# Sample and data processing

Each sample of 5-10 kg was crushed and sieved for zircon separation. Around 0.1-0.5 g zircon for each sample were obtained through magnetic and heavy liquid separation, and 250-300 grains were hand-picked and mounted on an epoxy, which was then polished until to cut all grains in half. Photomicrographs under polarized transmission and reflex light, and cathodoluminescence (CL) images under Scanning Electron Microscope (SEM) were taken for better observing their interior textures. All of these jobs elaborated above were conducted in Beijing Ion-probe Central and Microprobe Laboratory in the Chinese Academy of Geological Sciences, Beijing.

The standard operating conditions and data acquisition methods follow those described by Compston (1992), Williams (1998) and Whitehouse et al. (1999). Zircon U-Pb dating was performed at the Hefei University of Technology, under the LA-ICPMS system of Agilent-7500 spectrometer with a 213 nm Nd-YAG Merchantek laser unit. Spots were in diameter of ~30 um and each site was rostered 60s before analysis. The calibration of the U/Pb ratios were carried out using the geostandard 91500 reference zircon of 1065 Ma (Wiedenbeck et al., 1995). The glass NIST-610 (409 ppm Pb, 460 ppm U) was used as an external standard. Common-Pb corrections are based on the assumption that most contaminant Pb is kept on the surface of the grains or in the resin, and has a composition that can be approximated using the Stacey and Kramers (1975) model for the present day. Dating processing was conducted by using Isoplot programs (Ludwig, 2003) and ICPMSDataCal program (Liu et al., 2008; Liu et al., 2010), and the results quoted at 1σ level are presented in the table1-5.

# Supplementary table 1. LA-ICPMS U-Pb analytical results for zircon of samples from the Xiaotian-Mozitan shear zone

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Analysis | content(×10-6） | |  | Th/U | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |  | 207Pb/206Pb | | |  | 207Pb/235U | |  | 206Pb/238U | |
| U238 | Th232 |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Age | | ±1σ |  | Age | ±1σ |  | Age | ±1σ |
| *XMa1, mylonite, GPS:N31°10.89′；E116°37.62′* | | | | | | | | | | | | | | | | | | | | | | |
| XMa1-01 | 248 | 221 |  | 0.89 | 0.0598 | 0.0024 |  | 0.9972 | 0.0683 |  | 0.1210 | 0.0035 |  | 596 | | 107 |  | 702 | 35 |  | 736 | 20 |
| XMa1-02 | 216 | 218 |  | 1.01 | 0.0689 | 0.0026 |  | 1.2178 | 0.0458 |  | 0.1263 | 0.0033 |  | 896 | | 71 |  | 809 | 21 |  | 767 | 19 |
| XMa1-03 | 147 | 156 |  | 1.06 | 0.0666 | 0.0056 |  | 1.1588 | 0.0935 |  | 0.1250 | 0.0048 |  | 826 | | 171 |  | 781 | 44 |  | 760 | 27 |
| XMa1-04 | 564 | 428 |  | 0.76 | 0.0657 | 0.0021 |  | 1.1555 | 0.0403 |  | 0.1262 | 0.0032 |  | 798 | | 66 |  | 780 | 19 |  | 766 | 19 |
| XMa1-05 | 306 | 214 |  | 0.70 | 0.0701 | 0.0025 |  | 1.2226 | 0.0398 |  | 0.1262 | 0.0033 |  | 931 | | 77 |  | 811 | 18 |  | 766 | 19 |
| XMa1-06 | 198 | 208 |  | 1.05 | 0.0725 | 0.0021 |  | 1.2634 | 0.0470 |  | 0.1255 | 0.0033 |  | 1000 | | 66 |  | 829 | 21 |  | 762 | 19 |
| XMa1-08 | 447 | 509 |  | 1.14 | 0.0734 | 0.0047 |  | 1.2136 | 0.0676 |  | 0.1206 | 0.0031 |  | 1026 | | 125 |  | 807 | 31 |  | 734 | 18 |
| XMa1-11 | 315 | 327 |  | 1.04 | 0.0674 | 0.0021 |  | 1.1434 | 0.0452 |  | 0.1236 | 0.0033 |  | 849 | | 68 |  | 774 | 21 |  | 751 | 19 |
| XMa1-12 | 294 | 200 |  | 0.68 | 0.0710 | 0.0037 |  | 1.1902 | 0.0626 |  | 0.1220 | 0.0022 |  | 967 | | 102 |  | 796 | 29 |  | 742 | 13 |
| XMa1-14 | 258 | 286 |  | 1.11 | 0.0700 | 0.0023 |  | 1.2101 | 0.0439 |  | 0.1251 | 0.0034 |  | 929 | | 70 |  | 805 | 20 |  | 760 | 19 |
| XMa1-15 | 372 | 261 |  | 0.70 | 0.0690 | 0.0023 |  | 1.2007 | 0.0424 |  | 0.1258 | 0.0037 |  | 897 | | 70 |  | 801 | 20 |  | 764 | 21 |
| XMa1-17 | 248 | 235 |  | 0.94 | 0.0671 | 0.0026 |  | 1.1474 | 0.0413 |  | 0.1233 | 0.0017 |  | 842 | | 80 |  | 776 | 20 |  | 749 | 10 |
| XMa1-18 | 203 | 117 |  | 0.58 | 0.0554 | 0.0049 |  | 0.9408 | 0.0874 |  | 0.1226 | 0.0041 |  | 428 | | 197 |  | 673 | 46 |  | 745 | 23 |
| XMa1-20 | 242 | 363 |  | 1.50 | 0.0646 | 0.0027 |  | 1.0864 | 0.0460 |  | 0.1211 | 0.0019 |  | 761 | | 58 |  | 747 | 22 |  | 737 | 11 |
| XMa1-21 | 319 | 113 |  | 0.35 | 0.0658 | 0.0034 |  | 1.1037 | 0.0383 |  | 0.1200 | 0.0036 |  | 1201 | | 110 |  | 755 | 18 |  | 731 | 21 |
| XMa1-22 | 154 | 168 |  | 1.09 | 0.0664 | 0.0021 |  | 1.1706 | 0.0458 |  | 0.1261 | 0.0033 |  | 818 | | 68 |  | 787 | 21 |  | 766 | 19 |
| XMa1-23 | 225 | 187 |  | 0.83 | 0.0667 | 0.0020 |  | 1.1590 | 0.0410 |  | 0.1241 | 0.0032 |  | 827 | | 69 |  | 781 | 19 |  | 754 | 18 |
| XMa1-24 | 312 | 256 |  | 0.82 | 0.0636 | 0.0025 |  | 1.1029 | 0.0467 |  | 0.1237 | 0.0017 |  | 728 | | 86 |  | 755 | 23 |  | 752 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |
| *XMa2, granitic dyke cutting through the mylonite, GPS:N31°10.89′；E116°37.62′* | | | | | | | | | | | | | | | | | | | | | | |
| XMa2-01 | 373 | 212 |  | 0.57 | 0.0486 | 0.0036 |  | 0.1335 | 0.0080 |  | 0.0199 | 0.0005 |  | 129 | | 145 |  | 127 | 7 |  | 127 | 3 |
