Supplementary Tables

**Table S1 EPMA results of plagioclase from Yashan host and its MMEs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Yashan host | | | | | | | | MMEs | | | | | | | | | | | | | | | | | | |
| QX-2-1-3 C4 | | | | QX-2-1-3 C5 | | | | QX-3-1-3 C1 | | | | | QX-1-1-2 C2 | | | | | QX-3-1-6 C1 | | | | | | | | |
| rim1 | core1 | core2 | rim2 | rim1 | core1 | core2 | rim2 | rim 1 | rim 2 | rim 3 | core 4 | core 5 | 1 | 2 | 3 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| SiO2 | 60.4 | 60.1 | 60.0 | 60.5 | 64.1 | 61.1 | 60.8 | 60.6 | 56.4 | 55.4 | 56.3 | 60.6 | 61.3 | 60.5 | 62.5 | 55.8 | 61.7 | 64.3 | 65.5 | 60.8 | 59.7 | 59.9 | 59.4 | 60.0 | 60.7 | 60.3 | 60.4 |
| Al2O3 | 25.6 | 25.4 | 25.7 | 25.4 | 23.1 | 24.6 | 25.1 | 25.5 | 27.4 | 28.4 | 27.1 | 25.3 | 24.2 | 25.7 | 24.0 | 28.3 | 24.2 | 23.1 | 21.2 | 23.6 | 24.6 | 24.1 | 24.8 | 24.3 | 24.2 | 24.1 | 24.0 |
| CaO | 6.1 | 6.0 | 6.5 | 5.8 | 3.4 | 5.3 | 5.6 | 5.8 | 9.5 | 10.2 | 9.1 | 6.7 | 5.6 | 6.8 | 4.8 | 9.6 | 5.6 | 3.9 | 2.2 | 5.3 | 6.4 | 6.0 | 6.6 | 6.3 | 5.8 | 5.8 | 5.6 |
| Na2O | 7.9 | 7.8 | 7.6 | 8.0 | 9.7 | 8.3 | 8.0 | 8.3 | 6.2 | 5.9 | 6.4 | 7.7 | 8.4 | 7.5 | 8.0 | 5.5 | 7.6 | 9.2 | 10.6 | 8.3 | 7.6 | 7.7 | 7.5 | 7.7 | 8.2 | 7.9 | 8.1 |
| K2O | 0.2 | 0.4 | 0.3 | 0.2 | 0.2 | 0.4 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.4 | 0.2 | 0.3 | 0.1 | 0.1 | 0.3 | 0.4 | 0.4 | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 |
| Si | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 2.7 | 2.7 | 2.7 | 2.5 | 2.5 | 2.6 | 2.7 | 2.7 | 2.7 | 2.8 | 2.5 | 2.7 | 2.8 | 2.9 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| Al | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.3 | 1.3 | 1.3 | 1.5 | 1.5 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.5 | 1.3 | 1.2 | 1.1 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Ca | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 0.3 | 0.2 | 0.5 | 0.3 | 0.2 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Na | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.7 | 0.7 | 0.7 | 0.5 | 0.5 | 0.6 | 0.7 | 0.7 | 0.6 | 0.7 | 0.5 | 0.7 | 0.8 | 0.9 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| K | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| An | 29.4 | 29.3 | 31.4 | 28.4 | 16.2 | 25.5 | 27.3 | 27.6 | 45.4 | 48.8 | 43.9 | 32.1 | 26.9 | 33.3 | 24.2 | 48.2 | 28.4 | 18.8 | 10.1 | 25.8 | 30.8 | 29.1 | 32.2 | 30.8 | 27.8 | 28.4 | 27.2 |
