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Grain-size based sea-level reconstruction in the south Bohai Sea during the past 135 kyr

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Future anthropogenic sea-level rise and its impact on coastal regions is an important issue facing human civilizations. Due to the short nature of the instrumental record of sea-level change, development of proxies for sea-level change prior to the advent of instrumental records is essential to reconstruct long-term background sea-level changes on local, regional and global scales. Two of the most widely used approaches for past sea-level changes are: (1) exploitation of dated geomorphologic features such as coastal sands (e.g. Mauz and Hassler, 2000), salt marsh (e.g. Madsen et al., 2007), terraces (e.g. Chappell et al., 1996), and other coastal sediments (e.g. Zong et al., 2003); and (2) sea-level transfer functions based on faunal assemblages such as testate amoebae (e.g. Charman et al., 2002), foraminifera (e.g. Chappell and Shackleton, 1986; Horton, 1997), and diatoms (e.g. Horton et al., 2006).

While a variety of methods has been developed to reconstruct palaeo-changes in sea level, many regions, including the Bohai Sea, China, still lack detailed relative sea-level curves extending back to the Pleistocene (Yi et al., 2012). For example, coral terraces are absent in the Bohai Sea, and the poor preservation of faunal assemblages makes development of a transfer function for a relative sea-level reconstruction unfeasible. In contrast, frequent alternations between transgression and regression has presumably imprinted sea-level change on the grain size distribution of Bohai Sea sediments, which varies from medium silt to coarse sand during the late Quaternary (IOCAS, 1985). Advantages of grainsize-based relative sea-level transfer function approaches are that they require smaller sample sizes, allowing for replication, faster measurement and higher spatial or temporal resolution at a fraction of the cost of detail micro-palaeontological analysis (Yi et al., 2012).

Here, we employ numerical methods to partition sediment grain size using a combined database of marine surface and core samples, and to quantitatively reconstruct sea-level variation since the late Pleistocene in the south Bohai Sea, China. New insights into regional relative sea-level changes since the late Pleistocene are obtained (Yi et al., 2012):

(1) The grain size of surface and core samples can be mathematically partitioned using the Weibull distribution into four components. These four components with differing modal sizes and percentages could be interpreted as a long-term suspension component, which only settles under low turbulence conditions, sortable silt and very fine sand components transported by suspension during greater turbulence and bedload transport component, respectively.

(2) Through regression and rigorous verification techniques, the reference water level could be reconstructed from sediment grain size. The reconstruction quantitatively extends the regional relative sea-level history to the late Pleistocene, providing a comparatively long dataset to evaluate regional sea-level variability.

(3) We find no evidence of a sea-level high stand during MIS3 but rather a substantial regression during 70-30 cal kyr BP and potentially exposed land during 38-20 cal kyr BP. These results for the south Bohai Sea are in good agreement with published global sea-level records for the late Pleistocene, implying similarities between local and global sea-level patterns.

Therefore, it is concluded that grain-size based sea-level reconstruction provide results that are comparable to other reconstruction methods and demonstrates great potential application for future works. (The data was shared on http://hurricane.ncdc.noaa.gov/)

References

Chappell, J., Omura, A., Esat, T., McCulloch, M., Pandolfi, J., Ota, Y., Pillans, B., 1996. Reconciliation of late Quaternary sea levels derived from coral terraces at Huon Peninsula with deep sea oxygen isotope records. Earth and Planetary Science Letters 141, 227-236.

Chappell, J., Shackleton, N.J., 1986. Oxygen isotopes and sea level. Nature 324, 137-140.
Charman, D.J., Roe, H.M., Roland Gehrels, W., 2002. Modern distribution of saltmarsh testate amoebae: regional variability of zonation and response to environmental variables. Journal of Quaternary Science 17, 387-409.
Horton, B.P., 1997. Quantification of the indicative meaning of a range of Holocene sea-level index points from the western North Sea, Department of Geography. University of Durham, Durham City, UK, p. 509.
Horton, B.P., Corbett, R., Culver, S.J., Edwards, R.J., Hillier, C., 2006. Modern saltmarsh diatom distributions of the Outer Banks, North Carolina, and the development of a transfer function for high resolution reconstructions of sea level. Estuarine, Coastal and Shelf Science 69, 381-394.
IOCAS (Institute of Oceanology, Chinese Academy of Sciences), 1985. Bohai Sea Geology. Science Press, Beijing, China.
Madsen, A.T., Murray, A.S., Andersen, T.J., Pejrup, M., 2007. Temporal changes of accretion rates on an estuarine salt marsh during the late Holocene -Reflection of local sea level changes? The Wadden Sea, Denmark. Marine Geology 242, 221-233.
Mauz, B., Hassler, U., 2000. Luminescence chronology of Late Pleistocene raised beaches in southern Italy: new data of relative sea-level changes. Marine Geology 170, 187-203.
Yi, L., Yu, H.J., Ortiz, J.D., Xu, X.Y., Qiang, X.K., Huang, H.J., Shi, X., Deng, C.L., 2012. A reconstruction of late Pleistocene relative sea level in the south Bohai Sea, China, based on sediment grain-size analysis. Sedimentary Geology 281, 88-100.
Zong, Y., Shennan, I., Combellick, R.A., Hamilton, S.L., Rutherford, M.M., 2003. Microfossil evidence for land movements associated with the AD 1964 Alaska earthquake. The Holocene 13, 7-20.