# Initial uplift of the Tibetan Plateau and environmental implications

**Xiaohong Ge†, Shoumai Ren‡§*, Yongjiang Liu† and Lixiang Ma¶**

*† College of Earth Sciences, Jilin University, Changchun, 130061, CHINA*
*‡ Institute of Geomechanics, Chinese Academy of Geological Sciences, Beijing, 100081, CHINA*
*§ Strategic Research Center for Oil and Gas Resources, Ministry of Land & Resources, Beijing, 100034, CHINA*
*¶ Institute of Graduates, China University of Geosciences, Wuhan, 430074, CHINA*

** To whom correspondence should be addressed. E-mail: realshaw@vip.sina.com*

When did the Tibetan plateau uplift firstly? This is an attentive question to all geologists who are studying on the Himalayan structure. Aitchison et al. (2002) discovered the Oligocene-Early Miocene radiolarite silicon rock and the Lower Miocene Gangrinboche conglomerates along the Yarlung-Tsangpo suture zone, which provided a significant evidence to postpone by nearly 20 Ma the closure time of Tethys ocean along the Yarlung-Tsangpo suture belt. They also suggested that the real collision between Indian and Eurasian plate happened between 30 Ma to 25 Ma ago, unlike the previous supposition as 50 Ma (Patriat and Achache 1984). Therefore, we are sure that the initial uplift of the Tibetan plateau should have occurred in the Early Miocene period. This is also consistent with the results we got from the Qaidam basin recently.

Many profiles, which cross the Qaidam basin and East Kunlun Mountains, indicate that sedimentary center of the Qaidam basin was around Yiliping region in the central basin in Paleocene-Oligocene period, with the characteristics of diminishing depression. Grain size analyses of the related formation sediments and rather lower sedimentary rate indicate that the basin was in an extension tectonic setting at that time, then the Miocene basin area was reduced apparently, and the sedimentary rate was increased suddenly around 25 Ma ago. A foreland depression existed in front of the Paleo-Kunlun Mountains, which implies that the regional uplift happened in the whole Qaidam basin during the Mid-Miocene epoch and was eroded subsequently. The large-scale distribution of the angular unconformity between Xia Youshashan Formation and Shang Youshashan Formation, which is marked as T2' reflect layer in seismic profile, on the basin margin can provide the evidence for this raising procedure. This raising of compression in Qaidam basin about 25-22 Ma ago is actually the first uplift of the Tibetan plateau. The appearance of the loess in the adjacent region of Tibetan plateau around 22 Myr ago (Guo et al. 2002), the pre-Miocene thrust fold in the Qiangtang basin in the northern Tibet, the Lower Miocene conglomeratic molasses along the Yarlung-Tsangpo suture zone on the southern margin of the Lhasa terrane (Aitchison et al. 2002), the potassic lavas in western Tibet over the past 20 Myr (Chung et al. 1998, Turner et al. 1993) and the changes of sedimentary-tectonic setting and biological characters in northwestern China, are the symbols of the initial uplift of the Tibetan plateau.

The research results of Aitchison et al. (2002) could reasonably explained the geological background of the appearance of the arc-continent collision fossil-structure belt and Gangdess porphyritic copper ore deposit on both side of the Yarlung-Tsangpo suture belt, this suggests that the Yarlung-Tsangpo and Gangdess belts located on the anterior border of the arc-continent/arc-arc collision during the Paleo-Asian plate colliding to Tethys ocean plate, it is similar to the position of the present Japan-Taiwan- Philippine island arc around the west Pacific Ocean, while the hinterland, the region from the western China to Kazakstan, was in the tectonic surrounding similar to the eastern Asian plate. Large-scale peneplanation and pangeo-basin were developed at that time. Therefore, similar as Qaidam basin, the Tarim basin, Junggar basin, Tu-ha basin, and Hexi Corridor are not foreland or compression basins, and are likely the dishing depressions under the stretch environment during the Eocene-Oligocene period. The relative lower sedimentary rates in those basins during the Paleocene and the latitudinal circulation of the subtropical paleo-climate zone in western China also support above ideas.

## References

Aitchison JC, AM Davis, B Zhu and H Luo. 2002. New constraints on the India-Asia collision: the Lower Miocene Gangrinboche conglomerates, Yarlung Tsangpo suture zone, SE Tibet. *Journal of Asian Earth Sciences* **21**: 521-263

Chung SL, CH Lo, TY Lee, YQ Zhang, YW Xie, XH Li, KL Wang and PL Wang. 1998. Diachronous uplift of the Tibetan plateau starting 40 Myr ago. *Nature* **394:** 769-773

Guo ZT, WF Ruddiman, QZ Hao, HB0Wu, YS Qiao, RX Zhu, SZ Peng, JJ Wei, BY Yuan and TS Liu. 2002. Onset of Asian desertification by 22 Myr ago inferred from loess deposits in China. *Nature* **416**: 159-163

Patriat P and J Achache. 1984. India-Eurasia collision chronology has implications for crustal shortening and driving mechanism of plates. *Nature* **311**: 615-621

Turner S, C Hawkesworth, JQ Liu, N Rogers, S Kelley and P Calsteren. 1993. Timing of Tibetan uplift constrained by analysis of volcanic rocks. *Nature* **364**: 50-54