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Editorial: Seafloor processes: geomorphology, sediment-ocean interaction and natural resources

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Editorial on the Research Topic
Seafloor processes: geomorphology, sediment-ocean interaction and natural resources

Seafloor processes refer to the oceanic processes that take place near the seafloor, including physical, chemical, biological, and geological processes, which are related to submarine geomorphology, fluid dynamics, resources exploitation, and geotechnics, and are hard to fully describe due to the limitations of submarine detection technology and their interdisciplinary nature. Indeed, seafloor processes involve several scientific disciplines and fields, and require multi-level and multi-scale research. Moreover, the seafloor is interpreted as an essential interface between the lithosphere and hydrosphere, where substance circulation and energy exchange occur. The collection of works compiled in this Research Topic contributes to a deeper understanding, from multiple perspectives, of the study of seafloor processes.

In this Research Topic, Huang et al. indicate that approximately 98.9% of gold supplied in modern seafloor hydrothermal systems is transported into the depths of the global ocean, which is three to five orders of magnitude higher than what typically exists in deep ocean water.

Cold seeps are seafloor manifestations of methane-rich fluid migration from the sedimentary subsurface to the seabed and into the water column, accompanied by a series of biogeochemical reactions. Cen et al. infer that foraminiferal tests are extremely sensitive to alteration by methane-bearing fluids based on the elemental and stable carbon-oxygen isotopic compositions, and the elemental ratios of diagenetically altered tests are potentially reliable proxies for paleo-methane release events. Simultaneously, cold seeps are crucial for reconstructing the paleo-marine environment and tracing the origin of life and

the occurrence of minerals. The study of cold seeps in the southern South China Sea has demonstrated that cold seeps vary in time and space, and that fluid fluxes and tectonic settings have a significant impact on the sedimentary environment and geochemistry, resulting in obvious regional differences in the properties and activities of cold seeps (Chen et al.).

Seabed fluid flow is a constantly evolving dynamic process whose products can help complete a systematic understanding of seafloor evolution. For example, authigenic carbonates are direct records of past fluid flow near the seafloor. Feng et al. identify that the components of carbonates have a common trend among different seepage stages. Furthermore, this work infers that the temporal evolution of local fluid sources may play an essential role in determining carbonate isotope geochemistry. The small-scale event layers in the continental margin also contain abundant dynamic environmental information, and it is found that the changes in the ocean environment of the Late Quaternary, especially sea level and bottom water temperature, played a leading role in the occurrence of regional small-scale event layers (Li et al.).

The seafloor is rich in marine mineral resources with substantial economic and scientific research value. Ren et al. analyze the submarine ferromanganese (Fe-Mn) oxide precipitates from the South China Sea to form Fe-Mn polymetallic crusts and nodules. Moreover, they infer that it was formed in a short period of a sub-oxic environment and diagenetic process and would affect the enrichment of metals, such as Ni, during the growth process. Climate change and ocean evolution significantly impact the sedimentary processes in seamount regions. Tian et al. analyze the clay minerals, grain size, and ^{14}C ages of core SCS18-1 collected from the Beipo seamount in the northern South China Sea, and find that the relative content of EM1+EM2 and the illite chemical index, and the relative content of EM3 effectively indicate the changes in the intensity of East Asia summer monsoon winter monsoon, respectively.

Fresh submarine groundwater is a potentially untapped resource whose discharge impacts submarine morphology. However, the locations and extent of fresh submarine groundwater discharge and its impact on submarine morphology still need to be better understood. Hoffmann et al. use single and multibeam hydroacoustics and towfish (i.e., temperature, salinity, and turbidity) transects combined with remotely operated vehicle dives and sediment cores to better characterize submarine geomorphology. It is observed that there are a large number of seafloor depressions (pockmarks) caused by continuous seabed fluid flow.

The interaction between seawater and submarine topography caused by internal solitary waves will drive the disturbance of the benthic environment, but its impact on benthic organisms is less studied. Feng et al. perform *in-situ* observation in the Shenhu Canyon to determine the physical characteristics of internal solitary waves and the changes in benthic organisms. It is revealed that the abundance and density of benthic organisms were positively correlated with the time and intensity of interval solitary waves.

Seafloor processes still need to be wholly understood due to limitations in submarine detection technology and its spatial resolution. Because of the advantage of high spatial resolution, seismic reflection data has become a preferable tool to study and image seafloor processes. Han et al. combine fluid dynamics numerical simulation with seismic oceanography to discuss the formation mechanisms of the hair-like reflection configuration. As a consequence, it is deduced that the difference in seawater temperature and salinity can form a hair-like reflection configuration.

In this Research Topic, a comprehensive understanding of the patterns, mechanisms, and evolution of seafloor processes has been gained through multiple research methodologies. It has implications for submarine geomorphology, fluid dynamics, and natural resources, promoting the understanding of submarine biology and ecology, and marine geological activity and chemistry. Additionally, this Research Topic aims to demonstrate that multidisciplinary theories and approaches are required to address the interactions between the various seafloor processes, as well as the impact of natural and anthropogenic processes on the seafloor.

Author contributions

JC: Conceptualization, Writing – original draft, Writing – review & editing. WL: Writing – review & editing. ML: Writing – review & editing. LA: Writing – review & editing. SY: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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