

## “The South China Sea Deep” Research Program: Progress and Perspectives

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The Major Research Program “Deep Sea Processes and Evolution of the South China Sea”, or “The South China Sea Deep”, launched in January 2011 by the National Natural Science Foundation of China, is the first large-scale basic-research program in ocean science in the country. The program is scheduled to last for 8 years (2011–2018), with a total budget of ~US\$ 30 million, and its implementation is supported by additional undertakings such as the ocean drilling cruise and human occupied vehicles (HOV) divers. Development of the deep basin, deep-water sediments and biogeochemical processes are the three major components of the program (Wang, 2012). Up to now, nearly 400 scientists and students from 43 institutions have joined the research program. Over the past four years, remarkable research progress has been achieved in tectonics and sedimentology of the South China Sea (SCS).

A variety of new techniques have been used to reveal the tectonic features of the East and Southwest deep-water sub-basins. Nearly a hundred of OBS (**ocean- bottom seismometer**) were deployed to investigate the deep structure of the central basin, 1200-km long deep-tow magnetic survey was completed, volcanic rocks were drilled from seamounts and the oceanic crust. All the findings have provided new constraints on the structure of extinct ridge and the sea-floor spreading processes of the SCS. Of particular significance was the International Ocean Discovery Program Expedition 349 in 2014 that recovered over 1500 m of sediment strata at five sites and 78 m of basement basalt at three sites around 4,000m water depth. All these revealed the sea-floor spreading history and the deep tectonic features of the marginal basin (Li et al., 2014).

A large number of sub-projects are devoted to deep-water sedimentation, ranging from observation of the modern deep-water circulation and sediment transportation, up to reconstruction of paleo-sedimentation processes on the basis of seismic profiles. *In situ* mooring observations combined with numerical simulation has revealed a “sandwich” structure of the deep-water circulation in the SCS which is controlled by the Luzon Strait and the complicate bottom relief of the deep basins (Xu et al., 2014). Numerous deep-water mooring arrays and a tripod system were deployed in the NE continental slope to observe the sediment transport by deep-water and bottom currents. Clay mineralogy and trace element geochemistry were used to identify the provenance pattern and transport pace of terrigenous clastics (Liu et al., in press) . Submarine landslides and supercritical-flow bedforms were recognized on the basis of high-resolution seismic and multibeam bathymetric survey (Zhong et al., 2015). The new findings in modern oceanography and sedimentation have provided background for interpretation of the geological records. A number of sub-projects were set up to reconstruct the paleoceanographic response to basin evolution, to

investigate the evolution of carbonate platforms and carbon cycling of the SCS basin (e.g., Chen et al., 2015).

In terms of biogeochemical processes, the pioneering work on microbiology of deep-sea sediments and water column has led to new discoveries, showing the microbial role in biogeochemistry of the basin for the first time. The cold-seepages and submarine volcanos were explored using HOV divers (Feng and Chen, 2015). Based on multiple-year measurements, the seasonal pattern of CO<sub>2</sub> fluxes in the entire SCS was proposed and the total CO<sub>2</sub> budget estimated (Zhai et al., 2013). Currently, a new HOV diving cruise, as well as a new IODP expedition is in the planning stage, indicating encouraging perspectives of the research program.

The presentation will introduce the recent progress of the SCS Deep program and its research plan for the second half of its implementation period (2015-2018). The development of the program calls for enhanced international collaboration. An international working group was set up in 2014 to promote correlation of the deep basin with the surrounding islands and continents. The SCS Deep program is expected to contribute both to research breakthrough and to international cooperation in the region.

## References

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