

1. Identification and dating for the critical horizons

The three major unconformities (H₁-H₃, with ages of ~13.8 Ma, ~10.5 Ma and ~5.5 Ma, respectively) in this study were identified and traced following the scheme given by [Lin et al. \(2018\)](#) and [Jiang et al. \(2017\)](#), who defined the major unconformities on the northern SCS margin based on the combination of seismic-reflector characteristics and well-seismic tie results. The surfaces H₁, H₂ and H₃ are corresponding to the surfaces CS5, CS6 and CS6-4 in [Lin et al. \(2018\)](#), respectively. However, there is no solid dating for the surface that is defined as H₁₂ in the current study ([Fig. 1C](#)).

References:

- Jiang, J., Shi, H.S., Lin, C.S., Zhang, Z.T., Wei, A., Zhang, B., Shu, L.F., Tian, H.X., Tao, Z., Liu, H.Y., 2017. Sequence architecture and depositional evolution of the Late Miocene to Quaternary northeastern shelf margin of the South China Sea. *Mar. Pet.Geol.* 81, 79–97.
- Lin, C., He, M., Steel, R., Zhang, Z., Li, H., Zhang, B., Wu, W., Shu, L., Tian, H., Zhang, X., Xing, Z., Wang, S., Zhang, M., 2018. Changes in inner- to outer-shelf delta architecture, Oligocene to Quaternary Pearl River shelf-margin prism, northern South China Sea: *Marine Geology*, v. 404, p. 187-204.

2. Un-interpreted seismic profiles in the manuscript

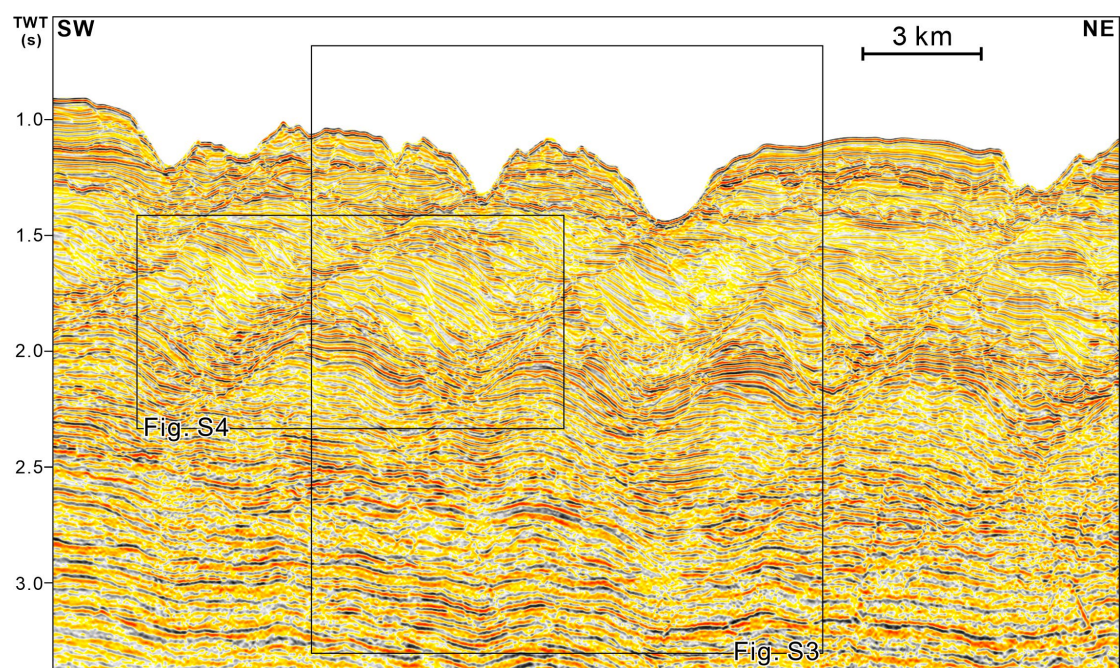


Fig. S1 Un-interpreted seismic profile shown in [Fig. 1C](#). The boxes represent the position of enlarged seismic profiles in [Figs. S3 and S4](#).

