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Reconstruction of Cenozoic growth process in North Tibet: Source to sink relation between the Qaidam Basin and East Kunlun Mountains

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Understanding the source to sink relation through time between the East Kunlun Mountains that form the northern boundary of the Tibetan plateau and the actively deforming Qaidam Basin to the north has important implications for unravelling the growth history of the entire plateau. In this study, LA-ICP-MS U-Pb dating of detrital zircons from 22 sandstone samples (Palaeocene to Holocene) collected from 4 sections within the southwestern Qaidam Basin are combined with sediment petrology analysis and seismic profile interpretation to investigate the tectonic and topographic growth of the East Kunlun Mountains and its effects on the evolution of the Qaidam Basin. The occurrence of carbonate debris containing foraminifera fossils in the Palaeocene conglomerate sequences as well as a wide population of Palaeozoic to late Proterozoic grains in the age spectra of detrital grains from Palaeocene strata suggest the East Kunlun Mountains were already exhumed before the deposition of the Palaeocene Lulehe Formation. The topographic evolution of the southern edge of the Qaidam Basin can be separated in three phases: exhumation in the East Kunlun Mountains initiated during or possibly before the deposition of the Paleocene Lulehe Fm.. Erosion only affected the remaining Mesozoic cover and the Paleozoic basement without eroding the Mesozoic granitoids and the Precambrian basement. The southwestern Qaidam Basin was already separated from the Hoh Xil Basin to the south. During the middle Eocene to Oligocene, the Qaidam Basin widened towards the south and east. However the widening of the basin, uplift and erosion in the East Kunlun Mountains were still active and probably increased leading to the exhumation of the Mesozoic granitoids. This increase in exhumation is consistent with already published thermochronology data in the East Kunlun Mountains and sedimentology data in both the Qaidam and Hoh Xil basins. The occurrence of numerous early Proterozoic and Archean ages suggests that connections still existed between the Qaidam Basin and the Hoh Xil and Kumukol basins through the growing East Kunlun Mountains. From the Miocene to present, the topography of the East Kunlun Mountains and the Altyn Tagh Range increased, progressively isolating the Qaidam Basin. The East Kunlun Mountains formed the main source for the sediments deposited in the southwestern Qaidam Basin while the material was derived from both the Altyn Tagh and East Kunlun ranges in the Huatugou area. The connections that might still existed during the early Miocene with the Tula Uplift area to the west and the northern edge of the Qiangtang Block to the south were rapidly cut. During the Pliocene to Present, an increasing amount of sediment recycling occurred leading to complex detrital zircon U-Pb ages distributions. The present-day valley-range landform in Qimen Tagh Range developed around or slightly prior to the Pleistocene.