frontiers | Frontiers in Earth Science

TYPE Editorial
PUBLISHED 12 January 2023
DOI 10.3389/feart.2022.1048801

OPEN ACCESS

EDITED AND REVIEWED BY
Sabine Schmidt,
Centre National de la Recherche Scientifique (CNRS), France

*CORRESPONDENCE
Xiting Liu,
liuxiting@ouc.edu.cn

SPECIALTY SECTION
This article was submitted to Marine Geoscience, a section of the journal *Frontiers in Earth Science*

RECEIVED 20 September 2022
ACCEPTED 29 September 2022
PUBLISHED 12 January 2023

CITATION
Liu X, Fan D, Xu F and Liu JP (2023), Editorial: Sedimentation on the continental margins: From modern processes to deep-time records. *Front. Earth Sci.* 10:1048801. doi: 10.3389/feart.2022.1048801

Editorial: Sedimentation on the continental margins: From modern processes to deep-time records

Xiting Liu[1,2]*, Daidu Fan[3], Fangjian Xu[4] and J. Paul Liu[5]

[1]Key Laboratory of Submarine Geosciences and Prospecting Technology, College of Marine Geosciences, Ocean University of China, Qingdao, China, [2]Laboratory for Marine Geology, Qingdao National Laboratory for Marine Science and Technology, Qingdao, China, [3]State Key Laboratory of Marine Geology, Tongji University, Shanghai, China, [4]College of Marine Science, Hainan University, Haikou, China, [5]Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, NC, United States

KEYWORDS

continental margin, sedimentary process, paleoclimate, paleoceanography, human activities

Editorial on the Research Topic
Sedimentation on the continental margins: From modern processes to deep-time records

The continental margin, which connects land and sea (Figure 1), is a key area of land-sea interaction (Walsh and Nittrouer, 2009), with a sedimentation process closely related to tectonic activities, climatic conditions, oceanic dynamics, and human activities (Fan and Li, 2002; Xu et al., 2017; Syvitski et al., 2022). Therefore, sediments on the continental margin can record environmental evolution both in terrestrial source and marine depositional areas (Shang et al., 2018; Pei et al., 2020; Dong et al., 2021). The continental margin is also the main location for the mineralization of organic matter (McKee et al., 2004; Liu et al., 2022), which affects the global carbon cycle (Bianchi and Allison, 2009; Ren et al., 2019). Sedimentation on different types of continental margins exhibits unique characteristics, such as the broad shelf dominated by the large East Asian rivers and the narrow shelf fed by the mountainous rivers of East Africa (Liu et al., 2004; Liu et al., 2009; Liu et al., 2016; Liu et al., 2018; Xu et al., 2021); thus, comparative studies on specific types of continental margins are needed. However, the complexity of interpreting signals from sedimentation processes to depositional records has limited our understanding of different types of continental marginal sedimentation (Figure 1). To fill this gap, this topic integrates the research results of different geological backgrounds and different time scales to form a new understanding of the knowledge system of sedimentation on global continental margins.

This Research Topic collected 27 articles from 162 authors worldwide, including articles on modern sedimentary dynamics and biogeochemical processes, historical

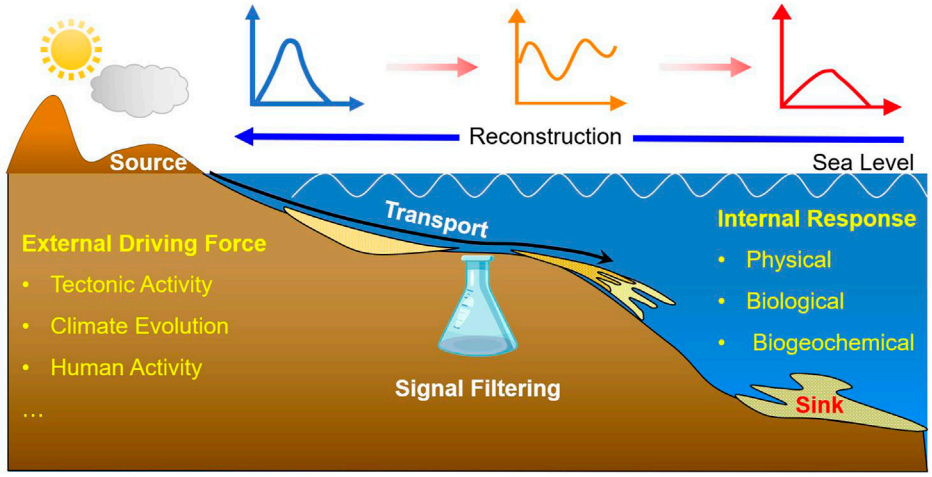

FIGURE 1
Schematic diagram of the sedimentation process and depositional record on the continental margin.

depositional records, and the impacts of human activity on sedimentation at the continental margins.