| XMa2-02 | 204 | 142 |  | 0.70 | 0.0500 | 0.0029 |  | 0.1397 | 0.0076 |  | 0.0200 | 0.0005 |  | 197 | | 131 |  | 133 | 7 |  | 128 | 3 |
| XMa2-03 | 597 | 583 |  | 0.98 | 0.0490 | 0.0022 |  | 0.1406 | 0.0090 |  | 0.0206 | 0.0006 |  | 149 | | 104 |  | 134 | 8 |  | 132 | 4 |
| XMa2-04 | 239 | 262 |  | 1.09 | 0.0481 | 0.0026 |  | 0.1349 | 0.0072 |  | 0.0202 | 0.0006 |  | 106 | | 121 |  | 128 | 6 |  | 129 | 4 |
| XMa2-06 | 488 | 257 |  | 0.53 | 0.0500 | 0.0024 |  | 0.1414 | 0.0078 |  | 0.0205 | 0.0006 |  | 195 | | 111 |  | 134 | 7 |  | 131 | 4 |
| XMa2-07 | 277 | 144 |  | 0.52 | 0.0521 | 0.0026 |  | 0.1485 | 0.0092 |  | 0.0207 | 0.0006 |  | 290 | | 113 |  | 141 | 8 |  | 132 | 4 |
| XMa2-08 | 510 | 313 |  | 0.61 | 0.0481 | 0.0033 |  | 0.1377 | 0.0086 |  | 0.0205 | 0.0006 |  | 103 | | 157 |  | 131 | 8 |  | 131 | 4 |
| XMa2-09 | 632 | 359 |  | 0.57 | 0.0522 | 0.0024 |  | 0.1441 | 0.0085 |  | 0.0199 | 0.0005 |  | 296 | | 103 |  | 137 | 7 |  | 127 | 3 |
| XMa2-10 | 464 | 361 |  | 0.78 | 0.0475 | 0.0024 |  | 0.1354 | 0.0095 |  | 0.0205 | 0.0006 |  | 77 | | 96 |  | 129 | 8 |  | 131 | 4 |
| XMa2-12 | 180 | 75 |  | 0.42 | 0.0487 | 0.0022 |  | 0.1364 | 0.0087 |  | 0.0201 | 0.0005 |  | 135 | | 113 |  | 130 | 8 |  | 128 | 3 |
| XMa2-13 | 583 | 260 |  | 0.45 | 0.0495 | 0.0021 |  | 0.1428 | 0.0069 |  | 0.0207 | 0.0006 |  | 171 | | 95 |  | 136 | 6 |  | 132 | 4 |
| XMa2-14 | 494 | 421 |  | 0.85 | 0.0514 | 0.0030 |  | 0.1462 | 0.0072 |  | 0.0206 | 0.0006 |  | 258 | | 143 |  | 139 | 6 |  | 131 | 4 |
| XMa2-15 | 157 | 170 |  | 1.09 | 0.0547 | 0.0031 |  | 0.1538 | 0.0081 |  | 0.0202 | 0.0005 |  | 400 | | 131 |  | 145 | 7 |  | 129 | 3 |
| XMa2-16 | 192 | 221 |  | 1.15 | 0.0491 | 0.0024 |  | 0.1382 | 0.0060 |  | 0.0205 | 0.0006 |  | 152 | | 113 |  | 131 | 5 |  | 131 | 4 |
| XMa2-17 | 482 | 271 |  | 0.56 | 0.0529 | 0.0030 |  | 0.1469 | 0.0063 |  | 0.0200 | 0.0006 |  | 327 | | 130 |  | 139 | 6 |  | 128 | 4 |
| XMa2-18 | 426 | 195 |  | 0.46 | 0.0536 | 0.0026 |  | 0.1483 | 0.0101 |  | 0.0200 | 0.0006 |  | 355 | | 116 |  | 140 | 9 |  | 127 | 4 |
| XMa2-19 | 623 | 253 |  | 0.41 | 0.0545 | 0.0028 |  | 0.1504 | 0.0068 |  | 0.0199 | 0.0005 |  | 393 | | 118 |  | 142 | 6 |  | 127 | 3 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |
| *XMa3, protomylonite, GPS:N31°26.40′；E116°02.31′* | | | | | | | | | | | | | | | | | | | | | | |
| XMa3-01 | 115 | 134 |  | 1.17 | 0.0687 | 0.0093 |  | 1.1977 | 0.2294 |  | 0.1248 | 0.0095 |  | | 890 | 269 |  | 800 | 106 |  | 758 | 54 |
| XMa3-02 | 4392 | 549 |  | 0.12 | 0.0498 | 0.0022 |  | 0.1537 | 0.0098 |  | 0.0223 | 0.0006 |  | | 186 | 100 |  | 145 | 9 |  | 142 | 4 |
| XMa3-06 | 630 | 274 |  | 0.44 | 0.0490 | 0.0024 |  | 0.1493 | 0.0066 |  | 0.0219 | 0.0003 |  | | 151 | 111 |  | 141 | 6 |  | 140 | 2 |
| XMa3-07 | 47 | 51 |  | 1.09 | 0.0743 | 0.0060 |  | 1.2880 | 0.1024 |  | 0.1260 | 0.0029 |  | | 1050 | 158 |  | 840 | 45 |  | 765 | 17 |
| XMa3-08 | 861 | 962 |  | 1.12 | 0.0546 | 0.0110 |  | 0.1669 | 0.0082 |  | 0.0221 | 0.0005 |  | | 396 | 393 |  | 157 | 7 |  | 141 | 4 |
| XMa3-09 | 563 | 726 |  | 1.29 | 0.0545 | 0.0053 |  | 0.1699 | 0.0079 |  | 0.0225 | 0.0008 |  | | 392 | 217 |  | 159 | 7 |  | 143 | 4 |
| XMa3-11 | 93 | 81 |  | 0.87 | 0.0721 | 0.0155 |  | 1.2520 | 0.1636 |  | 0.1250 | 0.0084 |  | | 990 | 469 |  | 824 | 74 |  | 759 | 48 |
| XMa3-12 | 87 | 100 |  | 1.15 | 0.07591 | 0.0127 |  | 1.3318 | 0.4718 |  | 0.1260 | 0.0102 |  | | 1094 | 385 |  | 860 | 205 |  | 765 | 59 |
| XMa3-14 | 514 | 355 |  | 0.69 | 0.0514 | 0.0025 |  | 0.1578 | 0.0076 |  | 0.0224 | 0.0003 |  | | 257 | 111 |  | 149 | 7 |  | 143 | 2 |
| XMa3-15 | 828 | 613 |  | 0.74 | 0.0514 | 0.0028 |  | 0.1627 | 0.0087 |  | 0.0231 | 0.0004 |  | | 257 | 122 |  | 153 | 8 |  | 147 | 3 |
| XMa3-17 | 1499 | 723 |  | 0.48 | 0.0516 | 0.0061 |  | 0.1563 | 0.0190 |  | 0.0220 | 0.0009 |  | | 265 | 252 |  | 147 | 17 |  | 141 | 6 |
| XMa3-18 | 1574 | 984 |  | 0.62 | 0.0536 | 0.0044 |  | 0.1615 | 0.0133 |  | 0.0219 | 0.0006 |  | | 354 | 181 |  | 152 | 12 |  | 140 | 4 |
| XMa3-21 | 682 | 729 |  | 1.07 | 0.0519 | 0.0031 |  | 0.1583 | 0.0096 |  | 0.0221 | 0.0005 |  | | 283 | 135 |  | 149 | 8 |  | 141 | 3 |
| XMa3-22 | 619 | 757 |  | 1.22 | 0.0519 | 0.0023 |  | 0.1610 | 0.0072 |  | 0.0225 | 0.0003 |  | | 280 | 106 |  | 152 | 6 |  | 143 | 2 |
| XMa3-23 | 974 | 318 |  | 0.33 | 0.0479 | 0.0091 |  | 0.1494 | 0.0292 |  | 0.0226 | 0.0006 |  | | 95 | 406 |  | 141 | 26 |  | 144 | 6 |
| XMa3-24 | 865 | 358 |  | 0.41 | 0.0502 | 0.0025 |  | 0.1526 | 0.0077 |  | 0.0220 | 0.0004 |  | | 211 | 117 |  | 144 | 7 |  | 141 | 2 |
| XMa3-27 | 908 | 536 |  | 0.59 | 0.0476 | 0.0063 |  | 0.1500 | 0.0205 |  | 0.0228 | 0.0006 |  | | 80 | 289 |  | 142 | 18 |  | 145 | 5 |
| XMa3-28 | 595 | 229 |  | 0.38 | 0.0547 | 0.0027 |  | 0.1673 | 0.0082 |  | 0.0221 | 0.0003 |  | | 467 | 113 |  | 157 | 3 |  | 141 | 2 |
| XMa3-29 | 7748 | 2203 |  | 0.28 | 0.0525 | 0.0059 |  | 0.1592 | 0.0185 |  | 0.0219 | 0.0009 |  | | 309 | 256 |  | 150 | 16 |  | 140 | 6 |
| XMa3-30 | 78 | 71 |  | 0.92 | 0.0724 | 0.0151 |  | 1.2406 | 0.2871 |  | 0.1230 | 0.0156 |  | | 998 | 435 |  | 819 | 130 |  | 748 | 90 |

