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| **Table S1.** Summary of major morphotectonic events across the NE Tibetan Plateau |
| Map ID | Studied region (locality) | Age (Ma) | Activity/Event  | Method  | Data source |
| **65-54 Ma** |
| **Altyn Tagh Shan** |
| 1 | Nanyishan | 65-54 | fast exhumation and tectonic uplift  | ZFT and seismic profiles  | Wang Y et al., 2015 |
| 2 | Lapeiquan-Huatugou | 53.5-16.9 | N-S compression | seismic reflection data, structural and stratigraphic analyses | Wu L et al., 2019 |
| 3 | Huatugou | 56-39  | strike-slip faulting  | detrital ZPb | Cheng F et al., 2016 |
| **Hei Shan-kuantan Shan-Bei Shan** |
| 4 | Hei Shan | 53-40 | fast exhumation | *in situ* AFT | An et al., 2020 |
| **Qaidam basin** |
| 5 | Hero hill | 49-22 | surface uplift to 1462+148/-227 m | δ18Oc of mammalian fossils and carbonates | Li L et al., 2017 |
| 6 | Yingchaogou region | 54-47 | fast exhumation | *in situ* AFT | Jian X et al., 2018 |
| 7 | regional large scale | 65-50 | initiation of thrust system, crust contraction | structural geology | Yin A et al., 2008 |
| 8 | west of the basin | 53.5-43.8 | tectonic activity | seismic profiles | Cheng F et al., 2019 |
| 9 | Qaidam Beishan | 65-50 | fast exhumation  | *in situ* AFT, K-feldspar 40Ar/ 39Ar | Zhuang et al., 2018 |
| 10 | Dahonggou | 52-46 | tectonic uplift | magnetostratigraphy | Ji J et al., 2015 |
| 11 | Dahonggou | ~54 | provenance change  | sandstone petrology, detrital ZPb, heavy minerals | Bush et al., 2016 |
|  | Lulehe | 65-53  | fast exhumation | detrital AFT | **this study** |
| **East Kunlun Shan** |
| 12 | Xidatan-Golmud  | 59-42 | tectonic activity | detrital ZFT  | Wang A et al., 2010 |
| 13 | Dongdatan-Xidatan-Golmud | 52.9  | fast exhumation | *in situ* AFT | Chen et al., 2011 |
| B1 | Wenquanhu-Deshuiwai | 65-47 | fast exhumation related to crustal shorting | *in situ* AFT, ZHe, AHe, illite 40Ar/ 39Ar  | Staisch et al., 2020 |
| 14 | Xiangride | 56-45 | fast exhumation | AFT | Wang G et al., 2007 |
| 15 | Buqingshan-Xiangride | 50 | fast exhumation | *in situ* AFT | Tian et al, 2020 |
| **Central Qilian Shan (Including Laji Shan-Jishi Shan)** |
| 16 | Shulenan Shan | ~55 | thrust faults | *in situ* AFT | Li B et al., 2020 |
| 17 | Daban Shan | 50-30 | fast exhumation | *in situ* AFT | Zhang J et al., 2015 |
| B2 | South Qilian city | ~65-60 | reheating event | *in situ* AFT | Wu C et al., 2021 |
| B3 | Xining basin | 69-49 | tectonic transition | magnetostratigraphy and detrital ZPb | He et al., 2021 |
| 18 | Xining basin | 55-52.5 | basin formation | magnetostratigraphy | Fang et al., 2019 |
| 19 | Xining-Lanzhou region | Paleocene | tectonic clockwise rotation  | magnetostratigraphy  | Dupont-Nivet et al., 2004 |
| 20 | Lanzhou basin | 70-58 | fast exhumation | detrital AFT | Wang X et al., 2017 |
| **West Qinling Shan** |
| 21 | Guide basin | 70-53 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2016 |
| B4 | Linxia basin | 51  | basin formation | magnetostratigraphy and detrital ZPb | Feng et al., 2022 |
| 22 | Ganjia-Dalijia Shan | 50-45 | fast exhumation | *in situ* AHe | Clark et al., 2010 |
| 23 | Taizi Shan | 50 ± 8 | reverse faulting | illite 40Ar/ 39Ar | Duvall et al., 2011 |
| 24 | Wudu basin | 70-58 | fast exhumation | detrital AFT | He et al., 2017a |
