



A Miocene Age Yangtze River: Evidence from Finger-printing Sediments

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The evolutionary history of the Yangtze River system has been the subject of great interest and debate, because it bears great significance for understanding the uplift history of the Tibetan Plateau and other regional tectonic and climatic evolution. Key issues identified by previous researchers include: 1) timing of the capture of the Jinsha Jiang (the upmost fragment of the Yangtze) at the First Bend; 2) timing of the incision of the Three Gorges. A predominant view claimed that the Three Gorges were not incised, and that the Jinshan Jiang did not drain to the east through the First Bend until Pleistocene (e.g. Li, et al., 2001). Others proposed scenarios implying that the formation of the Yangtze River system was completed by Miocene (Clark, et al., 2004), even as early as Eocene (Richardson, et al., 2010).

Based on systematic finger-printing (such as mineralogy, geochemistry, isotope, detrital zircon ages) of both surface sediments in the Yangtze River drainage, and Cenozoic sediments preserved in the lower Yangtze basins, this study suggests that the Yangtze River came into its present form in early Miocene.

1) Jiangnan Basin, just downstream of the Three Gorges, begun rifting in the late Cretaceous, and came into a stage of full development of graben-type basin during Paleogene, with vast deposition of lacustrine and evaporitic sequences. Facies analysis of Paleogene sediments does not show any major trunk streams with a comparable size of the Yangtze River running through.

2) At the end of Paleogene, Jiangnan Basin went through a period of adjustment, being characterized with uplift, folding and erosion, and eventually turned into a generally subsiding system (Dai, 1997). Neogene sediments overly unconformably the Paleogene, and cap up the whole basin. Facies analysis indicates that Neogene sediments are mainly of fluvial nature, being formed under the influence of large river systems.

3) Fluvial sediments of early to mid Miocene age exposed near Nanjing indicate that the lower reaches of the Yangtze River basin was prevailed by large river systems, the provenance of which resembled to the modern Yangtze.

4) Provenance of the core sediments of Pliocene age from Yangtze Delta Basin and Jiangnan Basin also indicates that the river has been running through from the upper to the lower reaches since early Pliocene.

In conclusion, the incision of the Three Gorges occurred most likely around Oligocene/Miocene boundary, as part of the process of regional tectonic adjustment during which basin development all over eastern China went through important evolution from graben-type to general subsiding, and associated drainage networks would also be adapted to a new tectonic regime.