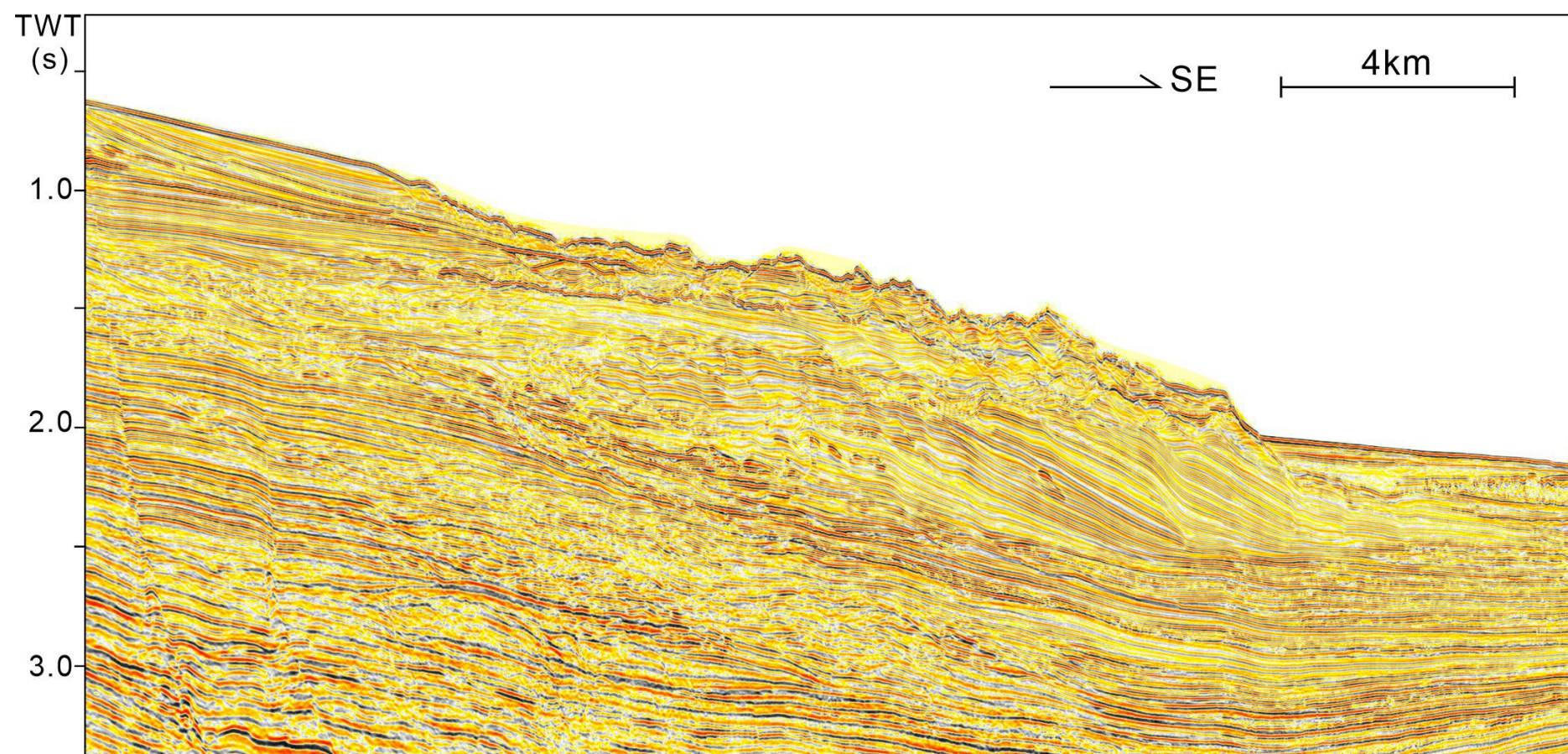


Fig. S2 Un-interpreted seismic profile shown in [Fig. 2A](#).

