Peter D. CLIFT and ZHENG Hongbo, 2013. Evolving River Systems and Climatic Conditions in Controlling the Fill of Sedimentary Basins on the Eastern Flank of the Tibetan Plateau. *Acta Geologica Sinica* (English Edition), 87(supp.): 544-545.

Evolving River Systems and Climatic Conditions in Controlling the Fill of Sedimentary Basins on the Eastern Flank of the Tibetan Plateau

Peter D. CLIFT[1, *] and ZHENG Hongbo[2]

1 Department of Geology and Geophysics, Louisiana State University, Baton Rouge, LA 70803, USA
2 School of Geography Science, Nanjing Normal University, 1 Wenyuan Road, Nanjing, China

Sedimentary basins generated in response to a variety of tectonic stresses have been formed on the eastern flank of the rising Tibetan Plateau during the Cenozoic. The gradual rise of Tibet coupled with long-term subsidence in southern and eastern China, following rifting of the South China Sea, and more recent Neogene extension in eastern China, has reversed the regional topographic gradient of the Cretaceous-Paleogene. This in turn has had a profound affect on the courses of the major river systems that have transferred large volumes of sediment to the deltas of eastern Asia. Some of that same sediment has been trapped onshore where subsidence has generated accommodated space, typically in small pull-apart basins close to the plateau, but also in major extensional depocenters, such as the Jianghan and Subei Basins. Re-routing of the upper and middle Yangtze away from the Red River is now known to have occurred prior to 23 Ma, but likely not before 36 Ma based on new U-Pb zircon dating from the Yangtze lower reaches. Nd isotopic data from the Hanoi Basin suggest a major reorganization of the river systems there and in SW China during the Oligocene, diverting coarser clastic flux, potential reservoir sandstones, east and away from the Yinggehai-Song Hong Basin. This change is likely driven by the start of topographic uplift in the region of the Yangtze First Bend and must predate the major gorge incision of the region that was underway prior to 10 Ma. As well as diverting rivers Tibetan surface uplift has aided intensification of the Asian summer monsoon, which has driven up both rates of bedrock erosion and sediment delivery, while also raising rates of chemical weathering and increasing the absolute intensity of alteration in the sediments found in any basin. The more humid climate would also be anticipated to result in greater organic carbon flux and enhance chances for its efficient burial because of fast sedimentation rates. The monsoon appears to have reached a maximum at ~15–17 Ma following initial increases after 24 Ma but then reduced after 8 Ma.

