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Provenance variability associated with East Asian Summer Monsoon precipitation change during the middle to late Holocene

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Hydroclimate variations associated with the East Asian Summer Monsoon precipitation exert significant impacts on lives of people inhabiting within the Yangtze River drainage and the coastal zone. Seasonal shift of main precipitation area is attributable to the reposition of northern limit of summer monsoon, which would lead to provenance and composition changes of suspended materials transported by the Yangtze River. Consequently, the interannual to millennial time-scale variability of the position of rain belt mentioned above could be recorded in the long-term change in compositional variation of the sediment originated from the suspended materials of the Yangtze River. The subaqueous Yangtze delta and the inner shelf of the East China Sea (ECS) are of primary importance owing to massive inputs of terrestrial materials from the Yangtze River. We could expect to recognize provenance changes in core sediments taken from the Yangtze subaqueous delta core YD13-1 and the inner shelf of ECS core MD06-3040 in association with spatial variability of EASM precipitation.

Provenance of sediment particles were evaluated on the basis of the electron spin resonance (ESR) signal intensity and crystallinity index (CI) of grain size separated quartz. Comparison the core sediments taken from the subaqueous Yangtze delta and the inner shelf of the East China Sea sites with modern Yangtze River sediments suggested that the Yangtze River would be a predominant source of the subaqueous Yangtze delta and mud belt on the inner shelf deposits. Moreover, detailed examination of quartz provenance within the Yangtze River drainage using ESR and CI enable us to discriminate the sediment contributions from the upper-middle/lower reaches, southern tributary, and northern tributary of the Yangtze drainage. Most of ESR in fine silt fraction of core YD13-1 samples from fine sandy layers and coarse silt layers of probable flood origin showed smaller values compared to the background sediments just above or below. This observation suggested that big flooding occurred mainly in the upper reaches of the Yangtze drainage. Variability of the main location of EASM precipitation (EASM front) on multi-centennial to millennial-scale has been detected from this result, which showed heavier precipitation in the Hangjiang and Jialinjiang with contribution from southeastern side of middle-lower reaches (Lake Dongting and Poyang) during 5-3.8 cal kyr BP, and in the Hangjiang, Jialingjiang, and Minjiang during 3.8-1.6 cal kyr BP, in the Minjiang and Jialingjiang during 1.6-1.0 cal kyr BP, and in the Minjiang and Jinshajiang with contribution from Hanjiang during 1.0-0.6 cal kyr BP. Temporal variations in ESR in fine silt fraction of core MD06-3040 sample showed the similar feature as YD13-1, which suggested both cores shared the same provenance changes on millennial time-scale. Modal grain size in fine silt of core MD06-3040 showed notable decrease at the timing of the lower EASM precipitation (presumably drought events) such as 6 cal kyr BP, 5.3 cal kyr BP, 4.5 cal kyr BP, 3.7-3.3 cal kyr BP, 2.2 cal kyr BP, 1.4-1.3 cal kyr BP, which also coincided with the dry periods derived from stalagmite δ^{18}O records in southern China and high salinity events recorded in the cores from northern ECS. The evolution of monsoonal climate with abrupt events in the Yangtze River drainage has been associated with spatio-temporal heterogeneity of precipitation area within the Yangtze drainage most likely resulted from migration of the EASM front. Fine silt fraction of both cores YD13 and MD06-3040 captured climatic signal delivered from the Yangtze drainage. High precipitation (detected in grain size at MD06-3040 site) is correlated with higher contribution of material from the upper reaches of the Yangtze drainage since 5 cal kyr BP. The stronger EASM has been associated with high precipitation and northwestward shift of monsoon front.