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Sedimentology, geochronology and provenance of the "Yangtze Gravels": Link Yangtze River to Late Cenozoic tectonic and climate in Eastern China

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The evolution of Yangtze, the longest river in Asia, has long been a research focus for more than a century[1]. Current models of drainage evolution argue that the present-day Yangtze has been integrated through a series of large-scale capture events in response to evolving tectonic and climate of East Asia during Late Cenozoic. Base on Ar-Ar geochronology and detrital zircon, Zheng et al.[2] dated the oldest Yangtze deposit (referred as "Yangtze Gravel") of >23 Ma in age, indicating a pre-Miocene establishment of the through-going Yangtze. However, the link between river integration and tectonic-climate evolution has never been elaborated due to limited exposure of the Yangtze Gravels. Here, we report several newly-found sections along Lower Yangtze Valley (From Yichang to Nanjing, Figure 1), as well as subsurface drilling cores and seismic profiles in Jianghan and Subei Basin. Our new geochronology results, including Ar-Ar dating of overlying basalt and fossil discrimination, illustrate that the Yangtze Gravels have been deposited during Miocene to Early Pleistocene. Detailed analysis of sedimentary facies, clast composition and detrital zircon reveal the fluvial environment with both proximal and distal source area, which reflects the tectonic transition of East China from rifting regime into regional downwarping since Oligocene-Miocene boundary[3]. This tectonic transition, accompanying with the uplift of Tibetan Plateau, provides a continental-scale gradient and an east-flowing way for Yangtze River. In addition, pollen and clay minerals data of Yangtze Gravels indicate a humid, moderate warm climate approximately related to the strength of the Asian Monsoon since Early Miocene[4]. Owing to this synchronous climate transition, both river discharge and sediment flux might have been dramatically increased for rapid erosion, which plays another important role on Yangtze River integration.

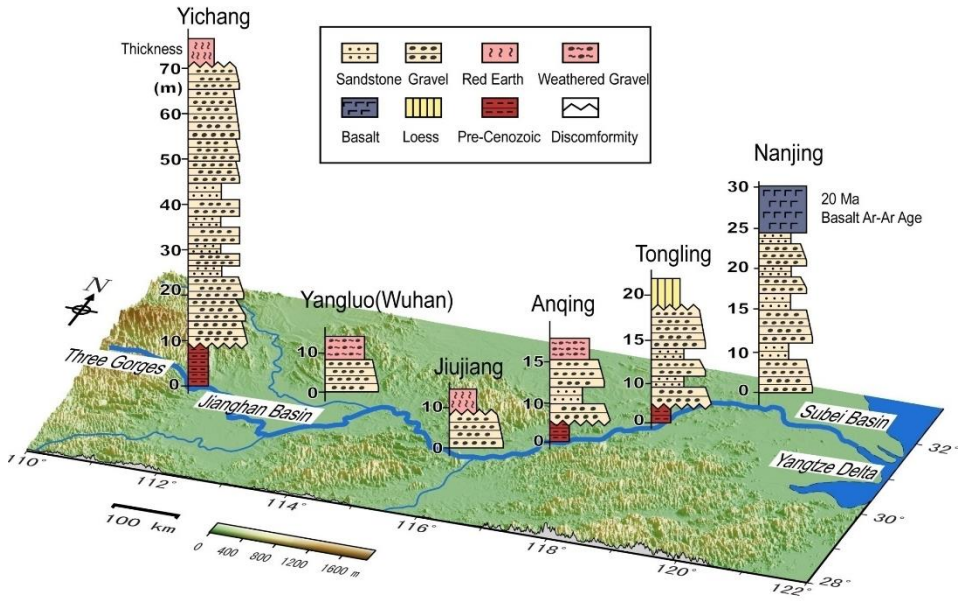

Figure 1: Simplified map showing the lithological logs of the "Yangtze Gravels" downstream of the Three Gorges from Yichang to Nanjing. Note that Nanjing section overlain by basalt lava.

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[2] Zheng H et al. (2013) PNAS 110(19): 7556-7561.
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[4] Sun X and Wang P (2005). 3-Palaeo 222(3-4): 181-222.