| Ab | 69.2 | 68.6 | 66.7 | 70.5 | 82.7 | 72.1 | 70.8 | 71.5 | 54.2 | 50.8 | 55.4 | 66.8 | 72.3 | 66.2 | 73.1 | 50.3 | 69.6 | 80.6 | 89.3 | 72.4 | 66.8 | 68.4 | 65.9 | 68.0 | 71.3 | 70.3 | 71.3 |
| Or | 1.4 | 2.1 | 2.0 | 1.1 | 1.1 | 2.4 | 1.9 | 1.0 | 0.4 | 0.4 | 0.7 | 1.1 | 0.9 | 0.5 | 2.6 | 1.5 | 2.0 | 0.6 | 0.6 | 1.8 | 2.4 | 2.6 | 1.9 | 1.2 | 0.9 | 1.3 | 1.5 |

**Table S2 EPMA results of amphibole from Yashan host and its MMEs**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Yashan host | |  | MMEs | | | | |
|  | QX-2-1-3 C1 | |  | QX-3-1-3 C2 | | | | QX-3-1-6 C2 |
|  | 1 | 2 |  | 1 | 2 | 3 | 4 | 1 |
| SiO2 | 47.71 | 48.54 |  | 49.69 | 50.17 | 50.04 | 52.26 | 47.95 |
| TiO2 | 0.79 | 0.52 |  | 0.67 | 0.54 | 0.51 | 0.27 | 0.72 |
| Al2O3 | 7.43 | 6.31 |  | 5.96 | 5.72 | 6.11 | 4.57 | 6.64 |
| FeO | 13.26 | 13.34 |  | 11.31 | 12.05 | 11.53 | 10.64 | 12.86 |
| MnO | 0.37 | 0.37 |  | 0.26 | 0.33 | 0.34 | 0.25 | 0.29 |
| MgO | 13.03 | 13.49 |  | 14.13 | 14.48 | 14.66 | 15.87 | 13.60 |
| CaO | 11.67 | 11.82 |  | 12.17 | 11.87 | 12.08 | 12.45 | 11.62 |
| Na2O | 1.32 | 1.02 |  | 1.07 | 1.07 | 1.02 | 0.86 | 1.38 |
| K2O | 0.79 | 0.59 |  | 0.55 | 0.53 | 0.54 | 0.36 | 0.74 |
| F | 0.66 | bd |  | 0.47 | 0.16 | bd | 1.21 | 0.02 |
| Si | 7.04 | 7.22 |  | 7.29 | 7.32 | 7.30 | 7.42 | 7.15 |
| AlⅣ | 0.96 | 0.78 |  | 0.71 | 0.68 | 0.70 | 0.58 | 0.85 |
| AlⅥ | 0.33 | 0.33 |  | 0.32 | 0.31 | 0.35 | 0.18 | 0.32 |
| Ti | 0.09 | 0.06 |  | 0.07 | 0.06 | 0.06 | 0.03 | 0.08 |
| Fe3+ | 0.66 | 0.63 |  | 0.78 | 0.71 | 0.69 | 0.95 | 0.55 |
| Fe2+ | 0.97 | 1.03 |  | 0.61 | 0.76 | 0.72 | 0.32 | 1.06 |
| Mn | 0.05 | 0.05 |  | 0.03 | 0.04 | 0.04 | 0.03 | 0.04 |
| Mg | 2.87 | 2.99 |  | 3.09 | 3.15 | 3.19 | 3.36 | 3.02 |
| Ca | 1.84 | 1.88 |  | 1.91 | 1.86 | 1.89 | 1.89 | 1.86 |
| Na | 0.38 | 0.29 |  | 0.30 | 0.30 | 0.29 | 0.24 | 0.40 |
| K | 0.15 | 0.11 |  | 0.10 | 0.10 | 0.10 | 0.07 | 0.14 |
| Total cations | 15.34 | 15.37 |  | 15.22 | 15.29 | 15.31 | 15.05 | 15.45 |
| SiT\* | 7.04 | 7.22 |  | 7.29 | 7.32 | 7.30 | 7.42 | 7.15 |
| AlT | 0.96 | 0.78 |  | 0.71 | 0.68 | 0.70 | 0.58 | 0.85 |
