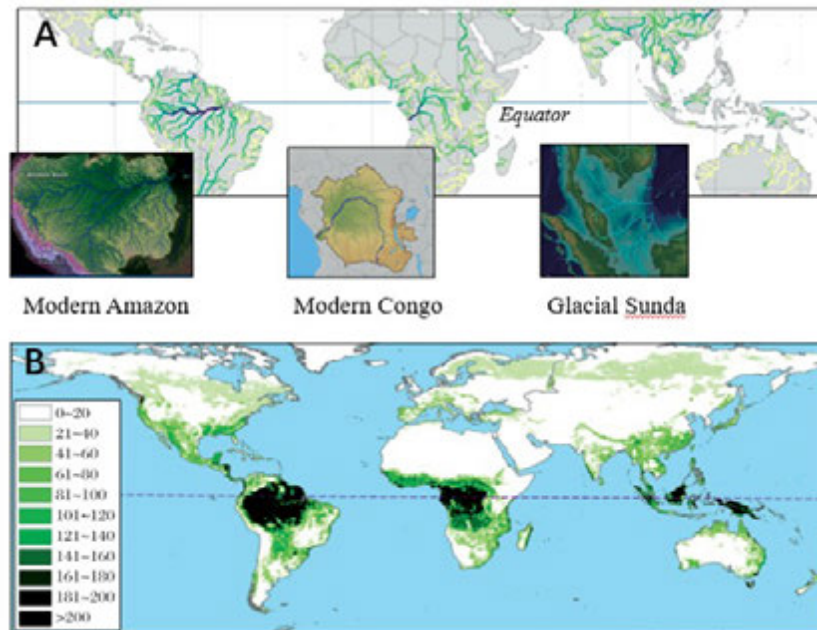


Figure 1. Terrestrial carbon storage in the tropics. A. Tropical rivers at the equator; B. Global total biomass carbon density (unit: MgC/hm²)

The Sunda Shelf, also known as the Great Asian Bank, covers an area of 1.8×10^6 km² and is the largest shelf area outside the polar regions. Over the Plio-Pleistocene time, tremendous amounts of clastic sediments have accumulated and provide ideal archives for paleo-environmental reconstructions. During the glacial low sea-level stand, the Sunda Shelf was widely subaerially exposed and extremely sensitive to sea-level changes because of its gentle topographic gradient ($\sim 1:9000$) and equatorial position. Several major paleo-‘trunk’ river systems of the Sunda Shelf flanked and fed by tributary systems represented major ancient sediment conduits during the Late Pleistocene, the buried organic carbon and sub-seafloor

carbon sequestration within the marine environment contribute greatly to the global carbon cycling. It is thus a formidable task to obtain record of paleo-environmental changes of the Sunda Shelf during the last 5 million years, which has the potential to become a world reference for studies of sea-level, tropical paleoclimate, and linkages between post-Miocene marine and continental records.

Forests and soil comprise the main body of terrestrial carbon storage. Although the modern Asian tropical forests in the Maritime Continent is limited in area, the carbon pool is significant. Of the global tropical peatlands, for example, 77% are in Southeast Asia. During the last glaciation, the global terrestrial carbon reservoir reduced and hence could not contribute to the glacial decrease of atmospheric carbon reservoir. But the Sunda Shelf is the only exception. Counterintuitively, modeling results show an increase of relative importance of tropical forests as a land carbon store at the LGM (30%) than at Holocene (25%), despite of the areal reduction of tropical forests by 18% during the LGM. The appearance of rain forests on the Sunda Shelf must have had its substantial impact not only on carbon cycle, but also on hydroclimate and ecological environments of the region and beyond.

To this end, two International workshop on scientific drilling in the Sunda Shelf were successfully convened. The first was in Jogjakarta, Indonesia during November 25-27, 2015, and the second in Shanghai, July 11-13, 2016, both sponsored by IODP-China (Figure 2). Scientists from 10 countries (Indonesia, Malaysia, Thailand, Vietnam, Japan, Australia, Germany, USA, UK, and China) participated in these workshops. The main purpose of the workshops was to develop a new IODP drilling proposal on the Sunda Shelf and to explore the possibility of its implementation with the Mission-Specific Platforms (MSP) in the near future. Two international working groups were set up to prepare the proposal and to organize site survey of the drill locations, respectively. This summer, a joint seismic cruise of Indonesian and Chinese geophysicists to the Sunda Shelf will take place in the area of drill sites. Hopefully, the IODP cruise to the Sunda Shelf will be implemented in 2020 or 2021.