# Supplementary table 2. LA-ICPMS U-Pb analytical results for zircon of samples from the Shangcheng-Macheng shear zone

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Analysis | content(×10-6） | |  | Th/U | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |  | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |
| U238 | Th232 |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Age | ±1σ |  | Age | ±1σ |  | Age | ±1σ |
| *SM1, granite pluton cutting the SMSZ, GPS:N31°32.46′;E115°19.70′* | | | | | | | | | | | | | | | | | | | | | |
| SM1-01 | 699 | 416 |  | 0.59 | 0.0510 | 0.0019 |  | 0.1446 | 0.0054 |  | 0.0205 | 0.0006 |  | 239 | 83 |  | 137 | 5 |  | 131 | 3 |
| SM1-02 | 864 | 545 |  | 0.63 | 0.0474 | 0.0102 |  | 0.1227 | 0.0273 |  | 0.0199 | 0.0015 |  | 78 | 439 |  | 118 | 25 |  | 127 | 9 |
| SM1-04 | 819 | 474 |  | 0.58 | 0.0544 | 0.0053 |  | 0.1449 | 0.0142 |  | 0.0199 | 0.0008 |  | 391 | 220 |  | 137 | 13 |  | 127 | 5 |
| SM1-05 | 434 | 359 |  | 0.83 | 0.0481 | 0.0041 |  | 0.1340 | 0.0113 |  | 0.0206 | 0.0008 |  | 106 | 189 |  | 128 | 10 |  | 132 | 5 |
| SM1-06 | 753 | 850 |  | 1.13 | 0.0508 | 0.0041 |  | 0.1334 | 0.0099 |  | 0.0200 | 0.0007 |  | 232 | 185 |  | 127 | 9 |  | 128 | 4 |
| SM1-08 | 107 | 120 |  | 1.12 | 0.0520 | 0.0026 |  | 0.1426 | 0.0069 |  | 0.0199 | 0.0006 |  | 287 | 115 |  | 135 | 6 |  | 127 | 4 |
| SM1-09 | 425 | 288 |  | 0.68 | 0.0499 | 0.0023 |  | 0.1393 | 0.0064 |  | 0.0202 | 0.0006 |  | 191 | 107 |  | 132 | 6 |  | 129 | 4 |
| SM1-10 | 344 | 183 |  | 0.53 | 0.0472 | 0.0031 |  | 0.1340 | 0.0088 |  | 0.0206 | 0.0007 |  | 61 | 152 |  | 128 | 8 |  | 132 | 4 |
| SM1-11 | 112 | 126 |  | 1.12 | 0.0493 | 0.0033 |  | 0.1364 | 0.0090 |  | 0.0203 | 0.0007 |  | 165 | 157 |  | 130 | 8 |  | 130 | 4 |
| SM1-14 | 259 | 230 |  | 0.89 | 0.0518 | 0.0025 |  | 0.1434 | 0.0070 |  | 0.0201 | 0.0006 |  | 276 | 110 |  | 136 | 6 |  | 128 | 4 |
| SM1-17 | 164 | 102 |  | 0.62 | 0.0487 | 0.0018 |  | 0.1340 | 0.0049 |  | 0.0199 | 0.0003 |  | 200 | 89 |  | 128 | 4 |  | 127 | 2 |
| SM1-18 | 205 | 161 |  | 0.78 | 0.0493 | 0.0018 |  | 0.1374 | 0.0052 |  | 0.0198 | 0.0003 |  | 165 | 91.7 |  | 131 | 5 |  | 127 | 2 |
| SM1-19 | 134 | 115 |  | 0.86 | 0.0540 | 0.0025 |  | 0.1540 | 0.0071 |  | 0.0207 | 0.0006 |  | 372 | 107 |  | 145 | 6 |  | 132 | 4 |
| SM1-20 | 527 | 441 |  | 0.84 | 0.0482 | 0.0079 |  | 0.1369 | 0.0231 |  | 0.0205 | 0.0012 |  | 122 | 335 |  | 130 | 21 |  | 131 | 8 |
| SM1-23 | 809 | 512 |  | 0.63 | 0.0473 | 0.0076 |  | 0.1339 | 0.0220 |  | 0.0205 | 0.0012 |  | 65 | 341 |  | 128 | 20 |  | 131 | 7 |
| SM1-24 | 168 | 127 |  | 0.76 | 0.0526 | 0.0079 |  | 0.1480 | 0.0229 |  | 0.0206 | 0.0011 |  | 322 | 311 |  | 140 | 20 |  | 131 | 7 |
| SM1-25 | 377 | 435 |  | 1.15 | 0.0502 | 0.0031 |  | 0.1398 | 0.0088 |  | 0.0202 | 0.0005 |  | 206 | 144 |  | 133 | 8 |  | 129 | 3 |
| SM1-26 | 844 | 885 |  | 1.05 | 0.0543 | 0.0023 |  | 0.1545 | 0.0067 |  | 0.0206 | 0.0006 |  | 383 | 96 |  | 146 | 6 |  | 132 | 4 |
| SM1-28 | 227 | 215 |  | 0.95 | 0.0489 | 0.0021 |  | 0.1405 | 0.0062 |  | 0.0207 | 0.0003 |  | 143 | 104 |  | 133 | 6 |  | 132 | 2 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *SM2, biotite feldspathic mylonite,GPS:N31°10.03′;E115°07.53′* | | | | | | | | | | | | | | | | | | | | | |
| SM2-01 | 185 | 114 |  | 0.62 | 0.0670 | 0.0018 |  | 1.1139 | 0.0402 |  | 0.1199 | 0.0034 |  | 836 | 56 |  | 760 | 19 |  | 730 | 19 |
| SM2-02 | 443 | 316 |  | 0.71 | 0.0600 | 0.0031 |  | 1.0092 | 0.0342 |  | 0.1205 | 0.0031 |  | 609 | 105 |  | 708 | 16 |  | 734 | 18 |
| SM2-03 | 139 | 114 |  | 0.81 | 0.0594 | 0.0040 |  | 0.9982 | 0.0433 |  | 0.1213 | 0.0037 |  | 592 | 109 |  | 703 | 21 |  | 738 | 21 |
| SM2-04 | 221 | 215 |  | 0.97 | 0.0575 | 0.0034 |  | 0.9539 | 0.0545 |  | 0.1199 | 0.0033 |  | 522 | 127 |  | 680 | 28 |  | 730 | 19 |
| SM2-06 | 525 | 325 |  | 0.62 | 0.0664 | 0.0034 |  | 1.1146 | 0.0601 |  | 0.1216 | 0.0036 |  | 817 | 127 |  | 760 | 29 |  | 740 | 21 |
| SM2-07 | 222 | 410 |  | 1.85 | 0.0660 | 0.0020 |  | 1.1264 | 0.0433 |  | 0.1228 | 0.0018 |  | 806 | 57 |  | 766 | 21 |  | 747 | 10 |
| SM2-08 | 218 | 157 |  | 0.72 | 0.0697 | 0.0021 |  | 1.1794 | 0.0793 |  | 0.1210 | 0.0035 |  | 922 | 70 |  | 791 | 37 |  | 736 | 20 |
| SM2-09 | 136 | 127 |  | 0.94 | 0.0655 | 0.0021 |  | 1.1021 | 0.0423 |  | 0.1205 | 0.0033 |  | 790 | 65 |  | 754 | 20 |  | 734 | 19 |
| SM2-10 | 396 | 215 |  | 0.54 | 0.0640 | 0.0184 |  | 1.0754 | 0.0584 |  | 0.1202 | 0.0036 |  | 742 | 405 |  | 741 | 30 |  | 732 | 21 |
| SM2-12 | 438 | 318 |  | 0.73 | 0.0706 | 0.0021 |  | 1.1837 | 0.0402 |  | 0.1212 | 0.0032 |  | 943 | 70 |  | 793 | 19 |  | 737 | 19 |
| SM2-13 | 354 | 151 |  | 0.43 | 0.0703 | 0.0047 |  | 1.2033 | 0.0304 |  | 0.1242 | 0.0032 |  | 936 | 136 |  | 802 | 26 |  | 755 | 19 |
| SM2-14 | 270 | 297 |  | 1.10 | 0.0647 | 0.0047 |  | 1.1250 | 0.0444 |  | 0.1247 | 0.0036 |  | 766 | 130 |  | 759 | 21 |  | 757 | 21 |
| SM2-15 | 311 | 120 |  | 0.39 | 0.0654 | 0.0041 |  | 1.1264 | 0.0649 |  | 0.1239 | 0.0035 |  | 787 | 149 |  | 766 | 33 |  | 753 | 20 |
| SM2-16 | 219 | 179 |  | 0.82 | 0.0687 | 0.0026 |  | 1.1496 | 0.0771 |  | 0.1201 | 0.0039 |  | 889 | 79 |  | 777 | 36 |  | 731 | 22 |
| SM2-17 | 313 | 186 |  | 0.60 | 0.0664 | 0.0028 |  | 1.1434 | 0.0453 |  | 0.1251 | 0.0037 |  | 822 | 87 |  | 774 | 22 |  | 760 | 21 |
| SM2-18 | 271 | 283 |  | 1.04 | 0.0662 | 0.0022 |  | 1.1525 | 0.0761 |  | 0.1257 | 0.0035 |  | 812 | 67 |  | 778 | 36 |  | 763 | 20 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *SM3, weakly foliated granitic dyke emplaced inbetween mylonite of the SMSZ,GPS:N31°10.03′;E115°07.53′* | | | | | | | | | | | | | | | | | | | | | |
| SM3-01 | 1348 | 380 |  | 0.28 | 0.0494 | 0.0021 |  | 0.1463 | 0.0061 |  | 0.0212 | 0.0006 |  | 167 | 103 |  | 139 | 5 |  | 135 | 4 |
| SM3-02 | 703 | 700 |  | 1.00 | 0.0481 | 0.0021 |  | 0.1384 | 0.0061 |  | 0.0211 | 0.0006 |  | 103 | 97 |  | 132 | 5 |  | 134 | 4 |
| SM3-03 | 488 | 521 |  | 1.07 | 0.0512 | 0.0019 |  | 0.1510 | 0.0063 |  | 0.0210 | 0.0006 |  | 250 | 100 |  | 143 | 6 |  | 134 | 4 |
| SM3-04 | 2070 | 1272 |  | 0.61 | 0.0488 | 0.0021 |  | 0.1448 | 0.0062 |  | 0.0215 | 0.0006 |  | 139 | 103 |  | 137 | 5 |  | 137 | 4 |
| SM3-05 | 610 | 277 |  | 0.45 | 0.0485 | 0.0022 |  | 0.1427 | 0.0062 |  | 0.0213 | 0.0006 |  | 126 | 103 |  | 135 | 6 |  | 136 | 4 |
| SM3-06 | 1674 | 1210 |  | 0.72 | 0.0508 | 0.0018 |  | 0.1490 | 0.0096 |  | 0.0213 | 0.0006 |  | 233 | 88 |  | 141 | 9 |  | 136 | 4 |
| SM3-07 | 1406 | 698 |  | 0.50 | 0.0476 | 0.0024 |  | 0.1425 | 0.0059 |  | 0.0217 | 0.0006 |  | 80 | 108 |  | 135 | 6 |  | 138 | 4 |
| SM3-08 | 275 | 288 |  | 1.05 | 0.0481 | 0.0022 |  | 0.1431 | 0.0086 |  | 0.0216 | 0.0006 |  | 104 | 102 |  | 136 | 8 |  | 138 | 4 |
| SM3-09 | 297 | 203 |  | 0.68 | 0.0490 | 0.0020 |  | 0.1467 | 0.0072 |  | 0.0217 | 0.0006 |  | 150 | 129 |  | 139 | 6 |  | 138 | 4 |
| SM3-10 | 3230 | 1261 |  | 0.39 | 0.0522 | 0.0021 |  | 0.1566 | 0.0062 |  | 0.0217 | 0.0006 |  | 296 | 96 |  | 148 | 6 |  | 138 | 4 |
| SM3-11 | 474 | 479 |  | 1.01 | 0.0495 | 0.0020 |  | 0.1495 | 0.0063 |  | 0.0216 | 0.0006 |  | 173.1 | 86 |  | 141 | 5 |  | 138 | 4 |
| SM3-12 | 530 | 480 |  | 0.90 | 0.0483 | 0.0022 |  | 0.1435 | 0.0066 |  | 0.0214 | 0.0007 |  | 117 | 100 |  | 136 | 6 |  | 137 | 4 |
| SM3-13 | 1216 | 1114 |  | 0.92 | 0.0506 | 0.0021 |  | 0.1506 | 0.0063 |  | 0.0216 | 0.0006 |  | 222 | 101 |  | 142 | 6 |  | 138 | 4 |
| SM3-14 | 442 | 449 |  | 1.02 | 0.0502 | 0.0023 |  | 0.1445 | 0.0068 |  | 0.0208 | 0.0006 |  | 205 | 104 |  | 140 | 6 |  | 133 | 4 |
| SM3-15 | 232 | 244 |  | 1.05 | 0.0499 | 0.0022 |  | 0.1470 | 0.0064 |  | 0.0210 | 0.0006 |  | 193 | 106 |  | 139 | 6 |  | 134 | 4 |
| SM3-16 | 647 | 270 |  | 0.42 | 0.0486 | 0.0024 |  | 0.1441 | 0.0067 |  | 0.0215 | 0.0006 |  | 131 | 113 |  | 137 | 6 |  | 137 | 4 |
| SM3-17 | 1196 | 498 |  | 0.42 | 0.0490 | 0.0024 |  | 0.1468 | 0.0067 |  | 0.0216 | 0.0006 |  | 150 | 111 |  | 139 | 6 |  | 138 | 4 |
| SM3-18 | 4653 | 1246 |  | 0.27 | 0.0519 | 0.0021 |  | 0.1566 | 0.0061 |  | 0.0213 | 0.0006 |  | 283 | 99 |  | 148 | 5 |  | 136 | 4 |
| SM3-19 | 3701 | 1139 |  | 0.31 | 0.0499 | 0.0024 |  | 0.1499 | 0.0062 |  | 0.0217 | 0.0006 |  | 191.4 | 115 |  | 137 | 6 |  | 138 | 4 |

# Supplementary table 3. LA-ICPMS U-Pb analytical results for zircon of samples from the Shuihou-Xishui-Tuanfeng shear zone