| 25 | Tianshui basin | 69-59 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2011 |
| 26 | Tianshui-Wudu | 60-50 | fast exhumation | *in situ* AFT | Enkelmann et al., 2006 |
| 27 | east of Tianshui-Wudu | 60-50 | fast exhumation | *in situ* AFT | Chen et al., 2015 |
| **Jiuquan basin** |
| B5 | Sunan | 61-43.1 | fast exhumation | detrital ZPb and AFT | Chen et al., 2022 |
|  | Jiuquan basin | 65-53 | fast exhumation | detrital AFT | **this study** |
| **43-39 Ma** |
| **Altyn Tagh Shan** |
| 28 | Tula | 49 | strike-slip faulting | detrital ZPb | Cheng F et al., 2015 |
| 29 | Mangnai | 49 | faulting | magnetostratigraphy, heavy minerals | Yin A et al., 2002 |
| Lenghu section |
| Jianglisai |
| Xishuigou |
| 30 | Jinghong Shan | 47-44 | fast exhumation | *in situ* AFT | Sobel et al., 2001 |
| 31 | Altyn Tagh north margin | 40±10  | fast exhumation | *in situ* AFT and ZFT | Jolivet et al., 2001 |
| B16 | Jianglisai-Luojianglisai  | 40-35 | fast exhumation | *in situ* AFT and ZFT | Gao et al., 2022 |
| 32 | Dangjin pass | 40-25 | faulting | *in situ* 40Ar/39Ar | Liu et al., 2007 |
| **Qaidam basin** |
| 11 | Dahonggou | ~46 | provenance change | sandstone petrology, detrital ZPb, heavy minerals | Bush et al., 2016 |
| 33 | Kunbei -Yueya Shan | 43.8-22 | tectonic deformation | 2D seismic cross-section | Wang Y et al., 2012 |
| 34 | large region of basin | 42.8-40.5 | crustal shorting and uplift | balanced cross-section restoration | Zhou et al., 2006 |
| 35 | eastern edge | 40 | fast exhumation | *in situ* AFT and ZFT | Jolivet et al., 2001 |
|  | Lulehe |  44-40 | fast exhumation | detrital AFT | **this study** |
| **East Kunlun Shan** |
| 36 | Qimen Tagh | 40-30 | fast exhumation | *in situ* AFT, ZPb | Liu D et al., 2017 |
| 37 | Dazaohuo-Qimen Tagh | 40-35 | fast exhumation | *in situ* K-feldspar 40Ar/39Ar, AHe  | Wang F et al., 2017 |
| 38 | Nuomuhong | 40 | surface uplift and fast exhumation | *in situ* biotite and K-feldspars 40Ar/39Ar, AHe  | Wang F et al., 2016 |
| **North Qilian Shan**  |
| 39 | Subei basin | 43-42 | basin formation | sedimentology | Song, 2006 |
| 40 | Jiuquan basin | 40.2 | tectonic uplift  | magnetostratigraphy | Dai et al., 2005 |
| 41 | Muli basin | 40.2-35.3 | surface uplift to 2180–3502 m | δ18Oc and δ13Cc of lacustrine sediments | Qi et al., 2015 |
| **South Qilian Shan**  |
| 42 | southwestern rim of Muli basin  | 40 | fast exhumation | *in situ* AFT | Qi et al., 2016 |
| **Central Qilian Shan (Including Laji Shan-Jishi Shan)** |
| 20 | Lanzhou basin | 50-41 | fast exhumation | detrital AFT | Wang X et al., 2017 |
| B2 | Qilian city | ~40-30 | reheating event | *in situ* AFT | Wu C et al., 2021 |
| **Haiyuan-Liupan Shan** |
| 43 | Sikouzi basin | 47.9 | basin formation | magnetostratigraphy | Han et al., 2008 |
|  |
| **West Qinling Shan** |
| 21 | Guide basin | 49-42 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2016 |
| 25 | Tianshui basin | 49-39 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2011 |
| **Jiuquan basin** |
|  | Jiuquan basin | 44-40 | fast exhumation | detrital AFT | **this study** |
| **34-29 Ma** |
| **Altyn Tagh Shan** |
| 43 | Yousha Shan | 31-15 | fast exhumation | *in situ* AFT | Wang E et al., 2006 |
| B15 | Subei | 36-31 | fast exhumation | *in situ* AHe  | Ye et al., 2022 |
| **Qaidam basin** |