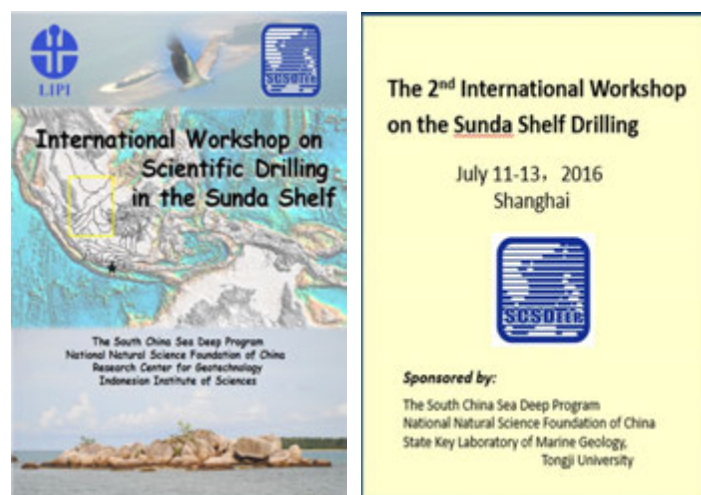


Figure 2. Two international workshops on the Sunda Shelf drilling were sponsored by IODP-China.

Workshop Report

IODP-PAGES Workshop on Global Monsoon

The IODP-PAGES Workshop on Global Monsoon in Long-term Records was held on September 7-9, 2017, in Shanghai, China. Forty-eight scientists from 12 countries exchange scientific findings from the seven recent IODP monsoon-related expeditions, discussed future research directions, and strongly recommended that monsoon system behavior should be included into a future IODP initial science plan.

In recent years (2013–2016), seven deep-ocean drilling expeditions were completed by IODP (Integrated Ocean Drilling Program and International Ocean Discovery Program) to explore the Cenozoic history of the Indian, East Asian, and Australian monsoons (Figure 1, Table 1). Earlier, between 1986 and 1999, at least ten ODP (Ocean Drilling Program) cruises carried out drilling in African, American, and Asian monsoon regions as well (Figure 1).

Table 1. IODP Monsoon Expeditions

IODP	Topic	Dates	Drill Sites
346	Sea of Japan, East China Sea: Asian monsoon	July-September 2013	U1422-U1430
353	Bay of Bengal: Indian monsoon rainfall	November 2014-January 2015	U1443-U1448
354	Bengal Fan: Himalaya and climate	January-March 2015	U1449-U1455
355	Arabian Sea: tectonic-monsoon interactions	March-May 2015	U1456-U1457
356	Indonesian Throughflow	July-September 2015	U1458-U1464
359	Sea Level, Currents, and Monsoon Evolution in the Indian	September-November 2015	U1465-U1472
363	Western Pacific Warm Pool	October-December 2016	U1482-U1490

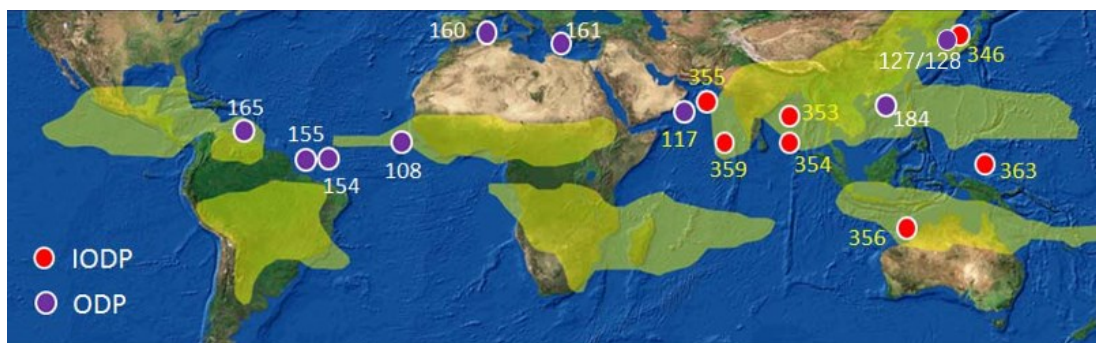


Figure 1. IODP/ODP Monsoon Expeditions

Traditionally, the variability of the monsoon has been studied almost exclusively on regional scales, by both the modern and paleo-monsoon communities. With the application of remote