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Analysis | content(×10-6） | |  | Th/U | 207Pb/206Pb | |  | 207Pb/235U | | |  | 206Pb/238U | |  | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |
| U238 | Th232 |  | Ratio | ±1σ |  | Ratio | | ±1σ |  | Ratio | ±1σ |  | Age | ±1σ |  | Age | ±1σ |  | Age | ±1σ |
| *SW1, mylonitic gneiss, GPS:N30°49.94′;E116°9.07′* | | | | | | | | | | | | | | | | | | | | | | |
| SW1-01 | 223 | 251 |  | 1.12 | 0.0645 | 0.0020 |  | 1.2006 | | 0.0538 |  | 0.1334 | 0.0035 |  | 757 | 66 |  | 801 | 25 |  | 807 | 20 |
| SW1-02 | 560.7 | 504 |  | 0.90 | 0.0640 | 0.0022 |  | 1.1596 | | 0.0433 |  | 0.1316 | 0.0035 |  | 741 | 67 |  | 782 | 20 |  | 797 | 20 |
| SW1-03 | 215 | 203 |  | 0.95 | 0.0657 | 0.0031 |  | 1.1739 | | 0.0517 |  | 0.1277 | 0.0022 |  | 797 | 93 |  | 788 | 22 |  | 775 | 13 |
| SW1-04 | 169 | 142 |  | 0.84 | 0.0625 | 0.0033 |  | 1.1380 | | 0.0484 |  | 0.1301 | 0.0035 |  | 691 | 75 |  | 772 | 23 |  | 788 | 20 |
| SW1-06 | 247 | 277 |  | 1.12 | 0.0646 | 0.0020 |  | 1.2017 | | 0.0523 |  | 0.1329 | 0.0034 |  | 763 | 60 |  | 801 | 25 |  | 805 | 20 |
| SW1-07 | 265 | 238 |  | 0.90 | 0.0686 | 0.0021 |  | 1.2663 | | 0.0498 |  | 0.1328 | 0.0034 |  | 887 | 64 |  | 831 | 22 |  | 804 | 19 |
| SW1-08 | 290 | 302 |  | 1.04 | 0.0626 | 0.0024 |  | 1.1484 | | 0.0520 |  | 0.1330 | 0.0034 |  | 695 | 67 |  | 777 | 24 |  | 805 | 19 |
| SW1-09 | 208 | 226 |  | 1.09 | 0.0652 | 0.0021 |  | 1.1647 | | 0.0771 |  | 0.1277 | 0.0035 |  | 782 | 66 |  | 784 | 35 |  | 775 | 20 |
| SW1-10 | 279 | 378 |  | 1.36 | 0.0705 | 0.0022 |  | 1.2390 | | 0.0521 |  | 0.1272 | 0.0023 |  | 941 | 65 |  | 818 | 23 |  | 772 | 13 |
| SW1-11 | 147 | 164 |  | 1.12 | 0.0709 | 0.0026 |  | 1.2749 | | 0.0576 |  | 0.1289 | 0.0034 |  | 956 | 68 |  | 835 | 27 |  | 781 | 19 |
| SW1-14 | 360 | 494 |  | 1.37 | 0.0712 | 0.0029 |  | 1.2589 | | 0.0521 |  | 0.1278 | 0.0034 |  | 964 | 76 |  | 827 | 23 |  | 775 | 19 |
| SW1-15 | 111 | 106 |  | 0.95 | 0.0675 | 0.0024 |  | 1.2060 | | 0.0510 |  | 0.1282 | 0.0035 |  | 852 | 69 |  | 803 | 24 |  | 778 | 20 |
| SW1-16 | 168 | 151 |  | 0.90 | 0.0719 | 0.0050 |  | 1.2662 | | 0.0535 |  | 0.1267 | 0.0035 |  | 985 | 138 |  | 831 | 24 |  | 769 | 20 |
| SW1-17 | 167.3 | 215 |  | 1.29 | 0.0755 | 0.0021 |  | 1.3269 | | 0.0488 |  | 0.1266 | 0.0033 |  | 1082 | 65 |  | 858 | 22 |  | 769 | 19 |
| SW1-18 | 85 | 123 |  | 1.45 | 0.0693 | 0.0019 |  | 1.2664 | | 0.0523 |  | 0.1311 | 0.0034 |  | 907 | 63 |  | 831 | 23 |  | 794 | 19 |
| SW1-21 | 209 | 200 |  | 0.96 | 0.0699 | 0.0024 |  | 1.2683 | | 0.0472 |  | 0.1313 | 0.0034 |  | 925 | 70 |  | 832 | 21 |  | 795 | 20 |
| SW1-22 | 140.2 | 190 |  | 1.35 | 0.0756 | 0.0027 |  | 1.3514 | | 0.0441 |  | 0.1291 | 0.0024 |  | 1087 | 78 |  | 868 | 21 |  | 783 | 14 |
| SW1-24 | 234 | 141 |  | 0.60 | 0.0654 | 0.0025 |  | 1.1944 | | 0.0451 |  | 0.1319 | 0.0036 |  | 787 | 80 |  | 798 | 21 |  | 799 | 20 |
| SW1-25 | 370 | 568 |  | 1.53 | 0.0658 | 0.0024 |  | 1.1781 | | 0.0393 |  | 0.1292 | 0.0033 |  | 1200 | 65 |  | 790 | 18 |  | 783 | 19 |
|  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *SW2, granitic vein emplaced in-between mylonite, GPS:N30°49.94′;E116°9.07′* | | | | | | | | | | | | | | | | | | | | | | |
| SW2-01 | 245 | 151 |  | 0.61 | 0.0482 | 0.0036 |  | | 0.1348 | 0.0096 |  | 0.0201 | 0.0003 |  | 109 | 163 |  | 128 | 9 |  | 128 | 2 |
| SW2-02 | 116 | 43 |  | 0.37 | 0.0538 | 0.0056 |  | | 0.1529 | 0.0137 |  | 0.0207 | 0.0006 |  | 362 | 216 |  | 144 | 12 |  | 132 | 4 |
| SW2-03 | 203 | 45 |  | 0.22 | 0.0496 | 0.0037 |  | | 0.1411 | 0.0096 |  | 0.0206 | 0.0004 |  | 176 | 165 |  | 134 | 9 |  | 132 | 2 |
| SW2-05 | 130 | 31 |  | 0.24 | 0.0522 | 0.0045 |  | | 0.1503 | 0.0119 |  | 0.0209 | 0.0004 |  | 294 | 186 |  | 142 | 10 |  | 134 | 3 |
| SW2-06 | 208 | 81 |  | 0.39 | 0.0521 | 0.0029 |  | | 0.1509 | 0.0077 |  | 0.0207 | 0.0006 |  | 288 | 121 |  | 143 | 7 |  | 132 | 4 |
| SW2-07 | 216 | 32 |  | 0.15 | 0.0526 | 0.0037 |  | | 0.1492 | 0.0096 |  | 0.0205 | 0.0004 |  | 313 | 152 |  | 141 | 8 |  | 131 | 3 |
| SW2-10 | 179 | 70 |  | 0.39 | 0.0485 | 0.0032 |  | | 0.1443 | 0.0094 |  | 0.0215 | 0.0004 |  | 123 | 155 |  | 137 | 8 |  | 137 | 3 |
| SW2-11 | 238 | 190 |  | 0.80 | 0.0464 | 0.0036 |  | | 0.1308 | 0.0093 |  | 0.0205 | 0.0004 |  | 18 | 167 |  | 125 | 8 |  | 131 | 2 |
| SW2-12 | 500 | 349 |  | 0.70 | 0.0518 | 0.0028 |  | | 0.1412 | 0.0069 |  | 0.0197 | 0.0003 |  | 275 | 125 |  | 134 | 6 |  | 126 | 2 |
| SW2-13 | 182 | 47 |  | 0.26 | 0.0462 | 0.0036 |  | | 0.1333 | 0.0094 |  | 0.0212 | 0.0004 |  | 7 | 174 |  | 127 | 8 |  | 135 | 2 |
| SW2-14 | 490 | 142 |  | 0.29 | 0.0499 | 0.0046 |  | | 0.1469 | 0.0127 |  | 0.0210 | 0.0004 |  | 190 | 207 |  | 139 | 11 |  | 134 | 2 |
| SW2-16 | 279 | 106 |  | 0.38 | 0.0495 | 0.0036 |  | | 0.1477 | 0.0102 |  | 0.0214 | 0.0004 |  | 169 | 158 |  | 140 | 9 |  | 136 | 2 |
| SW2-18 | 234 | 130 |  | 0.55 | 0.0533 | 0.0044 |  | | 0.1565 | 0.0118 |  | 0.0210 | 0.0003 |  | 343 | 186 |  | 148 | 10 |  | 134 | 2 |
| SW2-19 | 235 | 103 |  | 0.44 | 0.0515 | 0.0031 |  | | 0.1459 | 0.0088 |  | 0.0203 | 0.0003 |  | 264 | 135 |  | 138 | 8 |  | 130 | 2 |
| SW2-20 | 856 | 601 |  | 0.70 | 0.0522 | 0.0034 |  | | 0.1512 | 0.0062 |  | 0.0208 | 0.0007 |  | 294 | 159 |  | 143 | 5 |  | 133 | 4 |