| 9 | Xitie Shan | 36-25 | fast exhumation  | *in situ* AHe | Zhuang et al., 2018 |
| 11 | Dahonggou | ~32 | provenance change | sandstone petrology, detrital ZPb, heavy mineral of sediments | Bush et al., 2016 |
| B6 | Hongliugou | 33-10 | clockwise rotation | magnetostratigraphy | Li et al., 2020 |
| 44 | large region of the basin | 36.6 | basin extension | volume balance and accumulation rates of sediments | Métivier et al., 1998 |
| 45 | Dahonggou | 30.8 | surface uplift to 3300 ±1400 m | fossil leaves | Song et al., 2020 |
|  | Lulehe |  34-28  | fast exhumation | detrital AFT | **this study** |
| **East Kunlun Shan** |
| 46 | Kumukol basin | 35.5 | basin retreated northward | seismic profiles and stratigraphy analysis of sediments | Mao et al., 2014 |
| 47 | Xidatan | 30-20 | fast exhumation | *in situ* ZHe, AHe, ZPb | Dai J et al., 2013 |
| 48 | Nachitai | 35-30 | crustal shorting | *in situ* biotite 40Ar/39Ar | Liu et al., 2005 |
| 49 | Kunlun pass-Nachitai | 37-24 | tectonic unroofing | *in situ* biotite, K-feldspar 40Ar/39Ar | Mock et al., 1999 |
| 50 | Kunlun fault West | 30-25 | faulting | *in situ* AHe, ZHe | Duvall et al., 2013 |
| 51 | Xianride-Nomuhung | ~35 | fast exhumation | *in situ* AHe | Clark et al., 2010 |
| **South Qilian Shan**  |
| 52 | Qaidam Shan | 40-30 | fast exhumation | *in situ* AFT | Cheng X et al., 2016 |
| 53 | Dachaidan | ~30 | denudation | *in situ* biotite and K-feldspar 40Ar/39Ar, AFT | Wang F et al., 2004 |
| B7 | Hongshan | ~30 | surface uplift | magnetostratigraphy, detrital ZPb | Wang W. et al., 2022 |
| **North Qilian Shan (including Longshou Shan)** |  |
| 54 | Tuolai Shan | 30-25 | faulting-induced reheating | *in situ* AFT | Li B et al., 2020 |
| B2 | Longshou Shan | ~30 | fast exhumation | *in situ* AFT | Wu C et al., 2021 |
| **Central Qilian Shan (Including Laji Shan-Jishi Shan)** |
| B2 | South Menyuan | ~30 | fast exhumation | *in situ* AFT | Wu C et al., 2021 |
| 55 | Xining basin | ~36 | surface uplift to 2000–3000 m  | fossil pollen | Dupont-Nivet et al., 2008a |
| 56 | Lanzhou basin | 30-28 | surface uplift to 2000–3000 m | fossil pollen | Miao et al., 2013 |
| **West Qinling Shan** |
| 21 | Guide basin | 36-32 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2016 |
| 24 | Wudu basin | 37-36 | fast exhumation | detrital AFT | He et al., 2017 |
| 25 | Tianshui basin | 34-27 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2011 |
| 104 | Xunhua basin | ~30 | provenance change | magnetostratigraphy, detrital ZPb | Lease et al., 2012 |
| 57 | Linxia basin | 29 | tectonic activity | magnetostratigraphy | Fang et al., 2016 |
| B3 | Xining basin | 33-30 | tectonic transition | magnetostratigraphy and detrital ZPb | He et al., 2021 |
| **Jiuquan basin** |
| B5 | Sunan | 38.2-24.6 | fast exhumation | detrital ZPb and AFT | Chen et al., 2022 |
|  | Jiuquan basin | 34-28 | fast exhumation | detrital AFT | **this study** |
| **24-21 Ma** |
| **Altyn Tagh Shan** |
| 30 | Mangnai-Ruoqiang | 25-19 | fast exhumation | *in situ* AFT | Sobel et al., 2001 |
| B8 | Heishiqiu | 27-17 | clockwise rotation | magnetostratigraphy | Li et al., 2021a |
| 58 | Janggalsay | ~22 | counterclockwise tectonic rotation | magnetostratigraphy | Lu et al., 2014 |
| 59 | Xorkol basin | 24-16 | tectonic extrusion | detrital ZPb | Yue et al., 2003 |