| AlC | 0.33 | 0.33 |  | 0.32 | 0.31 | 0.35 | 0.18 | 0.32 |
| Fe3+C | 0.66 | 0.63 |  | 0.78 | 0.71 | 0.69 | 0.95 | 0.55 |
| TiC | 0.09 | 0.06 |  | 0.07 | 0.06 | 0.06 | 0.03 | 0.08 |
| MgC | 2.87 | 2.99 |  | 3.09 | 3.15 | 3.19 | 3.36 | 3.02 |
| Fe2+C | 0.97 | 1.00 |  | 0.61 | 0.76 | 0.72 | 0.32 | 1.03 |
| MnC | 0.05 | 0.00 |  | 0.03 | 0.01 | 0.00 | 0.03 | 0.00 |
| Fe2+B | 0.00 | 0.04 |  | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| MnB | 0.00 | 0.05 |  | 0.00 | 0.03 | 0.04 | 0.00 | 0.04 |
| CaB | 1.84 | 1.88 |  | 1.91 | 1.86 | 1.89 | 1.89 | 1.86 |
| NaB | 0.16 | 0.03 |  | 0.09 | 0.11 | 0.07 | 0.11 | 0.09 |
| NaA | 0.22 | 0.26 |  | 0.22 | 0.19 | 0.21 | 0.13 | 0.31 |
| KA | 0.15 | 0.11 |  | 0.10 | 0.10 | 0.10 | 0.07 | 0.14 |

Note: \* The subscript indicates the position of the ion in the crystal; bd, below detection

**Table S3 LA-ICP-MS zircon U–Pb isotopic dating results of Yashan host and its MMEs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample |  | Th |  | U | Th/U | Isotopic ratios | | | | | | rho | Isotopic age (Ma) | | | | | |
| Analysis |  | ppm |  | ppm | 207Pb/206Pb | ±1σ | 207Pb/235U | ±1σ | 206Pb/238U | ±1σ | 207Pb/206Pb | ±1σ | 207Pb/235U | ±1σ | 206Pb/238U | ±1σ |
| Yashan Host granodiorite | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-1-4-03 |  | 627 |  | 530 | 1.18 | 0.048321 | 0.002866 | 0.121959 | 0.006905 | 0.018441 | 0.000260 | 0.248946 | 122 | 128 | 117 | 6 | 118 | 2 |
| QX-2-1-4-04 |  | 854 |  | 947 | 0.90 | 0.048223 | 0.002528 | 0.120754 | 0.006002 | 0.018445 | 0.000286 | 0.312155 | 109 | 118 | 116 | 5 | 118 | 2 |
| QX-2-1-4-05 |  | 311 |  | 423 | 0.74 | 0.050598 | 0.003466 | 0.125462 | 0.007739 | 0.018280 | 0.000330 | 0.292761 | 233 | 157 | 120 | 7 | 117 | 2 |
| QX-2-1-4-06 |  | 695 |  | 796 | 0.87 | 0.050033 | 0.002933 | 0.124976 | 0.006820 | 0.018288 | 0.000262 | 0.262761 | 198 | 137 | 120 | 6 | 117 | 2 |
| QX-2-1-4-07 |  | 610 |  | 524 | 1.16 | 0.053160 | 0.003389 | 0.132631 | 0.007990 | 0.018267 | 0.000353 | 0.320466 | 345 | 144 | 126 | 7 | 117 | 2 |
| QX-2-1-4-08 |  | 438 |  | 486 | 0.90 | 0.051567 | 0.003359 | 0.129031 | 0.007972 | 0.018329 | 0.000272 | 0.240191 | 265 | 150 | 123 | 7 | 117 | 2 |