sensing and other new techniques over the last decade, the concept of the Global Monsoon has been introduced as a global-scale seasonal reversal of the three-dimensional monsoon circulation associated with the migration of rainfall in the monsoon trough and the intertropical convergence zone (ITCZ). In an effort to understand better the dynamics of monsoon variability, the “Global Monsoon and Low- Latitude Processes: Evolution and Variability” working group was established by PAGES (Past Global Changes) in 2007. This working group conducted two successive symposia in 2008 and 2010 in Shanghai, and published a special issue with 13 contributions and two synthesis papers in recent years. Obviously, the relevant community felt that the time was right for an international workshop to synthesize the research progress of monsoon-related IODP and ODP expeditions from a new viewpoint of the global monsoon system.

After two years of preparation, the IODP-PAGES Global Monsoon Workshop took place on September 7-9, 2017, in Shanghai, co-sponsored by IODP, PAGES and IODP-China. Forty-eight scientists from 12 countries participated in the workshop, presented the scientific findings from the seven recent IODP monsoon-related expeditions as well as the previous ODP cruise, discussed research directions, and made recommendations for the future IODP science program (Figure 2).

A number of questions were discussed during the workshop, such as applicability of the global monsoon concept at geological time scales, monsoon response to external forcing and internal feedback, initiation of the current monsoon systems, the use and interpretation of monsoon proxies, and the



Figure 2. Participants of the IODP-PAGES Global Monsoon Workshop

role of monsoonal circulation in the global climate system. In order to promote the development of global monsoon research and to elucidate its role in hydrological cycle at various geological time scales, the workshop came up with the following recommendations for the future IODP activities to be incorporated in the IODP Science Plan beyond 2023.

- Monsoon as a key feature of the low-latitude global hydrological cycle;
- Deep-time monsoon records in high resolution;
- Development and verification of monsoon proxies;
- Extension of geographic coverage of the ocean drilling.

IODP in Chinese

The substantial differences between the Chinese and western languages have been a barrier to communication in science, including the ocean drilling. To facilitate the participation of the Chinese community in IODP activities and to broaden the IODP influence in China, IODP-China has produced timely translation of important IODP documents into Chinese, first of all the long-term science plan of IODP (Figure 1). Remarkably the IODP Presidents wrote preface for all the Chinese versions of science plan.

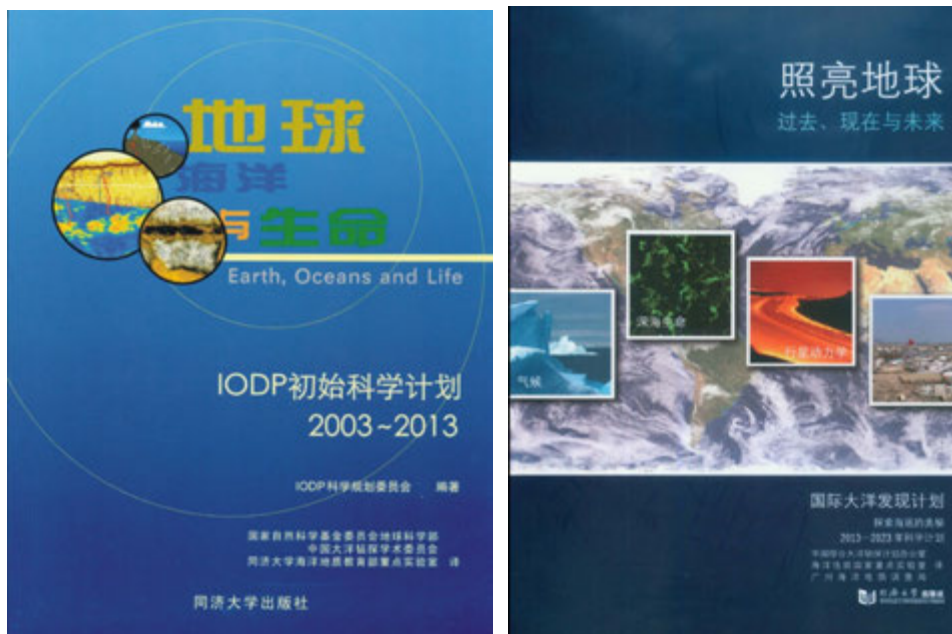


Figure 1. IODP Long-Term Science Plans in Chinese

Actually, the Chinese publications on ocean drilling trace back to the 1990s before China joined ODP. In 1995, for example, a 349-page monograph was published by the Tongji University Press, Shanghai, entitled “Ocean Drilling Program and Earth Science in China” (Figure 2). This book not only introduced the history and scientific achievements of DSDP/ODP, but also discussed several scientific topics of ocean drilling that the Earth scientists in China are most interested. Since 1998, after China joined ODP, the Laboratory of Marine Geology at Tongji University has regularly published “Ocean Drilling Newsletters” in Chinese (Figure 2).