| 60 | Eboliang | 22 | enhanced tectonic activity | detrital ZPb | Cheng F et al., 2016 |
| 61 | Subei-Dangjin Pass | 20 | rapid exhumation | *in situ* AHe and ZHe | Shi et al., 2018 |
| **Hei Shan-kuantan Shan-Bei Shan** |
| 62 | Yumen basin | ~24-16 | tectonic uplift | detrital ZPb | Wang W et al., 2016b |
| **Qaidam basin** |
| 5 | Hero hill | 22-8.1 | surface uplift to 1469+153/-234 m | δ18Oc of mammalian fossils and carbonates | Li L et al., 2017 |
| 9 | Qaidam Beishan | 20.6-12.5 | fast exhumation  | *in situ* AFT, K-feldsapr 40Ar/39Ar | Zhuang et al., 2018 |
| 63 | Arlar | 22 | strike-slip faulting  | 3D seismic cross section | Cheng X et al., 2015 |
| 64 | Dahonggou | 20 | tectonic activity | magnetostratigraphy and detrital ZPb | Nie et al., 2019 |
| 18.5 | source change  |
| 65 | Dahonggou | ~25.5 | deformation  | magnetostratigraphy, detrital ZPb | Wang W. et al., 2017 |
|  | Lulehe | 24-21 | fast exhumation | detrital AFT | **this study** |
| **East Kunlun Shan** |
| 50 | Kunlun fault center | 20-15 | faulting | *in situ* AHe, ZHe | Duvall et al., 2013 |
| 66 | western domain  | 25-20 | N-S crust shorting and thickening | restoration of balanced cross-section | Wu C et al., 2020 |
| B1 | Xidatan | 23-20 | fast exhumation related to strike-slip faulting | *in situ* AFT, ZHe, AHe | Staisch et al., 2020 |
| 67 | Qimen Tagh  | Neogene | left-lateral strike-slip faulting | seismic profiles and growth strata of basin succession | Cheng F et al., 2014 |
| B9 | Nuomuhong | ~25 | faulting-induced fast exhumation | *in situ* AHe | Li et al., 2020 |
| 68 | Central Kumkol basin | 22-15 | strike-slip faulting | magnetostratigraphy | Lu et al., 2016 |
| 69 | Qimen Tagh | 20 | fast exhumation | *in situ* AFT | Wu C et al., 2019 |
| Huashixia-Dulan  |
| 70 | Dongdatan | 26±3 | thrust faulting | *in situ* chlorite 40Ar/39Ar and AFT | Wu Z et al., 2009 |
| 71 | Dulan-Ela Shan | 22-21 | tectonic uplift | *in situ* AFT, magnetostratigraphy  | Lu et al., 2012 |
| 72 | Buqingshan-Xiangride | 20-10 | fast exhumation | *in situ* AFT  | Yuan et al., 2006 |
| **North Qilian Shan**  |
| 41 | Muli basin | 22.7-18.2 | surface uplift to ~2848 m | δ18Oc and δ13Cc of lacustrine sediments | Qi et al., 2015 |
| 73 | North rim of Jiuxi basin  | 20-10 | fast exhumation | *in situ* AFT and vitrinite-reflectance | George et al., 2001 |
| 74 | Wuwei Southwest  | 24 | fast exhumation | *in situ* AFT | Pan et al., 2013 |
| **Central Qilian Shan (Including Laji Shan-Jishi Shan)** |
| 75 | Laji Shan | ~22 | fast exhumation  | *in situ* AHe, AFT | Lease et al., 2011 |
| B3 | Xining basin | 23-19 | tectonic transition | magnetostratigraphy and detrital ZPb | He et al., 2021 |
| **West Qinling Shan** |
| 24 | Wudu basin | 23-19 | fast exhumation | detrital AFT | He et al., 2017 |
| 76 | Gonghe basin | 20 | basin formation | magnetostratigraphy and cosmogenic burial age | Craddock et al., 2011 |
| *B10* | *Lixian* | *23-22* | *volcano* | *Perovskite U-Pb* | *Liu et al., 2018* |
| **Haiyuan-Liupan Shan** |
| 77 | Nanhua Shan | 20-10 | fast exhumation | *in situ* AFT | Lin et al., 2011 |
| B11 | Tongxin basin | >21.7 | basin formation | magnetostratigraphy and cosmogenic burial age | Liang et al., 2021 |
| **Jiuquan basin** |
|  | Jiuquan basin | 24-21 | fast exhumation | detrital AFT | **this study** |
| **16-13 Ma** |
| **Altyn Tagh Shan** |