| QX-2-1-4-10 |  | 511 |  | 642 | 0.80 | 0.048643 | 0.003258 | 0.118340 | 0.007478 | 0.017915 | 0.000315 | 0.278293 | 132 | 148 | 114 | 7 | 114 | 2 |
| QX-2-1-4-11 |  | 533 |  | 508 | 1.05 | 0.050131 | 0.003239 | 0.125284 | 0.007637 | 0.018271 | 0.000291 | 0.261008 | 211 | 152 | 120 | 7 | 117 | 2 |
| QX-2-1-4-12 |  | 903 |  | 721 | 1.25 | 0.049660 | 0.002684 | 0.124301 | 0.006248 | 0.018561 | 0.000313 | 0.335283 | 189 | 123 | 119 | 6 | 119 | 2 |
| QX-2-1-4-13 |  | 751 |  | 591 | 1.27 | 0.053978 | 0.003597 | 0.133994 | 0.008204 | 0.018290 | 0.000272 | 0.243144 | 369 | 155 | 128 | 7 | 117 | 2 |
| QX-2-1-4-14 |  | 678 |  | 785 | 0.86 | 0.053807 | 0.002849 | 0.133489 | 0.006373 | 0.018238 | 0.000317 | 0.363867 | 361 | 120 | 127 | 6 | 117 | 2 |
| QX-2-1-4-15 |  | 571 |  | 618 | 0.92 | 0.052481 | 0.004282 | 0.128242 | 0.009853 | 0.018048 | 0.000363 | 0.261544 | 306 | 187 | 123 | 9 | 115 | 2 |
| QX-2-1-4-16 |  | 396 |  | 445 | 0.89 | 0.046798 | 0.005581 | 0.120898 | 0.014275 | 0.018236 | 0.000456 | 0.211819 | 39 | 263 | 116 | 13 | 116 | 3 |
| QX-2-1-4-17 |  | 975 |  | 875 | 1.11 | 0.050912 | 0.002788 | 0.128829 | 0.006997 | 0.018357 | 0.000267 | 0.267747 | 235 | 131 | 123 | 6 | 117 | 2 |
| QX-2-1-4-18 |  | 794 |  | 679 | 1.17 | 0.046061 | 0.003133 | 0.113243 | 0.006978 | 0.018244 | 0.000310 | 0.275625 | 400 | -233 | 109 | 6 | 117 | 2 |
| QX-2-1-4-19 |  | 792 |  | 870 | 0.91 | 0.049066 | 0.002858 | 0.119902 | 0.006462 | 0.017971 | 0.000210 | 0.217251 | 150 | 137 | 115 | 6 | 115 | 1 |
| QX-2-1-4-20 |  | 411 |  | 536 | 0.77 | 0.049104 | 0.003706 | 0.122234 | 0.008622 | 0.018401 | 0.000395 | 0.304288 | 154 | 167 | 117 | 8 | 118 | 3 |
| QX-2-1-4-22 |  | 768 |  | 812 | 0.95 | 0.046083 | 0.002524 | 0.116118 | 0.006058 | 0.018288 | 0.000255 | 0.267524 | 400 | -272 | 112 | 6 | 117 | 2 |
| QX-2-1-4-23 |  | 1306 |  | 777 | 1.68 | 0.047183 | 0.002459 | 0.118164 | 0.005871 | 0.018233 | 0.000238 | 0.262244 | 58 | 131 | 113 | 5 | 116 | 2 |
| Yashan MMEs Bright zircons | | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-2-7-01 |  | 779 |  | 603 | 1.29 | 0.048071 | 0.002839 | 0.120201 | 0.006996 | 0.018320 | 0.000307 | 0.288405 | 102 | 133 | 115 | 6 | 117 | 2 |
| QX-2-2-7-03 |  | 640 |  | 619 | 1.03 | 0.046343 | 0.002792 | 0.114189 | 0.005740 | 0.018058 | 0.000275 | 0.302631 | 17 | 137 | 110 | 5 | 115 | 2 |
