**Table S1. Summary of previously published Paleozoic and Proterozoic ages in Tibetan Plateau and Himalaya and Paleo-Tethys Triassic and Meso-Tethys Jurassic high-grade metamorphic rocks.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Proterozoic** | | | | | | | |
|  | **Location** | **Rock type** | **Methods** | **Age type** |  | **Display** | **References** |
| **HIMALAYA** | | | | | | | |
|  | Cona | Orthogneiss | core of zircon U–Pb or upper intercept | Protolith |  | 817–838 Ma | Ding and Zhang, (2018) |
|  |  | Orthogneiss | *rim of zircon U–Pb* | *Metamoprhic* |  | *31 Ma* |  |
|  | Bhutan | Meta-rhyolite | zircon and monazite U–Pb | Protolith |  | 1785 ± 34 Ma | Richards et al. (2006) |
|  |  | Orthogneiss | zircon and monazite U–Pb | Protolith |  | 830 ± 10 Ma |  |
|  |  | *Orthogneiss* | *rim of zircon U–Pb or lower intercept and monazite* | *Metamoprhic* |  | *14–20 Ma* |  |
|  | Hapoli | *Orthogneiss* | core of zircon U–Pb or upper intercept | Protolith |  | 1745–1760 Ma | Yin et al. (2010) |
|  |  | *Orthogneiss* | core of zircon U–Pb | Protolith |  | 825–878 Ma |  |
|  |  | *Orthogneiss* | *core of zircon U–Pb* | *Protolith* |  | *480–520 Ma* |  |
|  |  | *Orthogneiss* | *rim of zircon U–Pb or lower intercept* | *Metamoprhic* |  | *28–20 Ma* |  |
|  | **Location** | **Rock type** | **Methods** | **Age type** |  | **Display** | **References** |
| **LHASA (West to east)** | | | | | | | |
|  | Cuoguo Tso | Granite pegmatite | zircon U–Pb | Protolith |  | 1150 ± 13 Ma | Wu et al. (2016) |
|  | Cuoguo Tso | Pl gneiss | zircon U–Pb | Protolith |  | 701 ± 15 Ma |  |
|  | Yongzhu | Grt-Amp-bearing Pl gneiss | zircon U–Pb | Protolith |  | 730.8 ± 6.9 Ma | Zhang et al. (2013) |
|  | Yongzhu | Grt-bearing Pl amphibolite | zircon U–Pb | Protolith |  | 742. 1 ± 8. 3 Ma |  |
|  | Yongzhu | Grt-bearing Pl-Amp gneisses | zircon U–Pb | Protolith |  | 758.3 ± 6.1 Ma, |  |
|  | Yongzhu | Grt-bearing amphibolite | zircon U–Pb | Metamorphic |  | 665. 7 ± 6.5 Ma |  |
|  | Yongzhu | Felsic vein | zircon U–Pb | Protolith |  | 660. 1 ± 4.2 Ma |  |
|  | Guomang Tso | Granite dykes | zircon U–Pb | Protolith |  | 797± 10 Ma | Zhou et al.(2019) |
|  | Guomang Tso | Clastic rocks | zircon U–Pb | Deposition age |  | 800 Ma |  |
|  | Duoba area | Grt-bearing Pl gneiss | zircon U–Pb | Metamorphic |  | 847 ± 5.7 M | Li et al. (2015) |
|  | Ren Tso | Amphibolite | zircon U–Pb | Protolith |  | 822 ± 4 Ma | Hu et al. (2018b) |
|  | Ren Tso | Granitic gneiss | zircon U–Pb | Protolith |  | 806 ± 3 Ma |  |
|  | Ren Tso | Granitic gneiss | zircon U–Pb | Protolith |  | 810 ± 5 Ma |  |
|  | Ren Tso | Meta-gabbro | zircon U–Pb | Protolith |  | 931–925 Ma | Hu et al. (2016) |
|  | Ren Tso | Gabbro | zircon U–Pb | Protolith |  | 923 ± 3 Ma | Zeng et al. (2018) |
|  | Ren Tso | Gabbro | zircon U–Pb | Protolith |  | 572 ± 4 Ma | Hu et al. (2018a) |
|  | Ren Tso | Tonalite | zircon U–Pb | Protolith |  | 568 ± 4 Ma |  |
|  | Ren Tso | Rhyolite | zircon U–Pb | Protolith |  | 547–541 Ma |  |