| 2 | Lapeiquan-Huatugou | 16.9-15.3 | initial strain localization | seismic reflection data, structural and stratigraphic analyses | Wu L et al., 2019 |
| 28 | Caishiling | 15 | faulting displacement | detrital ZPb | Cheng F et al., 2015 |
| B8 | Heishiqiu | 17-10 | counterclockwise rotation | magnetostratigraphy | Li et al., 2021a |
| B12 | Eboliang | 15-7 | tectonic rotation | magnetostratigraphy | Li et al., 2021b |
| 58 | Janggalsay | 17-15 | counterclockwise tectonic rotation | magnetostratigraphy | Lu et al., 2014 |
| 78 | Jianglisai | 17-14 | faulting | *in situ* AFT | Li M et al., 2015 |
| 79 | Akatengneng Shan  | 16.2-11.1 | counterclockwise rotations | magnetostratigraphy | Li et al., 2017 |
| 80 | Mangai-Youshashan  | ~14.5 | strike-slip faulting  | structure and sedimentary analysis  | Wang L et al., 2010 |
| **Qaidam basin** |
| 33 | Kunbei fault-Yueya Shan | 14.9-0 | tectonic deformation | 2D seismic cross-section | Wang Y et al., 2012 |
| 65 | Dahonggou | ~12 | provenance change | magnetostratigraphy, detrital ZPb | Wang W. et al., 2017 |
| 81 | Honggouzi | ~16 | tectonic uplift | sedimentological analysis, seismic reflection profiles | Zhang T et al., 2018 |
| 82 | Huatugou | 15-12 | surface uplift  | δ18O, δ13C of basin sediments | Li L et al., 2016 |
| 83 | Huatugou | 15 | tectonic deformation | magnetostratigraphy | Chang et al., 2015 |
| 84 | Huatugou-Lenghu | ~15 | tectonic uplift | carbonate and chloride contents | Guo et al., 2018 |
| 85 | Xichagou section | 15 | tectonic reorganization | gravel counts, paleocurrent directions | Wu L et al., 2012 |
| 86 | Dahonggou | 12 | tectonic activity | magnetostratigraphy | Lu and Xiong, 2009 |
| 87 | Huaitoutala | 14.7 | tectonic uplift | magnetostratigraphy | Fang et al., 2007 |
| 88 | Huaitoutala | 15-10 | surface uplift to 3300–4000 m | leaf wax hydrogen isotopes | Zhuang et al., 2014 |
| 89 | ~12.4 | surface uplift to >700–1100 m | detrital ZPb, soil tetraethers  | Zhuang et al., 2019 |
|  | Lulehe | 16-15 | fast exhumation | detrital AFT | **this study** |
| **East Kunlun Shan** |
| 13 | Dongdatan-Xidatan-Golmud | 16.3-10 | fast exhumation | *in situ* AFT | Chen et al., 2011 |
| 50 | Kunlun fault west | 12-8 | faulting | *in situ* AHe, ZHe | Duvall et al., 2013 |
| Dulan Chaka Highland | 17-12 | fast exhumation | *in situ* AHe, ZHe |
| 68 | Central Kumkol basin | ~15 | counterclockwise tectonic rotation | magnetostratigraphy | Lu et al., 2016 |
| 90 | Jingyu basin | 15 | left-lateral transtension, tectonic extension | *in situ* AFT, K-feldspar 40Ar/39Ar | Jolivet et al., 2003 |
| 91 | Naitou Shan | 14-10 | fast exhumation | *in situ* AFT | Wang Y et al., 2018 |
| **Jiuquan basin** |
| 92 | Jiuxi basin | ~17 | basin provenance change | detrital ZPb | An et al., 2018 |
| 93 | Caogou | 13.5 | deformation from clockwise to counterclockwise rotation | magnetostratigraphy and AFT of sediments | Wang W et al., 2016a |
|  | Jiuquan basin | 16-15 | fast exhumation | detrital AFT | **this study** |
| **North Qilian Shan**  |
| 41 | Muli basin | 18.2-13.2 | surface uplift to ~3586 m | δ18Oc and δ13Cc of lacustrine sediments | Qi et al., 2015 |
| 94 | Yumen basin | ~16  | tectonic uplift | detrital ZPb | Wang W et al., 2016b |
| 100 | Tuolai Shan (west part) | 17-14 | fast exhumation  | *in situ* AFT | Zheng D et al., 2017 |
