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Research Advances

Paleo-Fluvial Systems during Marine Isotope Stages 6, 4 and 2 in the North Yellow Sea

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Objective

During the sea-level lowstands of the Late Quaternary, paleo-channels resulting from large-scale glacial regressions were extensively developed on continental shelves worldwide. Great attention has been paid to the mechanisms and ages of these successions of fluvial incisions, which provide insight into the sedimentary evolution and processes of shelves.

The North Yellow Sea (NYS), a typical river-dominated epicontinental sea in terms of its huge sediment discharge from large rivers such as the Huanghe River, Yalu River, and some rivers draining the Korean Peninsula during the Late Quaternary. Nevertheless, the stratigraphy and chronology of the paleo-fluvial successions in NYS during the Late Quaternary remain unresolved. In this study, the stratigraphic time series and facies of the paleo-channels in response to different sea-level regimes since MIS6 in NYS have been precisely disclosed by using high-resolution seismic reflections in conjunction with data from borehole DLC70-2.

Methods

About 4916 km-long high resolution seismic profiles have been analyzed in NYS. In this study, the profile across the core DLC70-2 was selected for the interpretation of stratigraphic structure, using a constant acoustic velocity of 1500 m/s.

A 70.6 m-deep borehole DLC70-2 was collected from the central NYS in 52.8 m water depth. The lithology, microfossil assemblages and chronology determined using accelerated mass spectrometry and optically stimulated luminescence have been considered for interpretation.

Results

Sedimentary units in the core DLC70-2 were confidently correlated with the observations of seismic units in the profiles. Most of the post-MIS6 successions in NYS were formed during the sea-level highstands of MIS5 to the early MIS4, MIS3 and MIS1, with major erosions in the late MIS6, the late MIS4 and MIS2. Particularly, our data reveal three regional sequence boundaries (S3, S2, S1 from the bottom up) with distinctive depositional hiatus, marked by V- or U-shaped high-amplitude channels downcutting into the underlying strata in seismic profiles (Fig. 1), which are correlated with the late MIS6, the late MIS4 and MIS2 sea-level lowstands, respectively. Three-stage paleo-fluvial systems were identified above these sequence boundaries: D3, overlying S3, fluvial to incised-channel filling facies with the sea-level lowstand of the late MIS6 (after ~140±14 ka BP); D2, above S2, estuarine facies during the sea-level lowstand of the late MIS4 (since ~72.5±7 ka BP); D1, above S1, estuarine to flooding plain facies during the period from the late LGM to the Younger Dryas event (~14602 to 10357 cal a BP) (Fig.1). All these paleo-fluvial systems vary considerably in thickness and lateral extent and capped by transgressive deposits since MIS6 in NYS.

Conclusion

The stratigraphic structure and sedimentary facies in NYS during the Late Quaternary were primarily governed by sea-level change and paleo-river and sea interaction, which leads to three-phase paleo-fluvial successions in response to the sea-level lowstands of the late MIS6 (after ~140±14 ka BP), the late MIS4 (since ~72.5±7 ka BP) and MIS2 (~14602 to 10357 cal a BP). This study not only contributes to a deep understanding of the regional response theory to global change, but also provides scientific evidence for engineering construction in the study area.

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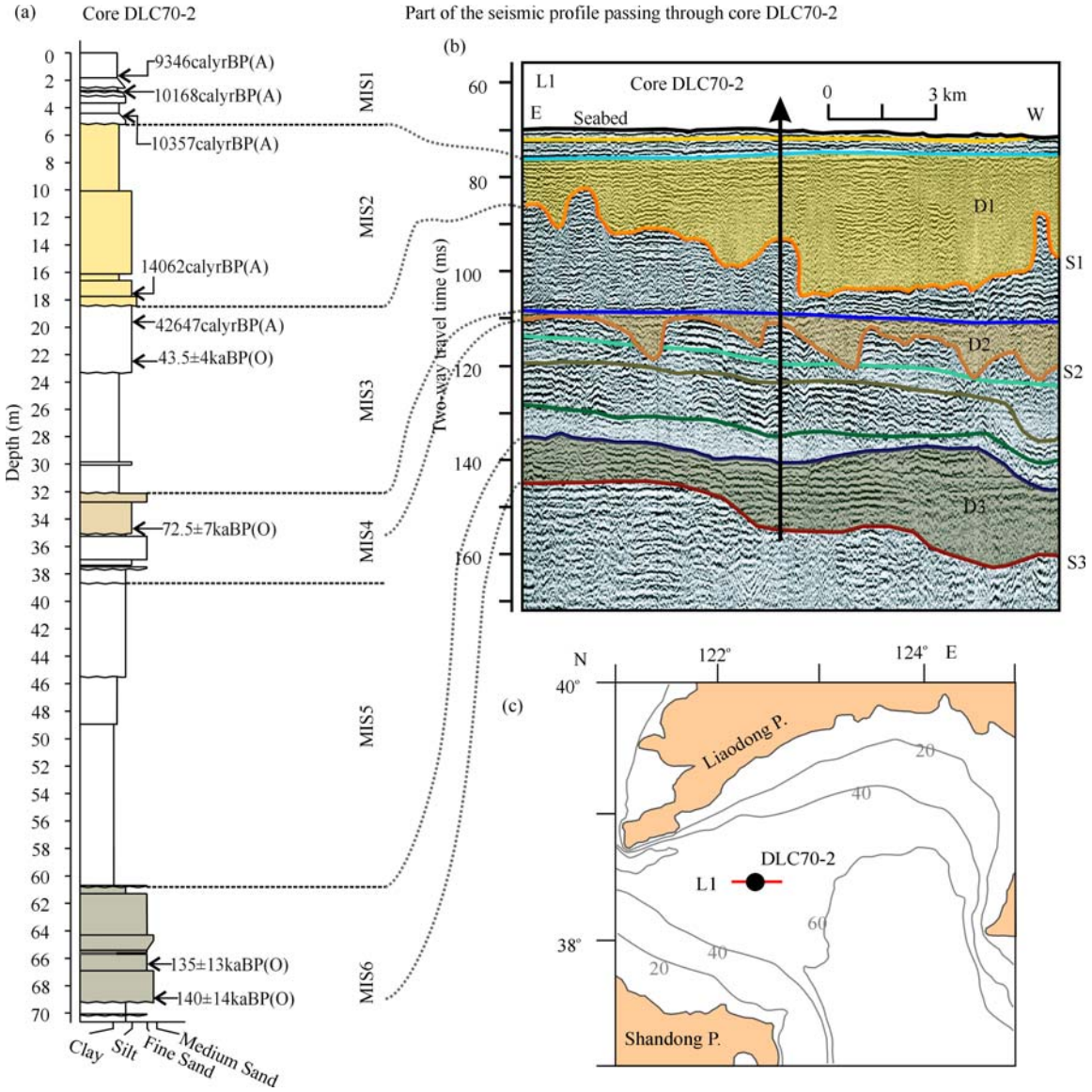

Fig.1 stratigraphic comparison and correlation of core DLC70-2 (a) with part of the east-west seismic profile (b). See locations in (c).

Three paleo-fluvial systems (D1 to D3 in a descending order) above three sequence boundaries (S1 to S3 in a descending order) were identified. Ages were obtained by AMS^{14}C dating (A) and OSL dating (O). Liaodong P., Liaodong Peninsula; Shandong P., Shandong Peninsula.

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