Coupling of sea level changes and neotectonic activities in the Pearl River Delta—insight from stratigraphic profile and chronology

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Despite several tens of Pleistocene eustatic oscillations, it is surprising that only two marine sequences were preserved in the PRD (Pearl River Delta), the third biggest delta along the mainland China coast. The younger marine sequence (SQ1) has been consensus on the age of Holocene, i.e., MIS1, whereas the chronology of the older marine sequence (SQ2) is still in debate, i.e., belongs to MIS3 or MIS5. Those favor younger transgression suggest rapid uplift following the SQ2 deposited according to $^{14}$C and early luminescence dating, while the others argued that the current depth of SQ2 is affected by tectonic subsidence and better match the sea-level altitude in MIS5. To address this problem, it is significant to investigate a complete spatial distribution of SQ2 prior to dating. We applied 250 boreholes to acquire 5 Quaternary stratigraphic profiles throughout the PRD. These profiles reveal that the deposition area of SQ2 with current depth at -15 - -35m a.s.l. only reach the southern part of PRD, showing a much less area than SQ1. Sediments synchronous to SQ2 in the northern part of PRD present coarse grain in fluvial or piedmont environment, implying an erosional state. Preliminary OSL dating on SQ2 in boreholes in southern PRD yielded 85.5±5 ka, suggesting the SQ2 probably deposited in MIS5, here we infer to the high sea-level in MIS5a with altitude at ca. -20m. Moreover, we estimate the isostasy by erosion of granite highland in/around the PRD via hypsometric integral curve. We find that the modern average altitude of the highland is ca. 100-150m lower than the estimated isostatic altitude, suggesting tectonic subsidence in PRD. Overall, we interpret that the PRD was an eroding highland and keep subsiding since MIS5. Because of the topographic high, transgression occurred in MIS5 did not extend northward to modern delta area and led to absence of SQ2 in northern PRD. Subjected to tectonic subsidence, the once topographic high subsided beneath the modern sea-level but still higher the sea-level in MIS3. Marine sequence did not develop in PRD until transgression occurred in Holocene.