

The initiation of Qiantangjiang tidal bores and its destructive effect on early Neolithic human activities in east China

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Deltas and estuaries, as opportunity-rich locations, long attracting humans, are often associated with high levels of risk, however. The lower Yangtze delta, flat with low elevation and a dense network of waterway, is vulnerable to extreme environmental events, such as flooding, and large tidal bores in the case of Qiantangjiang River and Hangzhou Bay, deeply affecting the people who live along their banks. The typical funnel-shaped coastal embayment, Hangzhou bay, favours the development of tide- over wave-dominated coastal processes, with the change between the two potentially being geologically instantaneous, both of which have been governed by Holocene sea level changes and geomorphic evolution of plains along its banks. To make clear the geomorphic evolution of coastal plain and its influence on ancestors, an exposed profile at the Kuahuqiao archaeological site, located on the flood plain of the Qiantangjiang River, and two natural sedimentary cores near the site, were retrieved and analyses, including lithology, sedimentary facies, grain size, elemental abundance and microfossil assemblages, were carried out. The result of such rich sedimentary dataset suggest that transgression occurred from about ~9,000 cal BP, but was restricted only to areas with elevation below ~25 m. Continuing sea level rise led to the gradual establishment of an estuary environment by ~8,000 cal BP, in which Kuahuqiao residents started to build their settlements in areas higher than, and farm rice in areas close to, the sea level at the time of sedimentation. Meanwhile, sediment discharge to, and accumulation in, the estuary led to the formation of a distinctive funnel-shaped embayment, facilitating the development of tidal bores. At around 7,600–7,500 cal BP, the tidal bores reached an extreme magnitude, causing catastrophic overbank flooding over the Qiantangjiang flood plain, ruining the Kuahuqiao site.