| SW2-22 | 418 | 155 |  | 0.37 | 0.0525 | 0.0043 |  | | 0.1559 | 0.0121 |  | 0.0216 | 0.0004 |  | 309 | 189 |  | 147 | 11 |  | 138 | 3 |
| SW2-24 | 236 | 76 |  | 0.32 | 0.0495 | 0.0035 |  | | 0.1392 | 0.0099 |  | 0.0203 | 0.0003 |  | 169 | 156 |  | 132 | 9 |  | 130 | 2 |
| SW2-25 | 252 | 126 |  | 0.50 | 0.0507 | 0.0029 |  | | 0.1439 | 0.0081 |  | 0.0205 | 0.0003 |  | 233 | 133 |  | 137 | 7 |  | 131 | 2 |
|  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *XT1, granitic lens, GPS:N30°28.57′;E115°12.81′* | | | | | | | | | | | | | | | | | | | | | | |
| XT1-01 | 729 | 16 |  | 0.02 | 0.0509 | 0.0075 |  | 0.1464 | | 0.0072 |  | 0.0210 | 0.0006 |  | 235 | 307 |  | 139 | 19 |  | 134 | 7 |
| XT1-02 | 955 | 13 |  | 0.01 | 0.0503 | 0.0043 |  | 0.1473 | | 0.0130 |  | 0.0212 | 0.0007 |  | 209 | 189 |  | 140 | 11 |  | 135 | 4 |
| XT1-06 | 600 | 24 |  | 0.04 | 0.0521 | 0.0043 |  | 0.1516 | | 0.0126 |  | 0.0212 | 0.0006 |  | 300 | 189 |  | 143 | 11 |  | 135 | 4 |
| XT1-10 | 896 | 777 |  | 0.87 | 0.0510 | 0.0027 |  | 0.1476 | | 0.0074 |  | 0.0210 | 0.0006 |  | 243 | 125 |  | 140 | 7 |  | 134 | 4 |
| XT1-11 | 667 | 68 |  | 0.10 | 0.0539 | 0.0030 |  | 0.1582 | | 0.0084 |  | 0.0215 | 0.0006 |  | 369 | 124 |  | 149 | 7 |  | 137 | 4 |
| XT1-12 | 786 | 36 |  | 0.05 | 0.0490 | 0.0024 |  | 0.1441 | | 0.0072 |  | 0.0212 | 0.0006 |  | 146 | 112 |  | 137 | 6 |  | 135 | 4 |
| XT1-15 | 897 | 34 |  | 0.04 | 0.0479 | 0.0023 |  | 0.1404 | | 0.0067 |  | 0.0214 | 0.0006 |  | 100 | 111 |  | 133 | 6 |  | 136 | 4 |
| XT1-18 | 791 | 31 |  | 0.04 | 0.0486 | 0.0024 |  | 0.1445 | | 0.0072 |  | 0.0215 | 0.0006 |  | 128 | 115 |  | 137 | 6 |  | 137 | 4 |
| XT1-20 | 1443 | 33 |  | 0.02 | 0.0479 | 0.0021 |  | 0.1382 | | 0.0059 |  | 0.0208 | 0.0006 |  | 100 | 91 |  | 131 | 5 |  | 133 | 4 |
| XT1-22 | 779 | 41 |  | 0.05 | 0.0489 | 0.0020 |  | 0.1436 | | 0.0058 |  | 0.0212 | 0.0002 |  | 143 | 96 |  | 136 | 5 |  | 135 | 2 |
| XT1-23 | 505 | 40 |  | 0.08 | 0.0469 | 0.0020 |  | 0.1380 | | 0.0059 |  | 0.0212 | 0.0003 |  | 43 | 100 |  | 131 | 5 |  | 135 | 2 |
| XT1-26 | 586 | 588 |  | 1.00 | 0.0558 | 0.0030 |  | 0.1648 | | 0.0092 |  | 0.0214 | 0.0004 |  | 443 | 122 |  | 155 | 8 |  | 136 | 2 |
| XT1-29 | 2281 | 414 |  | 0.18 | 0.0523 | 0.0019 |  | 0.1574 | | 0.0059 |  | 0.0218 | 0.0003 |  | 298 | 90 |  | 148 | 5 |  | 139 | 2 |
| XT1-30 | 3143 | 1319 |  | 0.42 | 0.0464 | 0.0035 |  | 0.1302 | | 0.0064 |  | 0.0214 | 0.0005 |  | 17 | 389 |  | 124 | 22 |  | 137 | 9 |
|  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *XT2 mylonite, GPS:N30°28.57′;E115°12.81′* | | | | | | | | | | | | | | | | | | | | | | |
| XT2-02 | 198 | 173 |  | 0.87 | 0.0648 | 0.0025 |  | 1.1701 | | 0.0417 |  | 0.1297 | 0.0034 |  | 768 | 69 |  | 787 | 19.5 |  | 786 | 19 |
| XT2-03 | 295 | 356 |  | 1.21 | 0.0702 | 0.0026 |  | 1.2297 | | 0.0491 |  | 0.1271 | 0.0033 |  | 934 | 76 |  | 814 | 22.4 |  | 771 | 19 |
| XT2-04 | 77 | 43 |  | 0.56 | 0.0678 | 0.0035 |  | 1.2469 | | 0.0601 |  | 0.1330 | 0.0019 |  | 863 | 106 |  | 822 | 27.2 |  | 805 | 11 |
| XT2-05 | 222 | 223 |  | 1.00 | 0.0681 | 0.0023 |  | 1.2530 | | 0.0462 |  | 0.1314 | 0.0034 |  | 871 | 70 |  | 825 | 20.8 |  | 796 | 19 |
| XT2-07 | 224 | 241 |  | 1.08 | 0.0688 | 0.0022 |  | 1.2501 | | 0.0463 |  | 0.1317 | 0.0035 |  | 893 | 70 |  | 823 | 20.9 |  | 798 | 20 |
| XT2-08 | 250 | 282 |  | 1.13 | 0.0704 | 0.0023 |  | 1.2526 | | 0.0499 |  | 0.1278 | 0.0034 |  | 941 | 74 |  | 825 | 22.5 |  | 775 | 19 |
| XT2-09 | 309 | 405 |  | 1.31 | 0.0739 | 0.0021 |  | 1.3605 | | 0.0573 |  | 0.1325 | 0.0036 |  | 1040 | 63 |  | 872 | 24.6 |  | 802 | 20 |
| XT2-10 | 278 | 347 |  | 1.25 | 0.0746 | 0.0021 |  | 1.3374 | | 0.0582 |  | 0.1290 | 0.0033 |  | 1058 | 69 |  | 862 | 25.3 |  | 782 | 19 |
| XT2-11 | 96 | 115 |  | 1.19 | 0.0743 | 0.0039 |  | 1.2845 | | 0.0629 |  | 0.1266 | 0.0025 |  | 1050 | 106 |  | 839 | 28 |  | 768 | 15 |
| XT2-12 | 91 | 72 |  | 0.80 | 0.0702 | 0.0025 |  | 1.2268 | | 0.0457 |  | 0.1271 | 0.0035 |  | 1000 | 72 |  | 813 | 21 |  | 771 | 20 |
| XT2-14 | 202 | 228 |  | 1.13 | 0.0661 | 0.0027 |  | 1.1721 | | 0.0510 |  | 0.1289 | 0.0044 |  | 809 | 86 |  | 788 | 24 |  | 781 | 25 |
| XT2-15 | 61 | 48 |  | 0.78 | 0.0658 | 0.0032 |  | 1.2038 | | 0.0578 |  | 0.1327 | 0.0037 |  | 798 | 102 |  | 802 | 27 |  | 804 | 21 |
| XT2-16 | 219 | 344 |  | 1.57 | 0.0634 | 0.0030 |  | 1.1535 | | 0.0569 |  | 0.1316 | 0.0035 |  | 720 | 100 |  | 779 | 27 |  | 797 | 20 |
| XT2-18 | 286 | 191 |  | 0.67 | 0.0662 | 0.0023 |  | 1.2133 | | 0.0412 |  | 0.1324 | 0.0035 |  | 813 | 72 |  | 807 | 19 |  | 802 | 20 |
| XT2-19 | 194 | 171 |  | 0.88 | 0.0655 | 0.0019 |  | 1.2018 | | 0.0455 |  | 0.1321 | 0.0035 |  | 791 | 62 |  | 801 | 21 |  | 800 | 20 |
| XT2-20 | 516 | 293 |  | 0.57 | 0.0665 | 0.0027 |  | 1.2093 | | 0.0474 |  | 0.1308 | 0.0036 |  | 833 | 81 |  | 805 | 22 |  | 793 | 21 |
| XT2-21 | 241 | 359 |  | 1.49 | 0.0716 | 0.0030 |  | 1.3025 | | 0.0547 |  | 0.1306 | 0.0020 |  | 976 | 86 |  | 847 | 24 |  | 791 | 12 |
| XT2-23 | 210 | 202 |  | 0.96 | 0.0698 | 0.0023 |  | 1.2391 | | 0.0515 |  | 0.1275 | 0.0034 |  | 920 | 69 |  | 818 | 23 |  | 774 | 19 |
| XT2-24 | 362 | 265 |  | 0.73 | 0.0654 | 0.0021 |  | 1.1949 | | 0.0394 |  | 0.1297 | 0.0034 |  | 787 | 67 |  | 798 | 18.2 |  | 786 | 19 |