3. Enlarged seismic profiles shown in the manuscript

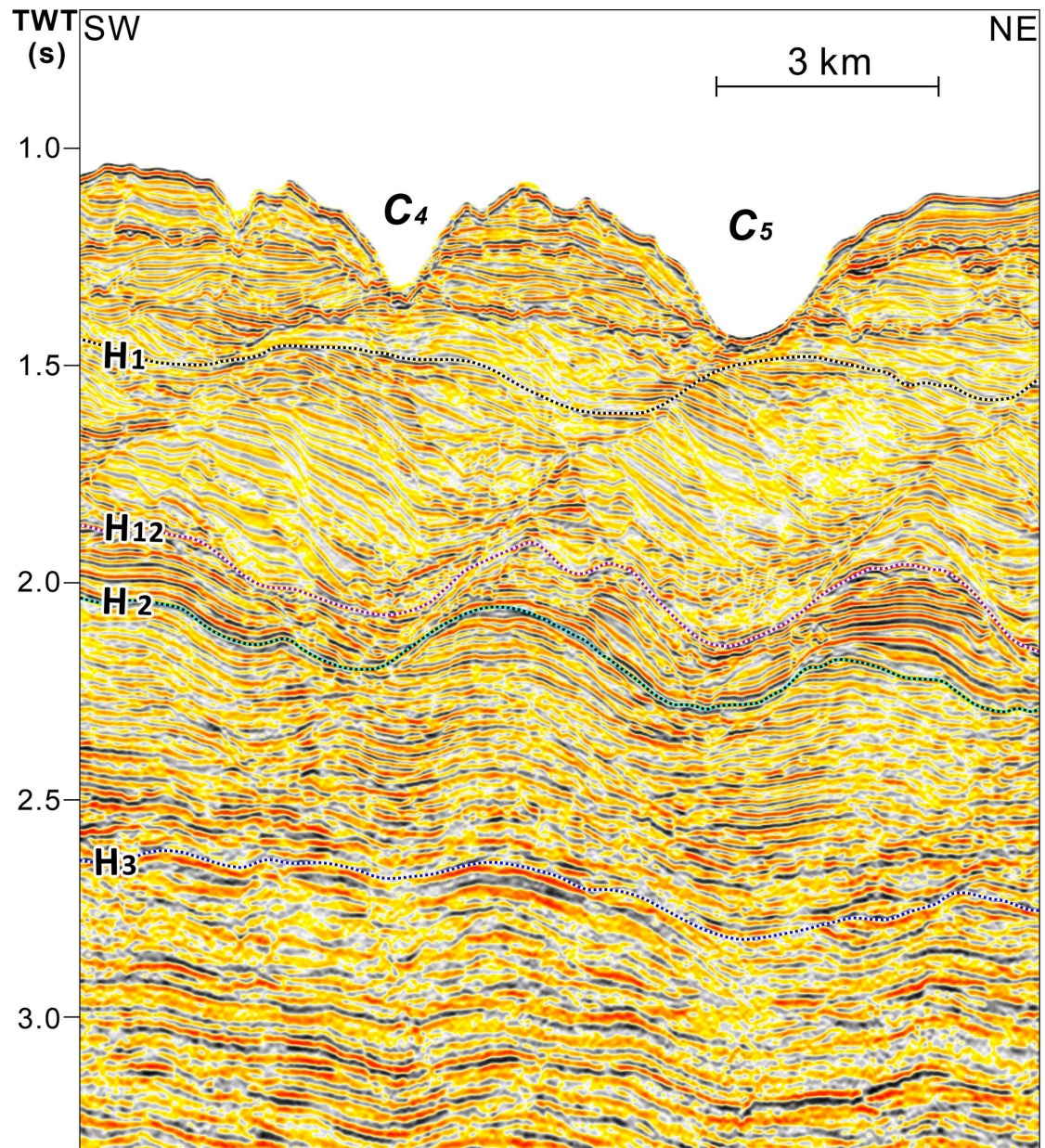


Fig. S3 Enlarged seismic profile showing the variation in the seismic-reflector character of the different units.