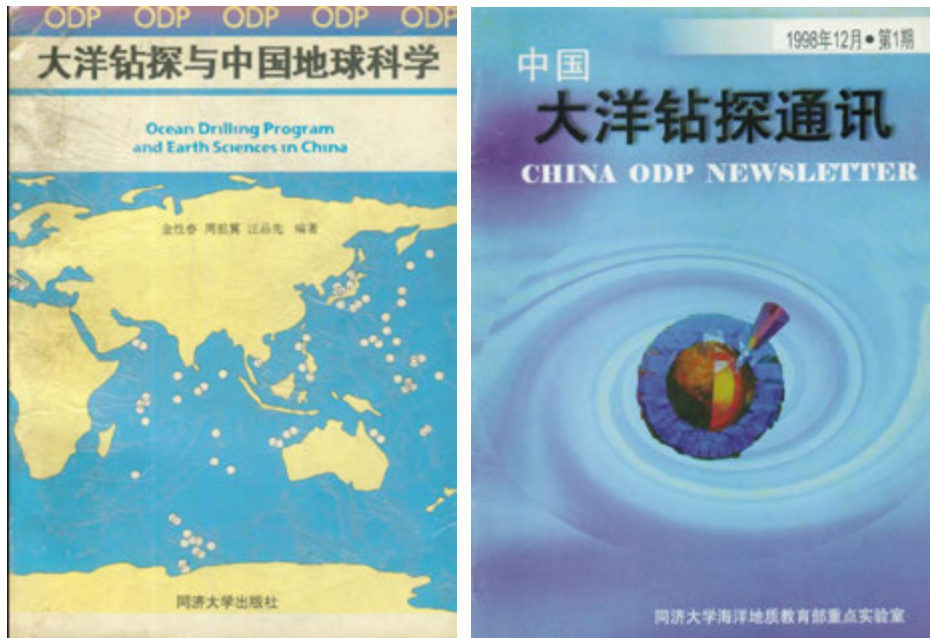


Figure 2. The Ocean Drilling Monograph and Newsletter in Chinese

The National Natural Science Foundation of China (NSFC) publishes a journal in Chinese entitled “Advances in Earth Sciences” (Figure 3). Time to time the journal publishes special issue or special section to report on recent progress or new development in ocean drilling. In the year 2017, for example, two special issues were published, one on “IODP beyond 2023”, the other on “Drilling the Sunda Shelf”.



Figure 3. A special issue of “Advances in Earth Sciences” in 2003, in the occasion of the inception of IODP (2003-2013).

Promoting marine geology in Asia: The 9th International Conference on Asian Marine Geology

Asia, the largest continent with highest plateaux and mountains in the world, is also the largest contributor of terrigenous detritus to the ocean floor. Active sedimentological and tectonical processes, operating in river deltas, marginal seas and deep-water trenches along the active continental margin of West Pacific, render marine geology of Asia particularly interesting both in academic and economic aspects. In fact, recent years have seen a rapid growth in resources exploration and geological investigations off Asian coasts, coupled with the high-speed economic development in that region. Vast amounts of marine geological data have been accumulated in the concerned institutions in Asia as well as in other countries interested in marine geology there.

To review the progress, 130 scientists from 15 countries or areas met at the First International Conference on Asian Marine Geology (ICAMG-1) held in Tongji University, Shanghai, China, from 7 to 11 September, 1988. The Conference was co-sponsored by Commission for Marine Geology of IUGS, Division of Marine Sciences and Intergovernmental Oceanographic Commission of UNESCO, Chinese Society of Marine Geology, Marine Geology Section of Chinese Society of Oceanology and Limnology, and Chinese National Natural Science Foundation. A total of 79 papers were presented at the Conference. The broad spectrum of topics included the tectonics and evolution of the western Pacific and its marginal seas, dynamic sedimentation in continental shelf and river estuary, coral-reef evolution, paleoceanography, deep-water and near-shore mineral resources and marine micropaleontology. Some years ago "marine geology" for most Asian countries meant nothing more than "coastal geology", but at this conference there were more papers dealing with deepwater and off-shore geology than on near-shore and coastal areas. Research on Asian marine geology has apparently extended from surface sediments to deeper structures, from near-shore to deep sea, from pure descriptive to the interpretation of dynamic processes and causal mechanisms.