Modern sedimentation dynamics on continental margins

Xie et al. analyzed water levels, daily river discharge, and bathymetric data from the Qiantang Estuary, China, in 2015 and delineated the seasonal tidal evolution along the estuary. Based on the CTD profiles and mooring measurements of the Line W program in the North Atlantic at about 35°N/70°W, Fan et al. found that the internal wave strain variance over the slope was up to five times larger than that in the interior. According to analyses of the vertical variation of Rossby number, kinetic energy in the submesoscale range, and kinetic energy spectra, Li et al. suggested that submesoscale motions between the New Jersey Shelf and Bermuda are mainly confined within the surface mixed layer, with seasonality that is strong in winter and weak in summer. Sun et al. reconstructed the migration of the coastline and river channels in the Northern Bohai Sea during the last century based on clay minerals. Chen et al. first applied grain size trend analysis (GSTA) and end-member analysis (EMA) to 232 surface sediment samples in the deep-sea environment to reveal sedimentary dynamics around isolated carbonate platforms in the northern South China Sea. By summarizing and analyzing research in the shelf-slope region offshore in the northeast of Taiwan, Chiang et al. refined the morphology of the Huapinghsu Channel/Mienhua Canyon System and proposed a new idea to illustrate this channel/canyon system as a sediment conduit transporting sediments from rivers in western Taiwan to the southern Okinawa Trough.

Biogeochemical cycles in the sediments on continental margins

Bruni et al. used a combination of literature and new data to study the drivers and biogeochemical consequences of wave- and current-induced resuspension on organic carbon cycling in modern, oxygen-depleted, "semi-liquid ocean bottom" regions, such as the Benguela upwelling region. Zhu et al. discovered bottom water DO conditions of the coastal northern South China Sea in the 20 th century based on the sedimentary $C_{28}\Delta^{22}/\Delta^{5,22}$ ratios of steroids and proposed that the net photosynthetic oxygen production outweighs source water- and warming-induced increasing deoxygenation in the study area. To determine the historical redox state in the hypoxic zone near the Changjiang River Estuary and its adjacent waters, Zhang et al. investigated the distribution and enrichment of Mo, U, and V in core 3050-2 and found a general oxic-suboxic environment since 2005. Wang et al. reported the spatial distribution of brGDGT-related indicators in surface sediments from the East China Sea and suggested that mixed sources of soil-derived brGDGTs were dominant, and that marine *in situ* brGDGTs were overprinted. Li et al. reported a significant contribution from lateral allochthonous organic matter from the mountainous river in hydrate-bearing sediments from three long sedimentary sites in the Shenhu area of the northern South China Sea. Zhang et al. illustrated the depth profiles of sedimentary $_{wt}CaCO_3$% from the West Pacific based on a newly compiled $CaCO_3$ data set and a carbonate model. Zhang et al. performed a comprehensive study of a long-term organic carbon record over the past 380 kyr from sediment core St10-PC in the Northwest Pacific, which highlighted the important contribution of environmental redox conditions on organic carbon burial in the deep

Northwest Pacific. Chen et al. analyzed the archaeal ammonia oxidation rate indicator GDGT-[2]/[3] ratio (Glycerol Dialkyl Glycerol Tetraether) from collected data profiles since the last glacial period in the northern South China Sea and reported higher ratios during the Holocene compared to those during the last glacial period.