| 101 | Qilian country | 17-15 | fast exhumation  | *in situ* AFT | Yu et al., 2019b |
| 95 | Huangcheng-Shuangta  | 15 | thrust faulting  | *in situ* AHe | Wang W et al., 2020 |
| **Central Qilian Shan (Including Laji Shan-Jishi Shan)** |
| 75 | Jishi Shan | ~13 | fast exhumation  | *in situ* AHe, AFT | Lease et al., 2011 |
| 96 | Subei basin | 14 | tectonic uplift  | detrital AFT  | Lin X et al., 2015 |
| 97 | Subei basin | 13.7 | tectonic uplift  | magnetostratigraphy | Sun J et al., 2005 |
| 98 | West Danghenan Shan  | 15 | fast exhumation  | *in situ* AHe and AFT | Yu et al., 2019a |
| 99 | Danghenan Shan | 12-9 | tectonic uplift  | biostratigraphy and magnetostratigraphy  | Wang et al., 2003 |
| 102 | Northeast Menyuan  | 15-10 | fast exhumation | *in situ* AFT, ZFT | Li B et al., 2019 |
| 103 | Xining basin | 17 | tectonic clockwise rotation  | magnetostratigraphy | Dupont-Nivet et al., 2008b |
| 104 | Xunhua Basin | 12-9 | provenance change | magnetostratigraphy, detrital ZPb | Lease et al., 2012 |
| 105 | Xunhua-Linxia basins | 16-11 | surface uplift | magnetostratigraphy and stable isotope records of sediments | Hough et al., 2011 |
| 106 | Linxia basin | 14.7-13.1 | provenance change | detrital ZPb | Saylor et al., 2018 |
| **West Qinling Shan** |
| 21 | Guide basin | 16-13 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2016 |
| 22 | Ganjia-Dalijia Shan | 18 | fast exhumation | *in situ* AHe | Clark et al., 2010 |
| 25 | Tianshui basin | 14-13 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2011 |
| 107 | Guide basin | 17-11 | tectonic clockwise rotation  | magnetostratigraphy | Yan et al., 2006 |
| 108 | Zeku | Ne | surface uplift to 1200–1400 m | fossil pollen | Hui et al., 2018 |
| *B13* | *Lixian* | *16-14* | *Volcano* | *K/Ar* | *Yu et al., 2011* |
| 109 | Tianshui basin | ~14 | tectonic uplift | detrital AFT and magnetostratigraphy | Wang X et al., 2012 |
| **Haiyuan-Liupan Shan** |
| B11 | Tongxin basin | 16.5 | thrust faulting | magnetostratigraphy | Liang et al., 2021 |
| **11-3 Ma** |
| **Altyn Tagh Shan** |
| 31 | Central Altyn Tagh | 7 | fast exhumation | *in situ* AFT and ZFT | Jolivet et al., 2001 |
| 32 | Dangjin pass | 10-8 | faulting reactive | *in situ* 40Ar/39Ar | Liu et al., 2007 |
| 78 | Jianglisai | 8-5 | faulting | *in situ* AFT | Li M et al., 2015 |
| 110 | Altun Shan | ~10 | fast exhumation | *in situ* AFT | Jolivet et al., 1999 |
| **Qaidam basin** |
| 5 | Hero hill | 8.1-2.5 | surface uplift to 2084+247/-354 m | δ18Oc of mammalian fossils and carbonates | Li L et al., 2017 |
| <2.5 | surface uplift to 2476+321/-445 m |
| 34 | Large region of the basin | 2.8 | crustal shorting and uplift | balanced cross-section restoration | Zhou et al., 2006 |
| 44 | Large region of the basin | 5.3 | tectonic extension | volume balance and accumulation rates of sediments | Métivier et al., 1998 |
| 81 | Honggouzi | ~10 | tectonic uplift | sedimentological analysis, seismic reflection profiles | Zhang T et al., 2018 |
| 87 | Huaitoutala | 8.1 | tectonic uplift | magnetostratigraphy | Fang et al., 2007 |
| 3.6 |
| 111 | Northwest edge | 7 | fast exhumation | *in situ* AFT and ZFT | Jolivet et al., 2001 |
| **East Kunlun Shan** |
| 13 | Dongdatan-Xidatan-Golmud | 5.1 | fast exhumation | *in situ* AFT | Chen et al., 2011 |