|  | Ren Tso | Mafic granulite | zircon U–Pb | Protolith |  | 886–897 Ma | Zhang et al. (2012a) |
|  |  | Mafic granulites and pelitic schist | zircon U–Pb | Metamorphic |  | 653 ± 4.3 Ma |  |
|  |  | Mafic granulite | rim of zircon U–Pb | Retrograde metamorphism |  | 483 ± 9.2 Ma |  |
|  | Ren Tso | Gabbro | zircon U–Pb | Protolith |  | 758–766 Ma | Hu et al. (2018c) |
|  | Ren Tso | Quartzite | zircon U–Pb | Deposition age |  | 931–869 Ma | Hu et al. (2018d) |
|  | Ren Tso | Amphibolite | zircon U–Pb | Protolith |  | 913–902 Ma |  |
|  | Ren Tso SE | Gabbro | zircon U–Pb | Protolith |  | 652 ±6 Ma | Hu et al. (2019) |
|  | Ren Tso SE | Diorite | zircon U–Pb | Protolith |  | 646 ± 5 Ma, 658 ± 9 Ma |  |
|  | Ren Tso SE | Tonalite | zircon U–Pb | Protolith |  | 652 ± 4 Ma |  |
|  | Naguo | Marble | zircon U–Pb | Metamorphic |  | 718 ± 14 Ma | Zhang et al. (2010) |
|  | West Nam Tso | Marble | zircon U–Pb | Metamorphic |  | 676 ± 25 Ma | Dong et al. (2011b) |
|  |  | Schist | zircon U–Pb | Metamorphic |  | ca. 690 Ma |  |
|  |  | Amphibolite | core of zircon U–Pb | Protolith |  | 856 ± 16 Ma |  |
|  |  | Amphibolite | rim of zircon U–Pb | Metamorphic |  | 683–661 Ma |  |
|  | West Nam Tso | Trondhjemite vein | zircon U–Pb | Protolith |  | 787 ± 9 Ma | Hu et al. (2005) |
|  | West Nam Tso | Granite vein | zircon U–Pb | Protolith |  | 748 ± 8 Ma |  |
|  | West Nam Tso | Meta-gabbro | zircon U–Pb | Protolith |  | 782 ± 11 Ma |  |
|  | Songduo | Meta-mafic rock | zircon U–Pb upper intercept | Protolith |  | 2450 ± 10 Ma | He et al. (2013b) |
|  | Nyingchi Complex | two-mica-two-feldspar gneiss | core of zircon U–Pb | Protolith |  | 1782–1784 Ma | Lin et al. (2013) |
|  | Nyingchi Complex | two-mica-two-feldspar gneiss | mantle of zircon U–Pb | Metamorphic |  | 1117 ± 29 Ma |  |
|  | Nyingchi Complex | two-mica-two-feldspar gneiss | mantle of zircon U–Pb | Metamorphic |  | 618–604 Ma |  |
|  | *Nyingchi Complex* | *Biotite two-feldspar gneiss* | *rim of zircon U–Pb* | *Metamorphic* |  | *23.2 ± 0.3 Ma* |  |
|  | Nyingchi Complex | Granite gneiss | zircon U–Pb | Protolith |  | 1343–1276 Ma | Xu et al. (2013) |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Proterozoic** | | | | | | | |
|  | **Location** | **Rock tyoe** | **Methods** | **Age type** |  | **Display** | **References** |
| **ANDUO** | | | | | | | |
|  | Nyainrong | Ortho-plagioclase amphibolite | zircon U–Pb | Protolith |  | 863 ± 10 Ma | Gu et al. (2012) |
|  | Nyainrong | Granitic gneiss | zircon U–Pb | Protolith |  | 819 ±5 Ma | Wang et al. (2012a) |
|  |  |  | *rim of zircon U–Pb* | *Metamoprhic* |  | *508–506* |  |
|  | Nyainrong | Orthogneiss | zircon U–Pb upper intercept | Protolith |  | 852 ± 18 Ma | Guynn et al. (2006) |
|  |  |  | *lower intercept and monazite* | *Metmorphic* |  | *167± 68 Ma* |  |
|  | **Location** | **Rock type** | **Methods** | **Age type** |  | **Display** | **References** |
| **SOUTH QIANGTANG** | | | | | | | |