# Supplementary table 4. LA-ICPMS U-Pb analytical results for zircon of samples from the NW-SE directed coaxial flow domain

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Analysis | content(×10-6） | |  | Th/U | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |  | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | | |
| U238 | Th232 |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Age | ±1σ |  | Age | ±1σ |  | Age | | ±1σ |
| *YX1, banded gneiss, GPS:N30°45.05′;E115°33.90′* | | | | | | | | | | | | | | | | | | | | | | |
| YX1-01 | 4555 | 37 |  | 0.01 | 0.0504 | 0.0021 |  | 0.1566 | 0.0069 |  | 0.0224 | 0.0007 |  | 213 | 110 |  | 148 | 6 |  | 143 | | 4 |
| YX1-02 | 4101 | 39 |  | 0.01 | 0.0505 | 0.0022 |  | 0.1561 | 0.0066 |  | 0.0224 | 0.0006 |  | 218 | 99 |  | 147 | 6 |  | 143 | | 4 |
| YX1-03 | 4054 | 62 |  | 0.02 | 0.0532 | 0.0021 |  | 0.1689 | 0.0073 |  | 0.0227 | 0.0006 |  | 336 | 101 |  | 158 | 6 |  | 145 | | 4 |
| YX1-05 | 3566 | 49 |  | 0.01 | 0.0526 | 0.0021 |  | 0.1644 | 0.0068 |  | 0.0224 | 0.0006 |  | 311 | 96 |  | 155 | 6 |  | 143 | | 4 |
| YX1-06 | 4503 | 123 |  | 0.03 | 0.0507 | 0.0021 |  | 0.1568 | 0.0061 |  | 0.0223 | 0.0006 |  | 226 | 114 |  | 148 | 5 |  | 142 | | 4 |
| YX1-07 | 4862 | 251 |  | 0.05 | 0.0486 | 0.0025 |  | 0.1549 | 0.0069 |  | 0.0231 | 0.0006 |  | 127 | 94 |  | 146 | 6 |  | 147 | | 4 |
| YX1-09 | 6639 | 211 |  | 0.03 | 0.0513 | 0.0031 |  | 0.1581 | 0.0079 |  | 0.0222 | 0.0007 |  | 211 | 141 |  | 149 | 7 |  | 142 | | 4 |
| YX1-10 | 4569 | 115 |  | 0.03 | 0.0501 | 0.0023 |  | 0.1574 | 0.0067 |  | 0.0227 | 0.0007 |  | 198 | 97 |  | 148 | 6 |  | 145 | | 4 |
| YX1-11 | 2266 | 202 |  | 0.09 | 0.0478 | 0.0024 |  | 0.1493 | 0.0068 |  | 0.0226 | 0.0006 |  | 90 | 93 |  | 141 | 6 |  | 144 | | 4 |
| YX1-14 | 5816 | 151 |  | 0.03 | 0.0493 | 0.0020 |  | 0.1516 | 0.0063 |  | 0.0222 | 0.0007 |  | 161 | 95 |  | 143 | 6 |  | 142 | | 4 |
| YX1-15 | 3451 | 62 |  | 0.02 | 0.0511 | 0.0022 |  | 0.1646 | 0.0064 |  | 0.0233 | 0.0006 |  | 246 | 101 |  | 155 | 6 |  | 148 | | 4 |
| YX1-17 | 3616 | 79 |  | 0.02 | 0.0488 | 0.0024 |  | 0.1512 | 0.0067 |  | 0.0224 | 0.0006 |  | 139 | 106 |  | 143 | 6 |  | 143 | | 4 |
| YX1-18 | 5134 | 139 |  | 0.03 | 0.0494 | 0.0022 |  | 0.1510 | 0.0077 |  | 0.0222 | 0.0006 |  | 166 | 100 |  | 143 | 7 |  | 142 | | 4 |
| YX1-22 | 4029 | 25 |  | 0.01 | 0.0478 | 0.0021 |  | 0.1500 | 0.0074 |  | 0.0225 | 0.0006 |  | 91 | 99 |  | 142 | 6 |  | 143 | | 4 |
| YX1-24 | 103 | 116 |  | 1.13 | 0.0650 | 0.0100 |  | 1.1427 | 0.1696 |  | 0.1261 | 0.0071 |  | 773 | 307 |  | 774 | 80 |  | 765 | | 41 |
| YX1-25 | 214 | 154 |  | 0.72 | 0.0603 | 0.0113 |  | 1.0438 | 0.1908 |  | 0.1254 | 0.0082 |  | 615 | 387 |  | 726 | 95 |  | 762 | | 47 |
| YX1-26 | 277 | 179 |  | 0.65 | 0.0705 | 0.0202 |  | 1.1652 | 0.3050 |  | 0.1191 | 0.0136 |  | 945 | 536 |  | 784 | 143 |  | 726 | | 78 |
| YX1-27 | 282 | 510 |  | 1.81 | 0.0653 | 0.0043 |  | 1.0839 | 0.0602 |  | 0.1194 | 0.0036 |  | 785 | 105 |  | 746 | 29 |  | 727 | | 20 |
| YX1-28 | 337 | 316 |  | 0.94 | 0.0642 | 0.0040 |  | 1.0598 | 0.0668 |  | 0.1198 | 0.0031 |  | 749 | 137 |  | 734 | 33 |  | 729 | | 18 |
|  | | | | | | | | | | | | | | | | | | | | | | |
| *YX2, foliated granitic boundin, GPS:N30°45.05′;E115°33.90′* | | | | | | | | | | | | | | | | | | | | | | |
| YX2-01 | 1767 | 827 |  | 0.47 | 0.0489 | 0.0017 |  | 0.1489 | 0.0051 |  | 0.0219 | 0.0002 |  | 143 | 88 |  | 141 | 4 |  | 140 | | 1 |
| YX2-02 | 1455 | 841 |  | 0.58 | 0.0481 | 0.0017 |  | 0.1439 | 0.0051 |  | 0.0215 | 0.0002 |  | 106 | 83 |  | 137 | 5 |  | 137 | | 2 |
| YX2-03 | 4547 | 1134 |  | 0.25 | 0.0538 | 0.0019 |  | 0.1653 | 0.0055 |  | 0.0221 | 0.0002 |  | 361 | 80 |  | 155 | 5 |  | 141 | | 1 |
| YX2-04 | 1318 | 612 |  | 0.46 | 0.0518 | 0.0080 |  | 0.1650 | 0.0238 |  | 0.0224 | 0.0013 |  | 276 | 318 |  | 155 | 21 |  | 143 | | 8 |
| YX2-06 | 847 | 241 |  | 0.28 | 0.0496 | 0.0022 |  | 0.1440 | 0.0063 |  | 0.0211 | 0.0003 |  | 176 | 101 |  | 137 | 6 |  | 135 | | 2 |
| YX2-07 | 2017 | 490 |  | 0.24 | 0.0536 | 0.0025 |  | 0.1551 | 0.0068 |  | 0.0208 | 0.0003 |  | 354 | 106 |  | 146 | 6 |  | 133 | | 2 |
| YX2-08 | 702 | 119 |  | 0.17 | 0.0511 | 0.0023 |  | 0.1584 | 0.0071 |  | 0.0224 | 0.0003 |  | 243 | 73 |  | 149 | 6 |  | 143 | | 2 |
| YX2-09 | 1765 | 648 |  | 0.37 | 0.0492 | 0.0061 |  | 0.1437 | 0.0167 |  | 0.0206 | 0.0010 |  | 167 | 267 |  | 136 | 15 |  | 131 | | 6 |
| YX2-11 | 2782 | 529 |  | 0.19 | 0.0514 | 0.0026 |  | 0.1591 | 0.0076 |  | 0.0221 | 0.0004 |  | 257 | 86 |  | 150 | 7 |  | 141 | | 3 |
| YX2-12 | 1769 | 1184 |  | 0.67 | 0.0501 | 0.0033 |  | 0.1466 | 0.0092 |  | 0.0209 | 0.0005 |  | 198 | 156 |  | 139 | 8 |  | 133 | | 3 |
| YX2-13 | 1368 | 505 |  | 0.37 | 0.0538 | 0.0040 |  | 0.1635 | 0.0113 |  | 0.0217 | 0.0006 |  | 365 | 168 |  | 154 | 10 |  | 138 | | 4 |
| YX2-14 | 2016 | 529 |  | 0.26 | 0.0512 | 0.0039 |  | 0.1621 | 0.0116 |  | 0.0225 | 0.0006 |  | 250 | 176 |  | 153 | 10 |  | 144 | | 4 |
| YX2-15 | 6160 | 659 |  | 0.11 | 0.0522 | 0.0051 |  | 0.1673 | 0.0154 |  | 0.0227 | 0.0008 |  | 295 | 226 |  | 157 | 13 |  | 145 | | 5 |
| YX2-17 | 4579 | 986 |  | 0.22 | 0.0519 | 0.0053 |  | 0.1624 | 0.0157 |  | 0.0221 | 0.0008 |  | 280 | 234 |  | 153 | 14 |  | 141 | | 5 |
| YX2-18 | 369 | 232 |  | 0.63 | 0.0537 | 0.0063 |  | 0.1702 | 0.0189 |  | 0.0226 | 0.0009 |  | 367 | 270 |  | 160 | 16 |  | 144 | | 6 |
| YX2-19 | 727 | 336 |  | 0.46 | 0.0515 | 0.0084 |  | 0.1630 | 0.0246 |  | 0.0222 | 0.0014 |  | 265 | 333 |  | 153 | 22 |  | 142 | | 9 |
|  | | | | | | | | | | | | | | | | | | | | | | |
| *YZ13, synkinematic granitic pluton with deformed carapace, GPS:N31°9.36′;E115°58.74′* | | | | | | | | | | | | | | | | | | | | | | |
| YZ13-02 | 374 | 499 |  | 1.3 | 0.0475 | 0.0010 |  | 0.1426 | 0.0038 |  | 0.0218 | 0.0003 |  | 73 | 98 |  | 135 | 7 |  | 139 | 4 | |
| YZ13-04 | 189 | 235 |  | 1.2 | 0.0485 | 0.0009 |  | 0.1455 | 0.0039 |  | 0.0218 | 0.0004 |  | 123 | 86 |  | 138 | 7 |  | 139 | 5 | |
| YZ13-05 | 453 | 489 |  | 1.1 | 0.0484 | 0.0010 |  | 0.1463 | 0.0030 |  | 0.0219 | 0.0003 |  | 118 | 95 |  | 139 | 5 |  | 140 | 4 | |
| YZ13-06 | 594 | 738 |  | 1.2 | 0.0472 | 0.0012 |  | 0.1413 | 0.0036 |  | 0.0217 | 0.0003 |  | 58 | 119 |  | 134 | 6 |  | 138 | 4 | |
| YZ13-08 | 275 | 411 |  | 1.5 | 0.0485 | 0.0012 |  | 0.1473 | 0.0038 |  | 0.0220 | 0.0003 |  | 123 | 114 |  | 140 | 7 |  | 140 | 4 | |
| YZ13-09 | 277 | 328 |  | 1.2 | 0.0527 | 0.0014 |  | 0.1594 | 0.0034 |  | 0.0219 | 0.0003 |  | 315 | 118 |  | 150 | 6 |  | 140 | 4 | |
| YZ13-10 | 491 | 496 |  | 1.0 | 0.0501 | 0.0011 |  | 0.1523 | 0.0030 |  | 0.0220 | 0.0003 |  | 199 | 100 |  | 144 | 5 |  | 140 | 4 | |
| YZ13-11 | 299 | 408 |  | 1.4 | 0.0474 | 0.0012 |  | 0.1430 | 0.0029 |  | 0.0219 | 0.0003 |  | 68 | 118 |  | 136 | 5 |  | 140 | 4 | |
| YZ13-12 | 486 | 669 |  | 1.4 | 0.0496 | 0.0010 |  | 0.1497 | 0.0043 |  | 0.0219 | 0.0003 |  | 175 | 92 |  | 142 | 7 |  | 140 | 4 | |
| YZ13-13 | 156 | 208 |  | 1.3 | 0.0493 | 0.0009 |  | 0.1500 | 0.0045 |  | 0.0221 | 0.0003 |  | 161 | 84 |  | 142 | 8 |  | 141 | 4 | |
| YZ13-14 | 299 | 317 |  | 1.1 | 0.0512 | 0.0012 |  | 0.1551 | 0.0037 |  | 0.0220 | 0.0003 |  | 249 | 106 |  | 146 | 6 |  | 140 | 4 | |
| YZ13-16 | 474 | 427 |  | 0.9 | 0.0464 | 0.0012 |  | 0.1414 | 0.0032 |  | 0.0221 | 0.0003 |  | 17 | 122 |  | 134 | 6 |  | 141 | 4 | |
| YZ13-17 | 184 | 261 |  | 1.4 | 0.0478 | 0.0010 |  | 0.1439 | 0.0039 |  | 0.0218 | 0.0003 |  | 88 | 97 |  | 137 | 7 |  | 139 | 4 | |
| YZ13-18 | 338 | 489 |  | 1.4 | 0.0489 | 0.0013 |  | 0.1469 | 0.0030 |  | 0.0218 | 0.0005 |  | 142 | 122 |  | 139 | 5 |  | 139 | 6 | |
| YZ13-19 | 430 | 397 |  | 0.9 | 0.0490 | 0.0010 |  | 0.1476 | 0.0030 |  | 0.0219 | 0.0003 |  | 147 | 94 |  | 140 | 5 |  | 140 | 4 | |
| YZ13-21 | 301 | 323 |  | 1.1 | 0.0474 | 0.0012 |  | 0.1432 | 0.0028 |  | 0.0219 | 0.0003 |  | 68 | 118 |  | 136 | 5 |  | 140 | 4 | |
| YZ13-23 | 370 | 548 |  | 1.5 | 0.0509 | 0.0013 |  | 0.1557 | 0.0037 |  | 0.0222 | 0.0003 |  | 235 | 116 |  | 147 | 6 |  | 142 | 4 | |
| YZ13-25 | 377 | 418 |  | 1.1 | 0.0488 | 0.0011 |  | 0.1485 | 0.0038 |  | 0.0221 | 0.0003 |  | 137 | 104 |  | 141 | 7 |  | 141 | 4 | |
| YZ13-26 | 380 | 542 |  | 1.4 | 0.0496 | 0.0009 |  | 0.1499 | 0.0033 |  | 0.0219 | 0.0003 |  | 175 | 83 |  | 142 | 6 |  | 140 | 4 | |
| YZ13-27 | 531 | 538 |  | 1.0 | 0.0493 | 0.0012 |  | 0.1492 | 0.0030 |  | 0.0220 | 0.0003 |  | 161 | 107 |  | 141 | 5 |  | 140 | 4 | |
| YZ13-28 | 353 | 337 |  | 1.0 | 0.0499 | 0.0013 |  | 0.1519 | 0.0038 |  | 0.0221 | 0.0003 |  | 189 | 116 |  | 144 | 7 |  | 141 | 4 | |
| YZ13-29 | 222 | 299 |  | 1.3 | 0.0471 | 0.0012 |  | 0.1439 | 0.0039 |  | 0.0221 | 0.0003 |  | 53 | 119 |  | 136 | 7 |  | 141 | 4 | |
| YZ13-30 | 98 | 119 |  | 1.2 | 0.0501 | 0.0012 |  | 0.1508 | 0.0033 |  | 0.0218 | 0.0003 |  | 199 | 109 |  | 143 | 6 |  | 139 | 4 | |
| YZ13-31 | 406 | 398 |  | 1.0 | 0.0514 | 0.0010 |  | 0.1547 | 0.0040 |  | 0.0218 | 0.0003 |  | 258 | 85 |  | 146 | 7 |  | 139 | 4 | |