The above two paragraphs are excerpted from the Preface of the Proceedings of the First International Conference on Asian Marine Geology (ICAMG-1) in 1988. Over the 30 years since then, seven more conferences were held in 5 Asian countries: Japan, Korea, Thailand, India, and China (Figure 1). This was a period of unprecedentedly rapid growth of economy, accompanied by remarkable development of offshore researches in the region. Thirty years ago, Japan was the only member of ODP; now we have three more countries from Asia as active members in the IODP community: Korea, India, and China. Asia has become one of three "pillar" regions in IODP together with North America and West Europe.

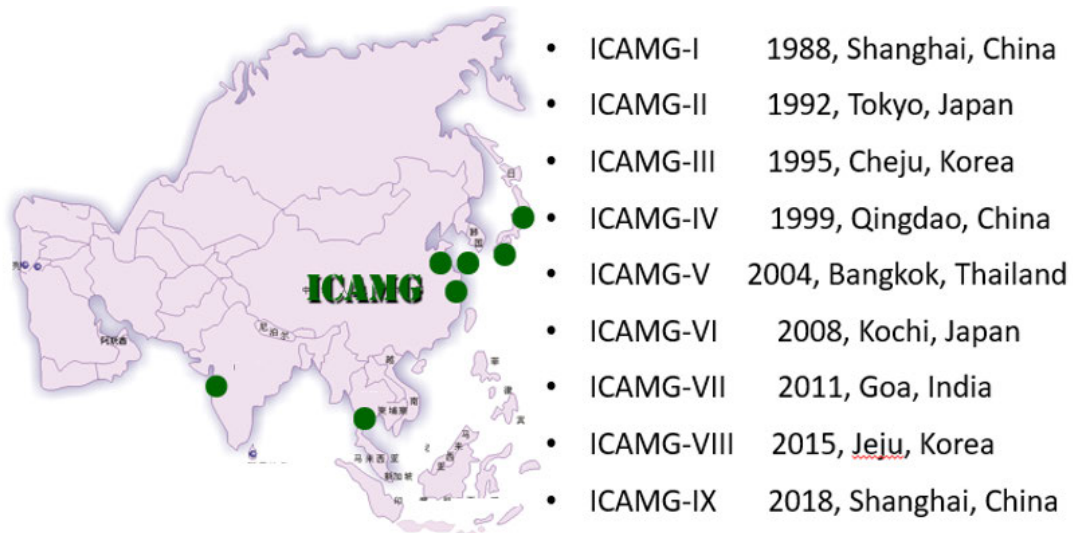


Figure 1. The successive ICAMG meetings over the past 30 years

Now the 9th ICAMG will be held again in Shanghai from October 10 to 12, 2018 to review the progress of Asian marine geology over the past 30 years, to exchange ideas on new frontier research, and to discuss the perspectives of future development of marine geology. More details are available on the meeting web: <https://icamg-9.tongji.edu.cn/>.



The 5th Conference on Earth System Science

Hosted by IODP-China Scientific Committee (SciCom), Department of Earth Sciences of National Natural Science Foundation of China (NSFC), and State Key Laboratory of Marine Geology (Tongji University), the 5th Conference on Earth System Science will be held on 2-4 July 2018 in Shanghai (Figure 1). The conference is a biennial academic event with the goal to facilitate interdisciplinary studies that cross geospheres and space-time, and to promote the integration of land and sea, ancient and modern, life science and earth science, and science and technology. The two recent conferences (third and fourth) received more than 1000 attendants in 2014 and 2016, respectively. In this coming July, there has already more than 1300 registrants, and the final attendants are expected about 1500.

Adhering to the excellent tradition of the previous four series conferences, this year's conference will continue to use Chinese and English as the main languages of communication. The most striking feature of the conference is that it is highly interdisciplinary, emphasizing and focusing on scientific discussions of all types of presentations (ranging from the plenary lecture to the oral and the poster presentations). Townhall meetings are organized in the evenings. The young scholar forum (plenary presentation) will be also organized for the first time, in order to help recognize outstanding young scholars in the field of earth system science. The conference will also highlight the spirit of combining science and culture and organize sessions for public education and outreach.



Figure 1. The announcement for the 5th Conference on Earth System Science, 2-4 July 2018, Shanghai. Website: <http://www.cess.org.cn>.

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