|  | Gamgmari | Clastic rock | zircon U–Pb | Deposition age |  | ca. 550 Ma | Wang et al. (2016) |
|  | **Location** | **Rock type** | **Methods** | **Age type** |  | **Display** | **References** |
| **NORTH QIANGTANG** | | | | | | | |
|  | Chaya | Chl-schist | zircon U–Pb upper intercept | Protolith |  | 965 ± 55 Ma | He et al. (2012) |
|  |  | Green-schist | zircon U–Pb | Protolith |  | 1048 ± 3 Ma |  |
|  | Yushu | Gneissic granite | zircon U–Pb | Protolith |  | 991 ± 4 Ma | He et al. (2013a) |
|  |  | Bi-Pl gneiss | zircon U–Pb | Deposition age |  | ca. 1044± 30 Ma |  |
| **Paleozoic** | | | | | | | |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **Himalayas from the west to east:** | | | | | | | |
|  | Kali Gandaki | Granitic gneiss | zircon U–Pb | Protolith | 484 ± 9 | 484 Ma | Godin et al. (2001) |
|  | Dadeldhura | Granite | zircon U–Pb | Protolith | 474 ± 10, 484 ± 10, 512 ± 11 | 512–474 Ma | Gehrels et al. (2006a) |
|  | Gyirong | Granitic gneiss | zircon U–Pb | Protolith | 499 ± 4 | 499 Ma | Wang et al. (2011) |
|  | Gyirong | Granitic gneiss | zircon U–Pb | Protolith | 485 ± 1, 486 ± 2, 475 ± 1, 474 ± 2 | 486–474 Ma | Wang et al. (2012b) |
|  | Kangmar |  | zircon U–Pb | Protolith | 488 ± 1, 496 ± 1 | 496–488 Ma |  |
|  | Yalashangbo |  | zircon U–Pb | Protolith | 499 ± 1, 495 ± 1 | 499–495 Ma |  |
|  | Gyirong | Gneiss | zircon U–Pb | Metamorphic | 514 ± 9 | 514 Ma | Xu et al. (2005) |
|  | Yadong | Gneiss | zircon U–Pb | Metamorphic | 512 ± 10 | 512 Ma |  |
|  | *Kangmar* | *Gneiss* | zircon U–Pb | *Protolith* | *849 ± 27* | *849 Ma* |  |
|  |  |  | zircon U–Pb | Metamorphic | 515 ± 9 | 515 Ma |  |
|  | Kathmandu | Porphyritic granite | zircon and monazite U–Pb lower intercept age | Protolith | 470 | 471–470 Ma | Schärer and Allègre, (1983) |
|  | Kathmandu | Granitic gneiss | zircon U–Pb | Protolith | 471 | Johnson et al. (2001) |
|  | Kathmandu | Granite, granitic dike | zircon U–Pb | Protolith | 473 ± 11, 476 ± 10, 480 ± 11, 484 ± 11 | 484–473 Ma | Gehrels et al. (2006b) |
|  | Kathmandu | Granitic dike | zircon U–Pb | Protolith | 473 ± 6, 476 ± 3, 484 ± 5 | Gehrels et al. (2003) |
|  | Kharta area | Mafic rock | zircon U–Pb | Protolith | 457 ± 6 | 457 Ma | Visonà et al. (2010) |
|  | Mabja | Granitic gneiss | zircon U–Pb | Protolith | 530 ± 9 | 530 Ma | Lee and Whitehouse, (2007) |
|  | Yadong | Granitic gneiss | zircon U–Pb | Protolith | 499 ± 4 | 499 Ma | Shi et al. (2010) |
|  | Kangmar | Granitic gneiss | zircon U–Pb upper intercept | Protolith | 509 ± 6, 509 ± 18 | 509 Ma | Lee et al. (2000) |
|  | Kampa | Granitic gneiss | zircon U–Pb | Protolith | 506 ± 3, 527 ± 6, | 527–506 Ma | Quigley et al. (2008) |
|  | Namche Barwa | Granitic gneiss | zircon U–Pb | Protolith | 499 ± 3, 490 ± 6 | 499–490 Ma | Zhang et al. (2008a) |
|  | Namche Barwa | Granitic gneiss | zircon U–Pb | Metamorphic | 505 ± 6 | 505 Ma |  |