Sedimentation in response to paleoclimatic and palaeoceanographic evolution

Ding et al. presented the first high-resolution grain-size record from Core CF1 in the Okinawa Trough and found the Kuroshio Current slow-down during 4.6–2.0 ka, followed by a quick enhancement after 2.0 ka with centennial-scale variabilities (500–700 years). Zhang et al. studied the sedimentological characteristics of the mud periphery area and reconstructed the sedimentary evolution at the east edge of the Central Yellow Sea Mud since MIS3a (45 ka). Zhang et al. used optically stimulated luminescence (OSL) dating and lithology of core YRD-1401 from the Yellow River delta to establish the late Quaternary sedimentary evolution of the southwestern coast of the Bohai Sea. Sang et al. used clay mineralogy, major-element geochemistry, and Sr-Nd isotopic compositions from Core MD05-2896 collected in the southern South China Sea to investigate the discrimination of sediment provenance and reconstruct a history of chemical weathering in the Mekong River basin over the last 45 ka. Wu et al. conducted a high-resolution rock magnetic investigation of the Holocene sediments of core DS01 collected near the West River channel in the head area of the Pearl River deltaic plain to study how the sea-level change, monsoon-driven discharge, and especially human activity since the late Holocene regulated regional environmental and sedimentary evolution. Rashid et al. studied the Late Pleistocene Labrador Sea depositional systems developed in front of ice streams and glacier outlets from the Laurentide Ice Sheet (LIS) using Huntec and 3.5 kHz seismic profiles and piston cores covering >1800 km of the eastern Canadian continental margin and the Labrador Basin. Li et al. studied a sediment core (ANT32-RA05C) collected from the continental slope of the Ross Sea, Antarctica by paleomagnetic and ^{230}Th dating and geochemical properties and reported a relationship between paleoenvironmental processes and the Antarctic temperature since the Late Pleistocene. Lyu et al. investigated iron oxide mineral content and major element compositions of the oceanic red beds at Site U1433 to reveal the Miocene deep-sea oxidation environment of the South China Sea and its interaction with the West Pacific. Shi et al. refined the chronostratigraphy of the upper 160 m sedimentary succession from Hole U1501C using paleomagnetic measurements and cyclostratigraphic analysis of natural gamma radiation (NGR) data to produce a high-resolution 15.54 Myr age model. Li et al. retrieved a record of the East Asian Summer Monsoon by studying the color reflectance of coastal sediments in the south Bohai Sea, East Asia, demonstrating an integrated forcing of ice-sheet evolution and solar insolation in the East Asian Summer Monsoon in the late Quaternary. Liu et al. identified three facies from the Liangshan Formation successions in western South China, which belong to the coastal alluvial plain, estuary, and deltaic environments that followed the dry-to-wet climatic shifts.

Impacts of human activity on marginal sedimentation

Lee et al. analyzed foraminiferal records collected from the continental slope off southwestern Taiwan, reporting that the anthropogenic carbon signal in the West Pacific was not weaker than that recorded in the Atlantic over the last century. Dong et al. reported a 55-year sedimentary record from Songkhla Lake, Thailand, including a three-stage sedimentary and input history of trace metals under anthropogenic effects since 1964.

In summary, the articles collected on this topic cover comprehensive studies on the sedimentation process and related biogeochemical processes on the continental margins at different times and spaces, from the tropical marginal seas to the high latitude glacial-dominated margins. The research methods included sedimentologic, biogeologic, geochemical, and geophysical data analysis. Therefore, these studies of different types of continental marginal sediments are of great scientific significance to provide a better understanding of the earth's surface process and the evolution of the earth's environment.

Author contributions

XL: conceptualization, funding acquisition, writing–original draft preparation and reviewing and editing; DF: funding acquisition, writing–reviewing and editing; JL and FX: writing–reviewing and editing.

Funding

This Research Topic was supported by the National Natural Science Foundation of China (41976053, 41976070, and 42276060) and the Natural Science Foundation of Shandong Province (ZR2021YQ26). We are grateful for the support of the *Frontiers* team and reviewers.

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.

