Earth connection in a marginal basin: Evolution of the South China Sea

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Abstract

Earth's surface environment is influenced by material and energy flows between its surface and interior reservoirs, and this "planetary cycle" or "Earth connection" is best studied in the spatiotemporal evolution of a marginal basin with a moderate size. In the modern ocean over 75% of the marginal basins are concentrated in the Western Pacific, with the South China Sea (SCS) being the largest. The opening of the SCS Basin by seafloor spreading has caused fundamental changes in ocean-continent interactions between the Pacific and Asia, and its closure with the development of the Manila Trench has resulted in reorganization of the surface environments of the marginal basin. The northward migration of the Philippine Sea Plate and East-dipping subduction of the SCS oceanic crust along the Manila Trench has not only reduced the size of the SCS, but has also restricted its deep water exchanges with the Pacific and remarkably improved the deep water ventilation in the SCS. Among many significant features, the SCS basin is filled with well preserved sediments about 144×10^{14}t since its opening, spread by coral reefs totally to an area of ca. 8000 km^2, matching the Great Barrier Reef in size, and scattered by a number of volcanic chains in its deep basin. All these provide ideal geological archives for reconstruction of the evolution history of the marginal sea.

Currently, a new IODP expedition is applied to drill through the soft sediment and recover the oceanic crust in the SCS, and a major research program "The South China Sea Deep" has been launched to reveal how the hydrological, biological, chemical and sedimentological processes were responding to basin evolution, and eventually to unveil its life history. International cooperation is solicited to enhance the research program by combining the modern deep-sea process and geological records of the marginal basin.