|  | Namche Barwa | Granite vein | zircon core U–Pb | Protolith | 524 ± 6 | 524 Ma | Qi et al. (2010) |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Paleozoic** | | | | | | | |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **LHASA** | | | | | | | |
|  | Bangle | Metabasalt/Metarhyolite | zircon U–Pb | Protolith | 492 ± 4 | 536–492 Ma | Zhu et al. (2012) |
|  | Banglei | Metarhyolite | zircon U–Pb | Protolith | 536 ± 4 | Pan et al. (2012) |
|  | Zhakang | Rhyolite | zircon U–Pb | Protolith | 501 ± 2 | 525–501 Ma | Ji et al. (2009) |
|  | Zhakang | Metarhyolite | zircon U–Pb | Protolith | 510 ± 4, 525 ± 3, 511 ± 4 | Hu et al. (2013) |
|  | Zhakang | Metarhyolite | zircon U–Pb | Protolith | 496 ± 12, 504 ± 15, 505± 8, 511 ± 13, 519 ± 7, 522 ± 9 | 522–496 Ma | Ding et al. (2015) |
|  | Xainza | Granite | zircon U–Pb | Protolith | 510 ± 7 | 510 Ma | Gehrels et al. (2011) |
|  | Miling | Gneiss | zircon U–Pb | Protolith | 496 ± 7 | 496 Ma | Dong et al. (2009) |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **BASU** | | | | | | | |
|  | Basu | Granite | zircon U–Pb | Protolith | 507 ± 10 | 507–492 Ma | Li et al. (2008b) |
|  | Basu | Gneiss | zircon U–Pb | Protolith | 500 ± 10 | Li et al., (2017) |
|  |  | *Gneiss* | *zircon U–Pb* | *Metamorphic* | *173± 10* |  |
|  |  | Meta-igneous | zircon U–Pb | Protolith | 492 ± 2 |  |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **ANDUO** | | | | | | | |
|  | Anduo | Meta-mafic and Meta-felsic rocks | zircon U–Pb | Protolith | 483 ± 6, 487 ± 6, 495 ± 5, 487 ± 12, 502 ± 5 | 502–483 Ma | Zhang et al. (2012b) |
|  | Anduo | Granitic gneiss | zircon U–Pb | Protolith | 488 ± 4 | 488 Ma | Xie et al. (2010) |
|  | *Anduo* | *Granitic gneiss* | *zircon U–Pb upper intercept* | *Protolith* | *910 ± 16, 878 ± 15, 838 ± 23* | *910–838 Ma* | *Guynn et al. (2012)* |
|  | Anduo | Granitic gneiss | zircon U–Pb | Protolith | 483 ± 13, 468 ± 53, 487 ± 16, 498 ± 11, 532 ± 7 | 532–483 Ma | Guynn et al. (2012) |
|  | Anduo | Granitic gneiss | zircon U–Pb | Protolith | 505 ± 3, 505 ± 5, 505 ± 4, 517 ± 4 | Xie et al. (2013) |
|  | Anduo | Granitic gneiss | zircon U–Pb upper intercept | Protolith | 531 ± 13 | Xu et al. (1985) |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **SOUTH QIANGTANG** | | | | | | | |
|  | Duguer Range | Granitic gneiss | zircon U–Pb | Protolith | 476 ± 5, 475 ± 5, 474 ± 5, 474 ± 5, 474 ± 4, 467 ± 8 | 476–467 Ma | Pullen et al. (2011) |
|  | Wugongshan | Granitic gneiss | zircon U–Pb | Protolith | 465 ± 5 | 465–432 Ma | Hu et al, (2010) |
|  | Guoganjianian | Cumulative gabbro | zircon U–Pb | Protolith | 461± 7, 432 ± 7 | Wang et al, (2008) |
|  | Gemuri, Bensong Co | Granite | zircon U–Pb | Protolith | 485 ± 3, 480 ± 3, 486 ± 4, 481 ± 3 | 486–480 Ma | Hu et al. (2015) |
|  | Gangma Co | Ophiolite suites (Gabbro, basalt, plagiogranite) | zircon U–Pb | Protolith | 487 ± 4, 486 ± 5, 501 ± 3, 437 ± 2, 441 ± 3 | 501–437 Ma | Zhai et al. (2016a) |
|  |  | Gabbro, basalt, andesite, granite gneiss | zircon U–Pb | Protolith | 490 ± 9, 483 ± 3, 473 ± 15, 477 ± 2, 475 ± 4, 453 ± 2 | 490–453 Ma | Liu et al. (2018) |