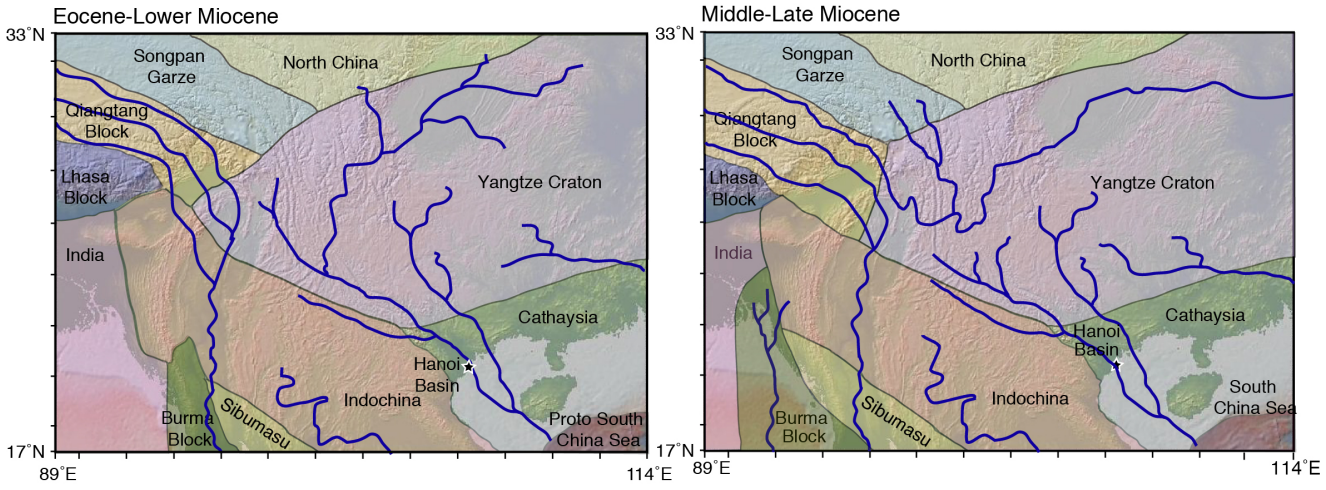

Fig. 1. Map modified from Hoang et al. (2009) showing the proposed large scale reorganization of major rivers in Eastern Tibet in controlling the filling of basins on the plateau margin, as well as the South China Sea.

* Corresponding author. E-mail: pclift@lsu.edu

New evidence from offshore now indicates that stronger monsoons also drive recycling of sediments from older deposits. Enhanced erosion of mountains that are associated with flexural foreland basins, such as the Longmen Shan-Sichuan Basin results in modest basin inversion and further reworking of older sediments that are then transported lower in the drainage system. A rising Tibetan Plateau affects the volumes and composition of fill of the sedimentary basins that surround the plateau and which buffer the final sediment flux to the marine deltas.

Keywords: uplift, river, monsoon, erosion, capture

References

Clift, P.D., Blusztajn, J., Nguyen, D.A., 2006. Large-scale drainage capture and surface uplift in eastern Tibet-SW China before 24 Ma inferred from sediments of the Hanoi Basin, Vietnam. *Geophys. Res. Letts.*, 33(L19403).

Clift, P. D., K. Hodges, D. Heslop, R. Hannigan, L. V. Hoang, and G. Calves (2008), Greater Himalayan exhumation triggered by Early Miocene monsoon intensification, *Nature Geosci.*, 1: 875-880. doi:10.1038/ngeo351.

Clift, P.D., and VanLaningham, S., 2010, A Climatic Trigger for a Major Oligo-Miocene Unconformity in the Himalayan Foreland Basin, *Tectonics*, *29*: TC5014, doi: 10.1029/2010TC002711.

Galy, V., France-Lanord, C., Beyssac, O., Faure, P., Kudrass, H.-R., Palhol, F., 2007. Efficient organic carbon burial in the Bengal fan sustained by the Himalayan erosional system. *Nature* 450: 407-411.

Hoang, L.V., Wu, F.Y., Clift, P.D., Wysocka, A., Swierczewska, A., 2009. Evaluating the evolution of the Red River system based on in-situ U-Pb dating and Hf isotope analysis of zircons. Geochem. Geophys. Geosyst. 10: doi:10.1029/2009GC002819

Hu, D., Böning, P., Köhler, C.M., Hillier, S., Pressling, N., Wan, S., Brumsack, H.-J., Clift, P.D., 2012. Deep sea records of the continental weathering and erosion response to East Asian monsoon intensification since 14ka in the South China Sea. *Chem. Geol.* 326-327: 1-18.

Liu, M., Cui, X., Liu, F., 2004. Cenozoic rifting and volcanism in eastern China: a mantle dynamic link to the Indo–Asian collision? *Tectonophysics*, 393: 29–42.

Wan, S., Clift, P.D., Li, A., Yu, Z., Li, T., Hu, D., 2012. Tectonic and climatic controls on long-term silicate weathering in Asia since 5 Ma. *Geophys. Res. Lett.* 39: L15611, doi:10.1029/2012GL052377.

Yan, Y., Carter, A., Huang, C.Y., Chan, L.S., Hu, X.Q., Lan, Q., 2012. Constraints on Cenozoic regional drainage evolution of SW China from the provenance of the Jianchuan Basin. Geophysics Geochemistry Geosystems 13.

Zheng, H., Jia, D., Chen, J., Wang, P., 2011. Forum Comment: Did incision of the Three Gorges begin in the Eocene? Geology.