| 50 | Kunlun fault East | 8-5 | faulting | *in situ* AHe, ZHe, AFT | Duvall et al., 2013 |
| 71 | Dulan-Ela Shan | 12-4.5 | tectonic uplift | *in situ* AFT, magnetostratigraphy  | Lu et al., 2012 |
| 90 | *Jingyu basin rim* | *10-8* | *volcano* | *in situ AFT, K-feldspar 40Ar/39Ar* | *Jolivet et al., 2003* |
| 112 | Kumkol basin | 7.5 | thrust faulting | paleomagnetism of growth strata | Lu et al., 2018 |
| **North Qilian Shan**  |
| 54 | Tuolai Shan | ~10 | fault reactivation  | *in situ* AFT | Li B et al., 2020 |
| 95 | Lenglong Ling | 5 | left-lateral faulting  | *in situ* AHe | Wang W et al., 2020 |
| 113 | Sunan basin | ~10 | fast exhumation  | *in situ* AHe | Zhuang et al., 2018 |
| B14 | Wuwei basin | 8.25 | surface uplift | magnetostratigraphy | Zhao et al., 2022 |
| 114 | Northwest edge  | 10-8 | faulting thrust-induced fast exhumation  | *in situ* AFT | Zheng et al., 2017 |
| 115 | Jinfo Temple | ~10 | faulting | *in situ* AHe | Zheng et al., 2010 |
| 31 | North-central part | 7 | fast exhumation | In situ AFT and ZFT | Jolivet et al., 2001 |
| 116 | Yumu Shan | 9.8-9.6 | surface uplift | magnetostratigraphy | Fang et al., 2012 |
| **South Qilian Shan**  |
| 117 | Delingha | ~18-11  | fast exhumation  | *in situ* AFT | Pang et al., 2019 |
| B7 | Hongshan | ~10 | surface uplift | magnetostratigraphy, detrital ZPb | Wang W. et al., 2022 |
| 118 | Chaka basin | 11 | basin initiation and deformation | magnetostratigraphy | Zhang H et al., 2011 |
| 9 |
| 6.1 |
| **Central Qilian Shan (Including Laji Shan-Jishi Shan)** |
| 119 | Danghenan Shan  | 9-7 | fast exhumation  | *in situ* AHe | Zhuang et al., 2018 |
| **Qilian Shan** |
| 120 | Large region | 10-5 | deformation | tectonic geomorphology  | Meyer et al., 1998 |
| **West Qinling Shan** |
| 25 | Ganquan of Tianshui basin | 8 | fast exhumation | *in situ* and detrital AFT | Wang X et al., 2011 |
| 26 | Tianshui-Wudu | 9-4 | fast exhumation | *in situ* AFT | Enkelmann et al., 2006 |
| 57 | Linxia basin | ~8 | tectonic clockwise rotation | magnetostratigraphy | Fang et al., 2016 |
| 109 | Tianshui basin | 9.2-7.4 | tectonic uplift | detrital AFT and magnetostratigraphy | Wang X et al., 2012 |
| 3.6-2.6 |
| 121 | Xining basin | 10.5-8 | surface uplift of 1000 m | sedimentary biomarkers  | Chen et al., 2019 |
| 122 | 8-7 | tectonic uplift | magnetostratigraphy | Fang et al., 2019 |
| 123 | Gonghe basin | 10-6 | faults activity | structure analysis | Craddock et al., 2014 |
| **Haiyuan-Liupan Shan** |
| 124 | Ningxia basin | 10-6 | basin inversion | detrital ZPb, seismic-reflection sections | Wang W et al., 2013 |
| 125 | Madong Shan  | 8.2-7.3 | fast exhumation | *in situ* AFT | Zheng D et al., 2006 |
| **Jiuquan basin** |
| B5 | Yumu Shan | 10±4 | fast exhumation | detrital ZPb and AFT | Chen et al., 2022 |
| *Notes.* ZPb = zircon U-Pb, ZFT (AFT) = zircon (apatite) fission-track, ZHe (AHe) = zircon (apatite) (U-Th)/He, Ne = Early–Middle Miocene. Volcanic eruptions are shown in italics. B-series of Map ID means that the data are recently added. The threshold value for fast generally ≥ 0.5 km/Myr. To facilitate comparison of the AFT data, bedrock AFT studies are shown in red font, while detrital AFT studies are shown in blue font. Locations of all the datasets are shown in Fig. 6b. |

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