

Northeastward growth and uplift of the Tibetan Plateau: Tectonic-sedimentary evolution insights from Cenozoic Hoh Xil, Qaidam and Hexi Corridor basins

Chengshan Wang†‡*, Zhifei Liu§ and Lidong Zhu†

† State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation, Chengdu University of Technology, Chengdu 610059, CHINA

‡ China University of Geosciences, Beijing 100083, CHINA

§ Laboratory of Marine Geology, Tongji University, Shanghai 200092, CHINA

* To whom correspondence should be addressed. E-mail: wcs@cdu.edu.cn

The northeastward growth of the Tibetan Plateau was addressed as a major uplift process of Northeast Tibet, deduced mainly from the Qaidam, Gonghe-Guide, and Hexi Corridor basins (Métivier et al. 1998; Pares et al. 2003). These studies contributed to a significant in understanding of the crustal thickening and oblique stepwise rise of Plio-Quaternary Tibet (Meyer et al. 1998; Tapponnier et al. 2001). But sedimentary basins in central Tibet still remain less studied because of harsh conditions for fieldwork. The Hoh Xil Basin, as the largest Cenozoic sedimentary basin in the hinterland of Tibetan Plateau, is situated in central Tibet between Kunlun and Tanggula ranges (Liu et al. 2001). From Hoh Xil Basin in central Tibet northeastwards to the Qaidam Basin in Northeast Tibet, and to the Hexi Corridor Basin at the northeast edge of Tibet, the Tibetan Plateau consists mainly of basin-ridge tectonic-sedimentary system with about six north-south trending latitude ranges, i.e. the Hoh Xil, Qaidam, and Hexi Corridor basins with the Kunlun and Qilian ranges between them. Our study focuses on the tectonic and sedimentary evolution of the basin-ridge system to contribute the understanding of the uplift history of the Tibetan Plateau.

The Hoh Xil Basin exposes 5823 m thick Cenozoic sediments, which were paleomagnetically dated as the Eocene-Early Oligocene (51.0-31.3 Ma) Fenghuoshan Group in the lower part and the Early Oligocene (31.3-30.1 Ma) Yaxicuo Group in the upper part (Liu et al., 2003), with the Early Miocene Wudaoliang on the top. The basin was formed first as a strike-slip/extensional basin and remained during the 51.0-47.0 Ma period. Then during 47.0-30.1 Ma, the basin developed as a foreland basin with the Tanggula range as its major clastic provenance that contributed depocenter in the basin to shift northeastwards. In the Early Miocene, the basin-widely-distributed Wudaoliang limestone suggests the Hoh Xil Basin to be a relatively stable intermontane basin (Wang et al., 2002). The Qaidam Basin is situated between the Kunlun range in the south and the Qilian range in the north with an amount of >15000 m thick Cenozoic sediments. Following previous studies, we reconstruct the tectonic-sedimentary history as: the extensional basin stage (65-46 Ma) with brown-violet conglomerate and sandstone upward-fining sequence; the foreland basin stage (46-2.45 Ma) with a southeast-east distribution pattern of sub-basins that obviously have a direct relationship with the activity of the Altyn Tagh Fault; the intermontane basin stage (2.45-0 Ma) with basin-wide-

distributed clastic sediments. The Hexi Corridor Basin was formed under the Altyn Tagh Fault activity as a strike-slip basin started from 37.7 Ma. During 30.3-0.13 Ma period, with the movement of the Qilian orogen, the basin depocenter shifted southwards to the mountain edge that indicates the formation of a foreland basin. From 0.13 Ma, the basin has evolved into an intermontane basin with a less than 100 m thick sediments.

The three Cenozoic sedimentary basins have a similar tectonic-sedimentary history, i.e. first as strike-slip/extensional basin, then as foreland basin, and last as intermontane basin. The evolution of their foreland basin stage indicates a northeastward shift of the orogenic uplift from 47.0-30.1 Ma in central Tibet (the Tanggula range), to 46-2.45 Ma in Northeast Tibet (the Kunlun range), and to 30.3-0.13 Ma in the northeast edge of Tibet (Qilian range). At the same time, each basinal depocenter also shift northeastwards with predominant northeastward paleocurrents. The tectonic-sedimentary evolution of the series of Cenozoic sedimentary basins strongly suggests the northeastward growth and uplift process of the Tibetan Plateau started from Eocene to present.

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