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# 博 士 論 文

Provenance and depositional variability in response to climate and sea level changes in the subaqueous Yangtze delta and the inner shelf of the East China Sea during the middle and late Holocene

(中期－後期完新世における気候および海水準変動に応答した揚子江デルタおよび東シナ海陸棚の堆積物供給源および堆積様式の変化)

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## 學位論文要約

Hydroclimate variations associated with the East Asian Summer Monsoon (EASM) precipitation exert significant impacts on lives of people inhabiting within the Yangtze River drainage and 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. Therefore, 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 sediment originated from the suspended materials in 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. Thus, any variation in the Yangtze River discharge and provenance could have been recorded in sediments of the Yangtze delta and ECS. Therefore, we could expect to recognize provenance changes in core sediments taken from the Yangtze subaqueous delta and the inner shelf of ECS in association with EASM precipitation variability. In order to reconstruct the EASM precipitation and provenance variability during the middle and late Holocene from these sediment records, it is also necessary to examine

the transportation mechanism of Yangtze-derived sediment including sediment reworking / re-deposition by coastal current, tide and local input, the migration of shoreline and estuary of the Yangtze River, as well as the change of depocenter in the Yangtze delta-mud belt region associated with the postglacial sea-level rise.

The postglacial sea-level rise provided a large accommodation space for river-derived sediment, which gave a significant influence on the sedimentation of the Yangtze delta and the inner shelf of the ECS. As a tide-dominated Yangtze delta began to prograde seaward under the condition of the decelerated sea level rise after 7.5-8 cal kyr B.P., the sedimentary evolution of the Yangtze delta should have been illustrated by core YD13 recovered from the subaqueous Yangtze delta, consisting of 1.6 m transitional sequence during 5-2.5 cal kyr BP and 7 m-thick prodelta sequence during 2.5 cal kyr BP to present. Core MD06-3040 recovered from the inner shelf of ECS consists of 3 m-transgressive systems tract (TST) and 16 m-highstand systems tract (HST).

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. The Yangtze River would be a predominant source of the subaqueous Yangtze delta and mud wedge on the inner shelf deposits by comparison the core sediments

recovered from both subaqueous Yangtze delta and mud wedge sites with modern Yangtze River sediments. Moreover, detailed examination of quartz provenance within the Yangtze River drainage using ESR and CI enable 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 for fine sandy layer and coarse silt layer samples show minima. Assuming this general tendency, decreasing of ESR in fine fraction could be used as the indicator of flooding frequency, which suggests that big flooding occurred mainly in the upper reaches of the Yangtze drainage. Variability of the location of EASM precipitation (EASM front) on multi-centennial to millennial-scale has been detected from this result which showed heavier precipitation in the southeastern side of middle-lower reaches (Lake Dongting and Poyang) during 5-3.8 cal kyr BP, and in the upper reaches during 3.8-1.6 cal kyr BP and 1-0.6 cal kyr BP

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 coincide with proxies, such as dry periods derived from stalagmite  $\delta^{18}\text{O}$  records (calibrated  $\Delta \delta^{18}\text{O}_{\text{sp}}$  record) in southern China and high salinity events

recorded in the cores from northern ECS. Such co-incidence of drought events and minima in grain size suggest that the Yangtze River discharge supplied by EASM precipitation has been a prevailing control on the sedimentation on the inner shelf of ECS.

The evolution of monsoonal climate with abrupt events in the Yangtze River drainage has been correlated with spatio-temporal heterogeneity of precipitation area within the Yangtze drainage as well as 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 associated with higher contribution of material from the upper reaches of the Yangtze drainage (detected in ESR from both YD13 and MD06-3040 sites) since 5 cal kyr BP. The stronger EASM has been associated with high precipitation and northwestward shift of monsoon front (or longer duration of frontal activity in the NW drainage of the Yangtze).