|  | *Xiangtaohu* | *Granulite* | *zircon U–Pb core* | *Protolith* | *ca. 481–500* |  | *Zhang et al. (2014)* |
|  |  |  |  | Metamorphic | 422 ± 7, 427 ± 4 | 427–422 Ma |  |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **SOUTHEAST TIBET** | | | | | | | |
|  | Fugong | Granite | zircon U–Pb | Protolith | 487 ± 11 | 487 Ma | Song et al. (2007) |
|  | Gongshan | Granitic gneiss | zircon U–Pb | Protolith | 474 ± 3, 462 ± 7 | 474–462 Ma | Liu et al. (2012) |
|  | Luxi | Granitic gneiss | zircon U–Pb | Protolith | 489 ± 11 | 489 Ma | Lin et al. (2012) |
|  | Pingda | Granite | zircon U–Pb | Protolith | 473 ± 6, 473 ± 5, 472 ± 5 | 492–460 Ma | Wang et al. (2013) |
|  | Ximeng | Granite | zircon U–Pb | Protolith | 463 ± 3, 460 ± 6, 462 ± 5 |
|  | Gaoligong | Granite | zircon U–Pb | Protolith | 492 ± 5, 488 ± 6, 484 ± 6, 485 ± 7, 491 ± 9 |
|  | Longjiang | Gneissic granite | zircon U–Pb | Protolith | 518 ± 4, 502 ± 3, 505 ± 3, 509 ± 4 | 518–502 Ma | Cai et al. (2013) |
|  | Pingda, Mengdui, Nansa, Songpo | Granite | zircon U–Pb | Protolith | 475 ± 9, 448 ± 6, 483 ± 7, 500 ± 10 | 502–448 Ma | Dong et al. (2013) |
|  | Mengnuo | Granite | zircon U–Pb | Protolith | 499 ± 5, 502 ± 5, 500 ± 4 | Liu et al. (2009) |
|  | Longlin | Meta-mafic rocks | zircon U–Pb | Protolith | 499 ± 2 | 499–480 Ma | Yang et al. (2012) |
|  | Pinghe | Granite | zircon U–Pb | Protolith | 486 ± 6, 486 ± 12, 480 ± 11, 480 ± 6 | Dong et al. (2012) |
|  |  | Cumulative gabbro | zircon U–Pb | Protolith | 461 |  | Wang et al. (2012c) |
|  | Mengku | Mafic schist | zircon U–Pb | Protolith | 451 ± 3, 451 ± 3 | 451 Ma | Wang et al. (2018) |
|  |  | *Eclogite* | *zircon U–Pb* | *Metamorphic* | *245 ± 4, 246 ± 2* | *245–246 Ma* |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Location** | **Rock type** | **Methods** | **Age type** | **Ages** | **Display** | **References** |
| **Triassic and Jurassic metamorphic rocks** | | | | | | | |
|  | Te1–Gangmacuo | Eclogite | zircon U–Pb | Metamorphic |  | 237–230 Ma | Zhai et al. (2011, 2016b) |
|  | Te2–Gemuri | Eclogite | zircon U–Pb | Metamorphic |  |  | Zhang et al. (2006) |
|  | Te3–Amugang | Eclogite | zircon U–Pb | Metamorphic |  |  | Zhang and Tang, (2009) |
|  | Te4–Baqing | Eclogite | zircon U–Pb | Metamorphic |  | 227–221 Ma | Zhang et al. (2018); Jin et al. (2019) |
|  | Te5–Songduo | Eclogite | zircon U–Pb | Metamorphic |  | 273–230 Ma | Cheng et al. (2015); Weller et al. (2016) |
|  | Te6–Mengku | Eclogite | zircon U–Pb | Metamorphic |  | 246–245 Ma | Wang et al. (2018) |
|  | Je1–Gaize | Eclogite | zircon U–Pb | Metamorphic |  | 194–170 Ma | Zhang et al. (2016) |
|  | Je2–Anduo | High pressure granulite | zircon U–Pb | Metamorphic |  | 190–170 Ma | Guynn et al. (2006, 2013); Lu et al. (2018) |
|  | Je3–Basu | Eclogite | zircon U–Pb | Metamorphic |  | 173 Ma | Zhang et al. (2008); Li et al. (2017) |

Notes: Italic ages represent those not plotting in Fig. 1.