Publisher's note

References

Bianchi, T. S., and Allison, M. A. (2009). Large-river delta-front estuaries as natural "recorders" of global environmental change. *Proc. Natl. Acad. Sci. U. S. A.* 106 (20), 8085–8092. doi:10.1073/pnas.0812878106

Dong, J., Li, A. C., Lu, Z. Y., Liu, X. T., Wan, S. M., Yan, H., et al. (2021). Millennial-scale interaction between the east asian winter monsoon and el nino-related tropical pacific precipitation in the Holocene. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 573, 110442. doi:10.1016/j.palaeo.2021.110442

Fan, D. D., and Li, C. X. (2002). Rhythmic deposition on mudflats in the mesotidal Changjiang Estuary, China. *J. Sediment. Res.* 72 (4), 543–551. doi:10.1306/112901720543

Liu, J. P., Milliman, J. D., Gao, S., and Cheng, P. (2004). Holocene development of the Yellow River's subaqueous delta, North Yellow Sea. *Mar. Geol.* 209 (1), 45–67. doi:10.1016/j.margeo.2004.06.009

Liu, J., Xue, Z., Ross, K., Wang, H., Yang, Z., Li, A., et al. (2009). Fate of sediments delivered to the sea by asian large rivers: Long-distance transport and formation of remote alongshore clinothems. *Sediment. Rec.* 7 (4), 4–9. doi:10.2110/sedred.2009.4.4

Liu, X., Rendle-Bühring, R., and Henrich, R. (2018). High-and low-latitude forcing of the East African climate since the LGM: Inferred from the elemental composition of marine sediments off Tanzania. *Quat. Sci. Rev.* 196, 124–136. doi:10.1016/j.quascirev.2018.08.004

Liu, X. T., Rendle-Buehring, R., Meyer, I., and Henrich, R. (2016). Holocene shelf sedimentation patterns off equatorial East Africa constrained by climatic and sea-level changes. *Sediment. Geol.* 331, 1–11. doi:10.1016/j.sedgeo.2015.10.009

Liu, X., Zhang, M., Li, A., Dong, J., Zhang, K., Gu, Y., et al. (2022). Sedimentary pyrites and C/S ratios of mud sediments on the East China Sea inner shelf indicate late Pleistocene-Holocene environmental evolution. *Mar. Geol.* 450, 106854. doi:10.1016/j.margeo.2022.106854

McKee, B. A., Aller, R. C., Allison, M. A., Bianchi, T. S., and Kineke, G. C. (2004). Transport and transformation of dissolved and particulate materials on continental margins influenced by major rivers: Benthic boundary layer and seabed processes. *Cont. Shelf Res.* 24 (7–8), 899–926. doi:10.1016/j.csr.2004.02.009

Pei, W. Q., Wan, S. M., Clift, P. D., Dong, J., Liu, X. T., Lu, J., et al. (2020). Human impact overwhelms long-term climate control of fire in the Yangtze River Basin since 3.0 ka BP. *Quat. Sci. Rev.* 230, 106165. doi:10.1016/j.quascirev.2020.106165

Ren, F., Fan, D., Wu, Y., and Zhao, Q. (2019). The evolution of hypoxia off the Changjiang Estuary in the last 3000 years: Evidence from benthic foraminifera and elemental geochemistry. *Mar. Geol.* 417, 106039. doi:10.1016/j.margeo.2019.106039

Shang, S., Fan, D. D., Yin, P., Burr, G., Zhang, M. Y., and Wang, Q. (2018). Late quaternary environmental change in oujiang delta along the northeastern zhe-min uplift zone (southeast China). *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 492, 64–80. doi:10.1016/j.palaeo.2017.12.012

Syvitski, J., Ángel, J. R., Saito, Y., Overeem, I., Vörösmarty, C. J., Wang, H., et al. (2022). Earth's sediment cycle during the Anthropocene. *Nat. Rev. Earth Environ.* 3 (3), 179–196. doi:10.1038/s43017-021-00253-w

Walsh, J. P., and Nittrouer, C. A. (2009). Understanding fine-grained river-sediment dispersal on continental margins. *Mar. Geol.* 263 (1-4), 34–45. doi:10.1016/j.margeo.2009.03.016

Xu, F., Hu, B., Dou, Y., Song, Z., Liu, X., Yuan, S., et al, Sun, Z., Li, A., and Yin, X. (2017). Prehistoric heavy metal pollution on the continental shelf off Hainan Island, South China Sea: From natural to anthropogenic impacts around 4.0 kyr BP. *The Holocene* 28 (3), 455–463. doi:10.1177/0959683617729445

Xu, F., Hu, B., Zhao, J., Liu, X., Xu, K., Xiong, Z., et al. (2021). Provenance and weathering of sediments in the deep basin of the northern South China Sea during the last 38 kyr. *Mar. Geol.* 440, 106602. doi:10.1016/j.margeo.2021.106602