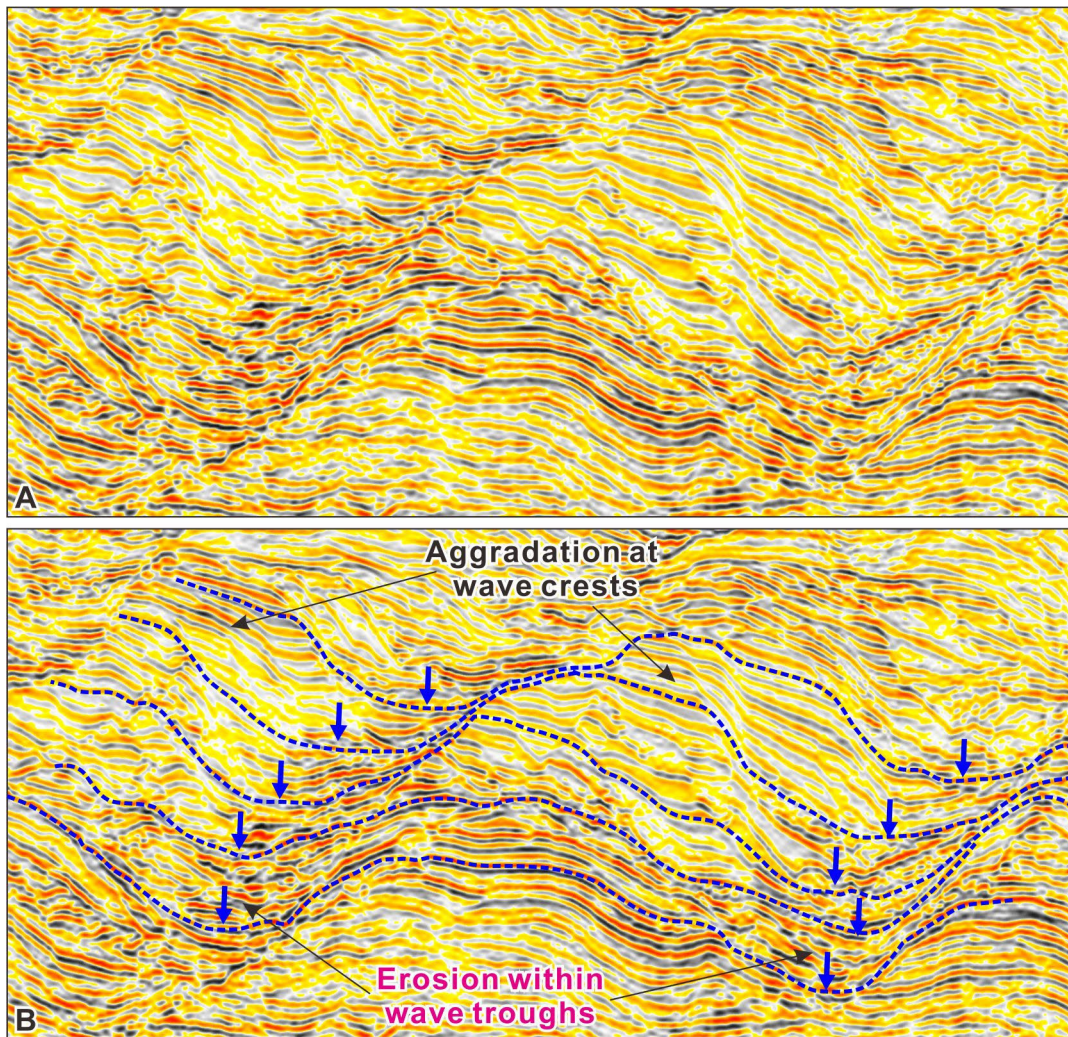


Fig. S4 Un-interpreted (A) and interpreted (B) enlarged seismic profile across the canyons, displaying aggradation at wave crests and erosion within wave troughs. The blue arrows indicate the thalwegs of the along-slope migrating canyons. Note the truncation at the eastern flanks of the canyons. See the location in Fig. S1.

4. Seismic interpretation for sediment waves

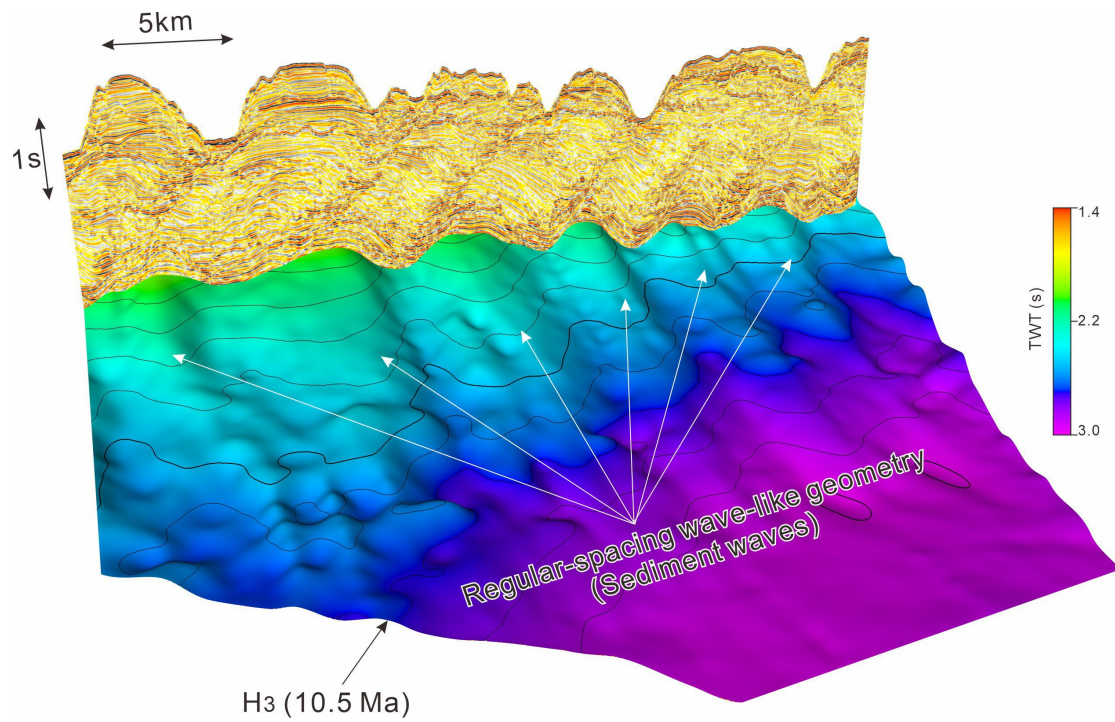


Fig. S5 Three-dimensional (3D) view of the surface H_3 (with an age of 10.5 Ma) and the seismic profile normal to the orientation of the regular-spacing wave crests