# Supplementary table 5. LA-ICPMS U-Pb analytical results for zircon of samples from the radial directed submagmatic flow domain

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Analysis | content(×10-6） | |  | Th/U | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |  | 207Pb/206Pb | |  | 207Pb/235U | |  | 206Pb/238U | |
| U238 | Th232 |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Ratio | ±1σ |  | Age | ±1σ |  | Age | ±1σ |  | Age | ±1σ |
| *LT20, leucosome in the migmatite, GPS:N30°49.78′；E115°24.18′* | | | | | | | | | | | | | | | | | | | | | |
| LT20-03 | 351 | 192 |  | 0.55 | 0.0495 | 0.001 |  | 0.142 | 0.004 |  | 0.1417 | 0.0039 |  | 171 | 102 |  | 135 | 7 |  | 133 | 2 |
| LT20-04 | 602 | 256 |  | 0.43 | 0.0487 | 0.001 |  | 0.14 | 0.004 |  | 0.1397 | 0.0044 |  | 132 | 132 |  | 133 | 8 |  | 133 | 2 |
| LT20-06 | 529 | 187 |  | 0.35 | 0.0507 | 0.001 |  | 0.147 | 0.005 |  | 0.1471 | 0.0052 |  | 226 | 125 |  | 139 | 9 |  | 134 | 2 |
| LT20-07 | 367 | 156 |  | 0.42 | 0.0484 | 0.001 |  | 0.142 | 0.004 |  | 0.1415 | 0.0039 |  | 118 | 105 |  | 134 | 7 |  | 135 | 2 |
| LT20-09 | 419 | 140 |  | 0.34 | 0.0494 | 0.001 |  | 0.144 | 0.004 |  | 0.1444 | 0.0042 |  | 166 | 102 |  | 137 | 7 |  | 135 | 2 |
| LT20-10 | 1808 | 989 |  | 0.55 | 0.0505 | 0.001 |  | 0.138 | 0.004 |  | 0.1383 | 0.0045 |  | 217 | 98.8 |  | 132 | 8 |  | 127 | 1 |
| LT20-11 | 1262 | 393 |  | 0.31 | 0.0511 | 0.001 |  | 0.14 | 0.005 |  | 0.1398 | 0.005 |  | 244 | 115 |  | 133 | 9 |  | 127 | 1 |
| LT20-12 | 250 | 133 |  | 0.53 | 0.0497 | 0.001 |  | 0.141 | 0.005 |  | 0.1414 | 0.0047 |  | 180 | 129 |  | 134 | 8 |  | 131 | 2 |
| LT20-15 | 183 | 106 |  | 0.58 | 0.0505 | 0.001 |  | 0.15 | 0.004 |  | 0.1497 | 0.0043 |  | 217 | 108 |  | 142 | 7 |  | 137 | 2 |
| LT20-16 | 345 | 110 |  | 0.32 | 0.0508 | 0.001 |  | 0.151 | 0.004 |  | 0.1507 | 0.0044 |  | 231 | 107 |  | 143 | 8 |  | 137 | 2 |
| LT20-17 | 189 | 130 |  | 0.69 | 0.0513 | 0.003 |  | 0.15 | 0.004 |  | 0.1503 | 0.0043 |  | 253 | 237 |  | 142 | 7 |  | 136 | 4 |
| LT20-18 | 232 | 122 |  | 0.52 | 0.0511 | 0.002 |  | 0.146 | 0.003 |  | 0.1463 | 0.0034 |  | 244 | 212 |  | 139 | 6 |  | 133 | 4 |
| LT20-19 | 442 | 266 |  | 0.6 | 0.0518 | 0.001 |  | 0.153 | 0.004 |  | 0.1526 | 0.0037 |  | 276 | 95.3 |  | 144 | 6 |  | 137 | 2 |
| LT20-20 | 757 | 516 |  | 0.68 | 0.0509 | 0.001 |  | 0.149 | 0.004 |  | 0.1494 | 0.0042 |  | 235 | 107 |  | 141 | 7 |  | 136 | 2 |
| LT20-21 | 368 | 190 |  | 0.51 | 0.051 | 0.001 |  | 0.15 | 0.004 |  | 0.1495 | 0.0039 |  | 240 | 106 |  | 141 | 7 |  | 136 | 2 |
| LT20-22 | 242 | 105 |  | 0.43 | 0.0519 | 0.001 |  | 0.153 | 0.005 |  | 0.1525 | 0.0054 |  | 280 | 121 |  | 144 | 9 |  | 136 | 2 |
| LT20-23 | 134 | 92 |  | 0.69 | 0.0521 | 0.001 |  | 0.153 | 0.005 |  | 0.1532 | 0.005 |  | 289 | 120 |  | 145 | 9 |  | 136 | 2 |
| LT20-25 | 410 | 245 |  | 0.6 | 0.0504 | 0.001 |  | 0.149 | 0.005 |  | 0.1485 | 0.0049 |  | 212 | 126 |  | 141 | 8 |  | 137 | 2 |
| LT20-26 | 218 | 148 |  | 0.68 | 0.0526 | 0.001 |  | 0.155 | 0.004 |  | 0.1553 | 0.0044 |  | 311 | 93.3 |  | 147 | 8 |  | 137 | 2 |
| LT20-27 | 449 | 308 |  | 0.69 | 0.0491 | 0.001 |  | 0.145 | 0.004 |  | 0.1448 | 0.0036 |  | 152 | 93.5 |  | 137 | 6 |  | 137 | 2 |
| LT20-28 | 175 | 90 |  | 0.52 | 0.0497 | 0.001 |  | 0.148 | 0.003 |  | 0.1477 | 0.0034 |  | 180 | 91.9 |  | 140 | 6 |  | 137 | 2 |
| LT20-30 | 245 | 271 |  | 1.11 | 0.0677 | 0.002 |  | 1.142 | 0.044 |  | 1.1418 | 0.0445 |  | 858 | 127 |  | 773 | 41 |  | 744 | 36 |
| LT20-31 | 293 | 345 |  | 1.18 | 0.0679 | 0.002 |  | 1.153 | 0.041 |  | 1.1529 | 0.0409 |  | 865 | 124 |  | 779 | 38 |  | 749 | 36 |
| LT20-32 | 179 | 161 |  | 0.9 | 0.064 | 0.002 |  | 1.185 | 0.047 |  | 1.1846 | 0.047 |  | 742 | 145 |  | 794 | 43 |  | 812 | 38 |
| LT20-34 | 151 | 177 |  | 1.17 | 0.0676 | 0.002 |  | 1.145 | 0.046 |  | 1.1449 | 0.0457 |  | 856 | 149 |  | 775 | 42 |  | 747 | 37 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *LT21, Pegmatite cutting the migmatite, GPS:N30°49.78′；E115°24.18′* | | | | | | | | | | | | | | | | | | | | | |
| LT21-01 | 1775 | 330 |  | 0.19 | 0.04862 | 0.00461 |  | 0.1281 | 0.0121 |  | 0.0191 | 0.0008 |  | 128 | 211 |  | 122 | 11 |  | 122 | 5 |
| LT21-02 | 614 | 259 |  | 0.42 | 0.04850 | 0.00332 |  | 0.1271 | 0.0088 |  | 0.0191 | 0.0006 |  | 124 | 152 |  | 121 | 8 |  | 122 | 4 |
| LT21-03 | 543 | 326 |  | 0.60 | 0.04858 | 0.00316 |  | 0.1306 | 0.0087 |  | 0.0193 | 0.0006 |  | 128 | 144 |  | 125 | 8 |  | 123 | 4 |
| LT21-05 | 283 | 149 |  | 0.53 | 0.04785 | 0.00300 |  | 0.1275 | 0.0079 |  | 0.0193 | 0.0006 |  | 100 | 135 |  | 122 | 7 |  | 123 | 4 |
| LT21-06 | 213 | 150 |  | 0.70 | 0.06315 | 0.01130 |  | 1.0438 | 0.1908 |  | 0.1254 | 0.0082 |  | 722 | 387 |  | 726 | 95 |  | 762 | 47 |
| LT21-07 | 991 | 379 |  | 0.38 | 0.04788 | 0.00864 |  | 0.1225 | 0.0225 |  | 0.0194 | 0.0013 |  | 100 | 372 |  | 117 | 20 |  | 124 | 8 |
| LT21-08 | 179 | 194 |  | 1.08 | 0.06563 | 0.00982 |  | 1.1472 | 0.1740 |  | 0.1317 | 0.0075 |  | 794 | 312 |  | 776 | 82 |  | 798 | 43 |
| LT21-09 | 99 | 117 |  | 1.19 | 0.06846 | 0.01004 |  | 1.1427 | 0.1696 |  | 0.1261 | 0.0071 |  | 883 | 307 |  | 774 | 80 |  | 765 | 41 |
| LT21-10 | 700 | 268 |  | 0.38 | 0.04841 | 0.00567 |  | 0.1273 | 0.0149 |  | 0.0197 | 0.0009 |  | 120 | 256 |  | 122 | 13 |  | 126 | 6 |
| LT21-12 | 147 | 156 |  | 1.06 | 0.06886 | 0.00560 |  | 1.1588 | 0.0935 |  | 0.1250 | 0.0048 |  | 894 | 169 |  | 781 | 44 |  | 760 | 27 |
| LT21-13 | 378 | 234 |  | 0.62 | 0.04819 | 0.00378 |  | 0.1260 | 0.0093 |  | 0.0193 | 0.0006 |  | 109 | 174 |  | 120 | 8 |  | 123 | 4 |
| LT21-14 | 898 | 120 |  | 0.13 | 0.05202 | 0.00262 |  | 0.1426 | 0.0069 |  | 0.0199 | 0.0006 |  | 287 | 115 |  | 135 | 6 |  | 127 | 4 |
| LT21-15 | 1332 | 261 |  | 0.20 | 0.04736 | 0.00877 |  | 0.1295 | 0.0247 |  | 0.0198 | 0.0014 |  | 78 | 380 |  | 124 | 22 |  | 126 | 9 |
| LT21-16 | 1357 | 172 |  | 0.13 | 0.04768 | 0.00860 |  | 0.1276 | 0.0236 |  | 0.0194 | 0.0013 |  | 83 | 381 |  | 122 | 21 |  | 124 | 9 |
| LT21-18 | 724 | 96 |  | 0.13 | 0.05415 | 0.00933 |  | 0.1463 | 0.0258 |  | 0.0197 | 0.0013 |  | 376 | 348 |  | 139 | 23 |  | 126 | 8 |
| LT21-19 | 1240 | 179 |  | 0.14 | 0.05242 | 0.00688 |  | 0.1385 | 0.0183 |  | 0.0193 | 0.0010 |  | 306 | 283 |  | 132 | 16 |  | 123 | 6 |
| LT21-20 | 932 | 401 |  | 0.43 | 0.05178 | 0.00658 |  | 0.1373 | 0.0176 |  | 0.0192 | 0.0010 |  | 276 | 267 |  | 131 | 16 |  | 123 | 6 |
| LT21-21 | 890 | 208 |  | 0.23 | 0.05168 | 0.00537 |  | 0.1400 | 0.0146 |  | 0.0197 | 0.0009 |  | 333 | 241 |  | 133 | 13 |  | 126 | 5 |
| LT21-23 | 977 | 99 |  | 0.10 | 0.04657 | 0.00320 |  | 0.1269 | 0.0085 |  | 0.0198 | 0.0006 |  | 33 | 150 |  | 121 | 8 |  | 126 | 4 |
| LT21-24 | 730 | 203 |  | 0.28 | 0.04934 | 0.00292 |  | 0.1323 | 0.0079 |  | 0.0194 | 0.0006 |  | 165 | 139 |  | 126 | 7 |  | 124 | 4 |
| LT21-27 | 955 | 230 |  | 0.24 | 0.05180 | 0.00255 |  | 0.1434 | 0.0070 |  | 0.0201 | 0.0006 |  | 276 | 110 |  | 136 | 6 |  | 128 | 4 |
| LT21-28 | 970 | 90 |  | 0.09 | 0.05131 | 0.00223 |  | 0.1401 | 0.0061 |  | 0.0197 | 0.0005 |  | 254 | 100 |  | 133 | 5 |  | 126 | 3 |
| LT21-30 | 1178 | 457 |  | 0.39 | 0.04918 | 0.00218 |  | 0.1331 | 0.0057 |  | 0.0196 | 0.0005 |  | 167 | 101 |  | 127 | 5 |  | 125 | 3 |

# Detailed rocking information, zircon morphology and dating results of the dated samples

#### 4.2.1 Samples from the Xiaotian-Mozitan shear zone (XMSZ)

##### Sample XMa1

This sample is collected from a mylonitic sheath fold of the XMSZ (Fig.4c). Zircon grains in it are of 100– 150 um in length with aspect ratio around 1:3– 1:4, greyish or yellowish in color, generally automorphic prism in crystal shapes. Oscillatory zoning with middle-to-light luminescence is commonly observed on CL images of most zircons (Fig. 10XMa1). Twenty-five grains were selected to be dated and 18 spots out of 25 yielded apparent ages with concordance values above 90 percent. These 18 ages all rest on or close to (within the error bar) the concordia line, defining a weighted mean 206Pb/238U age of 750.4±7.4 Ma (MSWD= 0.48) with variable Th/U ratios ranging from 0.35 to 1.49.

##### Sample XMa2

The sample is a granitic dyke that cut through the mylonitic sheath fold referred above (Fig. 4c). Zircon grains in this sample are in changeable sizes of 50 to 150 um in lengths, grey in color, and a high proportion of them are broken and incomplete. Concentric automorphic zoning could be observed from the complete grains under polarized light. CL images consistently display interior textrue of clear oscillatory zonation with light luminescence in most grains (Fig. 10XMa2). U-Pb dating was performed on 20 grains of clear internal textures, which produced 17 apparent ages, plotting on the concordia line. The age population of this sample is concentrated, with a weighted mean 206Pb/238U age of 129.4±1.7 Ma (MSWD= 0.29) and high Th/U ratios of 0.40 to 1.15.

##### Sample XMa3

It is a felsic protomylonite in which large feldspar porphyroblasts are well developed. Zircon grains in this sample have relatively similar sizes of 150 um in length with aspect ratios of 1:3–1:4, mostly yellowish in color. Regular prismatic crystals are predominant among these grains. The majority of zircon crystals present coherent growth of oscillatory zoning with middle to low luminescence, while some of them carry inherited cores of weak oscillatory zoning mostly in CL brightness or greyness (Fig. 10XMa3). LA-ICPMS performance was conducted on 35 spots from 30 representative grains. Twenty-one apparent ages with concordance over 90 percent were obtained, including six from the cores and others from rim domains of the core-bearing grains or inner domains of the core-free grains. Ages from the cores are concentrated, from 748 Ma to 765 Ma, to form a weighted mean 206Pb/238U age of 763±28 Ma (MSWD= 0.01) with Th/U ratios of 0.87~1.17. Other 16 ages define a weighted mean 206Pb/238U age of 142.1±1.4 Ma (MSWD= 0.57) with Th/U ratios of 0.12~1.29.

#### 4.2.2 Samples from the Shangcheng-Macheng shear zone (SMSZ)

##### Sample SM1

The sample is a granite from a pluton that intruded in mylonites of the SMSZ (Fig. 7a). Zircon grains from this sample are sufficiently grown, with automorphic prismatic shapes, greyish or colorless, around 100 um in length and 30 – 50 um in width. CL images present oscillatory zoning developed from consistent growth (Fig. 10 SM1). Nineteen analyses from 29 grains were obtained by LA-ICP MS performance. A weighted mean 206Pb/238U age of 129.0±1.4 Ma (MSWD= 0.61) was defined, with Th/U ratios of 0.53 to 1.15.

##### Sample SM2

The sample is a biotite-feldspathic mylonite of the SMSZ (Fig. 7e). Zircon grains from this sample have sizes of 70 um to 150 um with aspect ratios of 1.5 – 4, mostly yellowish in color, automorphic-to-hypautomorphic prism in crystal shape. Oscillatory zoning is well developed in most grains, which show luminescence of different extents, from CL darkness to CL brightness (Fig. 10 SM2). Twenty spots on homogeneous domains of 20 grains were performed by LA-ICPMS. One concentrated cluster of zircon ages from 16 analyses was obtained, defining a weighted mean 206Pb/238U age of 742.0±9.0 Ma (MSWD= 0.35), with Th/U ratios ranging from 0.39 to 1.85.

##### Sample SM3

It is from a granitic dyke with mylonization at the edges (Fig. 7e). Zircon grains of SM3 are generally irregular in hypautomorphic-xenomorphic shapes sizing from 30 um to 120 um with aspect ratios of 1:1-1:4, grey or yellowish in color. Cracks within or across the crystals are common, and a large proportion of the grains are broken and incomplete. CL images show interior textures of oscillatory zonation mostly with middle luminescence (Fig. 10 SM3). Twenty grains with coherent structures received LA-ICPMS performance, yielding 19 spot analyses, which define a weighted mean 206Pb/238U age of 136.5±1.7 Ma (MSWD= 0.20), with Th/U ratios of 0.27-1.07.

#### 4.2.3 Samples from the Shuihou-Xishui-Tuanfeng shear zone (SXTSZ)

##### Sample SW1

This sample was collected from mylonitic gneiss on the Shuihou-Wuhe segment of the SXTSZ (Fig. 10b). Zircons from this sample have sizes of 80-200 um in length with aspect ratios of 1:2-1:4, mostly yellowish in color. The majority of the grains bear regular prismatic shapes and remain relatively complete. Concentric oscillatory zoning is commonly displayed on CL images of the most zircon grains (Fig. 10 SW1). Twenty five spots from 20 grains were selected to have LA-ICPMS analyses performed, yielding 19 concordant apparent-ages, which define a weighted mean 206Pb/238U age of 785.2±8.0 Ma (MSWD = 0.52), with high Th/U ratios ranging from 0.60 to 1.53 (1.0 in average).

##### Sample SW2

It is from a granitic vein encased in mylonitic gneisses as its wall rock, in which sample SW1 was collected (Fig. 10b). Zircons from this sample are in lengths of 50-150 um with aspect ratios ranging from 1:2 to 1:5, grey in color under planer-polarized light. Most of the grains appear automorphic-to-hypautomorphic crystal shapes, but are largely broken into fragments. CL images exhibit distinct oscillatory zoning in their interior textures (Fig. 10 SW2). Eighteen apparent ages out of 25 dated spots were obtained from 20 grains, yielding a weighted mean 206Pb/238U age of 132±1.8 Ma (MSWD= 2.0), with Th/U ratios ranging from 0.03 to 0.1.

##### Sample XT1

It is a delta-shaped felsic lens with oriented augen feldspar porphyroblasts of delta-type inside, on the Xishui-Tuanfeng segment of the SXTSZ (Fig. 10e and f). Zircons in this sample have variable sizes widely ranging from 30 um to 150 um, with aspect ratios broadly changing from 1:1 to 1:5, mostly grey in color. The grains are automorphic (partially) to hypautomorphic (mainly) in crystal shapes. Interior structures of them are characteristic of oscillatory zoning in different degrees, mostly in CL greyness (Fig. 10 XT2). Thirty spots from 25 grains were dated by LA-ICPMS analyses, which produced 14 apparent ages with concordant values above 90 percent, defining a weighted mean 206Pb/238U age of 136.1±1.4 Ma (MSWD = 0.35), with a wide range of Th/U ratios from 0.01 to 1.0.

##### Sample XT2

It was collected from a felsic mylonite that is the wall rock of the sample XT1. Zircon grains in this sample have sizes of 80~100 um in length with aspect ratios ranging from 1:2 to 1:4, grey in color mostly. The majority of grains were sufficiently grown into automorphic crystals of prismatic shapes, with concentric structures of oscillatory zoning mainly in CL greyness or brightness (Fig. 10 XT1). Twenty five spots from 25 grains were analyzed, which produced 19 apparent ages of concordant values above 90 percent, defining a weighted mean 206Pb/238U age of 789.4±8.1 Ma (MSWD= 0.52), with Th/U ratios ranging from 0.56 to 1.57 (1.0 in average).

#### 4.2.4 Samples from the NW-SE directed coaxial flow domain

##### Sample YX1

This sample was collected from the NW-SE directed coaxial flowing gneiss (Fig. 15 c and d). Zircon grains vary in sizes from 40 um to 120 um with aspect ratios of 1:1-1:4. Crystal shapes of these zircons are variable from automorphic to xenomorphic, grey or yellowish in color. Mainly two types of zircons were recognized in the light of their interior texture displayed on the CL images. Type-one is characterized by a core-mantle texture, as non-zoned mantles mostly in CL darkness surround irregularly-shaped cores most of which remain oscillatory zoning with middle-to-strong luminescence. Type-two features homogeneously-grown interior textures with non-zoning or patched/sector zoning mostly in CL greyness (Fig. 10 YX1). Two populations of ages were obtained from 35 spots, which gave 19 apparent ages with concordance over 90 percent. The first population is comprised of five ages ranging between 726 Ma and 765 Ma, all of which are derived from core domains of the type-one grains, defining a weighted mean 206Pb/238U age of 734±24 Ma (MSWD= 0.29), with high Th/U ratios of 0.65-1.81. The second population consists of 14 ages, which are derived from mantle domains of the type-one grains and inner domains of the type-two grains. A weighted mean 206Pb/238U age of 143.6±2.1 Ma (MSWD = 0.26) with low Th/U ratios of 0.006~0.089 was defined.

##### Sample YX2

The sample was collected from a geometrically symmetric granitic boudin with weak internal-foliation concordant with the intensive external-foliation in its wall rocks of the NW-SE directed coaxial flowing gneiss (Fig. 15e). Zircon grains in this sample have regular prismatic shapes in most cases, ranging in size from 30–100 um in length with aspect ratios of 1:2-1:4, grey or yellowish in color. CL images show oscillatory zoning with middle-to-low luminescence in interior structures of most grains (Fig. 10 XY2). Eighteen analyses from 25 grains were obtained by LA-ICPMS analyses. A concentrated age population was formed by 16 apparent ages, defining a weighted mean 206Pb/238U age of 138.6±1.8 Ma (MSWD= 2.1), with Th/U ratios ranging from 0.3 to 1.0. The weighted mean 206Pb/238U age of 138.6±1.8 Ma is interpreted as the emplacement timing of the dyke.

##### Sample YZ13

The sample was collected from a granitic intrusion that carries a deformation carapace (Fig. 15f). Zircon grains in the sample are greyish to colorless, generally long prismatic automorphic in shape, 100 ~ 150 um in size, with aspect ratios of 1:2-1:4. Most of the grains exhibit homogeneous texture of clear oscillatory zoning in middle to light luminescence in CL images (Fig. 10 YZ13). Twenty-four concordant ages within the error bar were obtained by LA-ICPMS analyses, with Th/U ratios of 0.9 to 1.5, defining a weighted mean 206Pb/238U age of 139.9±1.5Ma (MSWD= 0.7).

#### 4.2.5 Sample from the radial directed submagmatic flow domain

##### Sample LT20

The sample was collected from the stromatic migmatite of the Huangtuling dome (Fig. 16a). Zircon grains in the sample are greyish to yellowish in color, xenomorphic-hypautomorphic to automorphic in stubby to long prismatic shape, and 100~150 um in size, with aspect ratio of 1:1 to 1:3. Most of the grains carry inherited cores with newly grown mantles. The cores show magmatic oscillatory zoning of middle to light luminescence, and the mantles present planar or weak to clear oscillatory zoning of middle to black luminescence in CL images (Fig. 10 LT20). Thirty five spots from 30 grains were analyzed, producing 25 concordant ages within the error bar. Four Neoproterozoic ages of 744±36 ~ 812±38 Ma with Th/U ratios of 0.9 to 1.2 are unanimously from the inherited cores, and the mantles give a sequence of ages from 137±2 ~ 127±1 Ma with Th/U ratios ranging from 0.3 to 0.7.

##### Sample LT21

The sample was collected from a ductilely undeformed pegmatite that intruded into the stromatic migmatite in the Huangtuling dome (Fig. 16a). Zircon grains in this sample have sizes of 70~150 um in length with aspect ratios ranging from 1:2 to 1:4, yellowish in color mostly. Crystal grains were differentially grown into xenomorphic shapes or automorphic ones, a large portion of which carry inherited cores and oscillatory zoning mantles, few with non-zoned or planer zoned internal texture (Fig. 10 LT21). Thirty five spots from 30 grains were analyzed, which produced 23 concordant ages within the error bar. The mantles and homogeneously grown grains give Early Cretaceous ages that define a weighted mean 206Pb/238U age of 124.7±2.0 Ma (MSWD= 0.19), with Th/U ratios ranging from 0.09 to 0.62 (0.3 in average). The inherited cores universally yield Neoproterozoic ages.

# Reference

Compston, W. (1992), Zircon U-Pb ages for the early Cambrian time-scale, *J.geolog.soc*, *149*(2), 171-184.

Liu, Y., Z. Hu, S. Gao, D. Günther, J. Xu, C. Gao, and H. Chen (2008), In situ analysis of major and trace elements of anhydrous minerals by LA-ICP-MS without applying an internal standard, *Chemical Geology*, *257*(1), 34-43. <https://doi.org/10.1016/j.chemgeo.2008.08.004>.

Liu, Y., Z. Hu, K. Zong, C. Gao, S. Gao, J. Xu, and H. Chen (2010), Reappraisement and refinement of zircon U-Pb isotope and trace element analyses by LA-ICP-MS, *Chinese Science Bulletin*, *55*(15), 1535-1546. <https://doi.org/10.1007/s11434-010-3052-4>.

Ludwig, K. R. (2003), ISOPLOT 3.0: A Geochronological Toolkit for Microsoft Excel. Berkeley Geochronology Center Special Publication, *US Geol. Sur. Open File Rep.*, *39*, 91-445.

Stacey, J. S., and J. D. Kramers (1975), Approximation of terrestrial lead isotope evolution by a two-stage model, *Earth and Planetary Science Letters*, *26*(2), 207-221. <https://doi.org/10.1016/0012-821X(75)90088-6>.

Whitehouse, M. J., B. S. Kamber, and S. Moorbath (1999), Age significance of U–Th–Pb zircon data from early Archaean rocks of west Greenland—a reassessment based on combined ion-microprobe and imaging studies, *Chemical Geology*, *160*(3), 201-224. <https://doi.org/10.1016/S0009-2541(99)00066-2>.

Wiedenbeck, M., P. Allé, F. Corfu, W. L. Griffin, M. Meier, F. Oberli, A. V. Quadt, J. C. Roddick, and W. Spiegel (1995), Three natural zircon standards for U‐Th‐Pb, Lu‐Hf, trace element and REE analyses, *Geostandards & Geoanalytical Research*, *19*(1), 1-23. <https://doi.org/10.1111/j.1751-908X.1995.tb00147.x>.

Williams, I. S. (1998), U-Th-Pb geochronology by ion microprobe, *Applications of Microanalytical Techniques to Understanding Mineralizing Processes*.