| QX-2-2-7-04 |  | 422 |  | 499 | 0.85 | 0.050725 | 0.004963 | 0.124406 | 0.011229 | 0.018169 | 0.000337 | 0.205525 | 228 | 211 | 119 | 10 | 116 | 2 |
| QX-2-2-7-05 |  | 783 |  | 807 | 0.97 | 0.049757 | 0.002827 | 0.122762 | 0.006877 | 0.018080 | 0.000247 | 0.243870 | 183 | 127 | 118 | 6 | 116 | 2 |
| QX-2-2-7-06 |  | 649 |  | 529 | 1.23 | 0.052320 | 0.004104 | 0.131139 | 0.009524 | 0.018211 | 0.000334 | 0.252855 | 298 | 184 | 125 | 9 | 116 | 2 |
| QX-2-2-7-07 |  | 575 |  | 564 | 1.02 | 0.055197 | 0.004981 | 0.139846 | 0.011251 | 0.018834 | 0.000372 | 0.245458 | 420 | 202 | 133 | 10 | 120 | 2 |
| QX-2-2-7-09 |  | 649 |  | 636 | 1.02 | 0.046523 | 0.002952 | 0.118169 | 0.007132 | 0.018597 | 0.000300 | 0.266873 | 33 | 135 | 113 | 6 | 119 | 2 |
| QX-2-2-7-10 |  | 429 |  | 459 | 0.94 | 0.048658 | 0.003607 | 0.120901 | 0.008236 | 0.018314 | 0.000278 | 0.222982 | 132 | 167 | 116 | 7 | 117 | 2 |
| QX-2-2-7-12 |  | 1046 |  | 918 | 1.14 | 0.047805 | 0.002598 | 0.121027 | 0.006585 | 0.018353 | 0.000249 | 0.249511 | 100 | 113 | 116 | 6 | 117 | 2 |
| QX-2-2-7-13 |  | 650 |  | 643 | 1.01 | 0.046101 | 0.004239 | 0.119817 | 0.009828 | 0.018814 | 0.000418 | 0.270572 | 400 | -191 | 115 | 9 | 120 | 3 |
| QX-2-2-7-14 |  | 589 |  | 585 | 1.01 | 0.050529 | 0.002645 | 0.127853 | 0.006361 | 0.018240 | 0.000258 | 0.284471 | 220 | 122 | 122 | 6 | 117 | 2 |
| QX-2-2-7-15 |  | 435 |  | 470 | 0.93 | 0.049769 | 0.004775 | 0.118463 | 0.009037 | 0.017760 | 0.000348 | 0.256995 | 183 | 211 | 114 | 8 | 113 | 2 |
| QX-2-2-7-16 |  | 796 |  | 632 | 1.26 | 0.049177 | 0.004050 | 0.118488 | 0.008466 | 0.017698 | 0.000344 | 0.272085 | 167 | 172 | 114 | 8 | 113 | 2 |
| QX-2-2-7-17 |  | 461 |  | 552 | 0.84 | 0.047512 | 0.004332 | 0.116172 | 0.009121 | 0.018224 | 0.000335 | 0.234192 | 76 | 204 | 112 | 8 | 116 | 2 |
| QX-2-2-7-18 |  | 2045 |  | 1144 | 1.79 | 0.051984 | 0.002568 | 0.131000 | 0.006364 | 0.018190 | 0.000207 | 0.234581 | 283 | 113 | 125 | 6 | 116 | 1 |
| QX-2-2-7-19 |  | 458 |  | 486 | 0.94 | 0.047969 | 0.003354 | 0.117031 | 0.007007 | 0.018151 | 0.000297 | 0.273439 | 98 | 156 | 112 | 6 | 116 | 2 |
| QX-2-2-7-20 |  | 1110 |  | 1053 | 1.05 | 0.053699 | 0.002299 | 0.134642 | 0.005872 | 0.018178 | 0.000227 | 0.286239 | 367 | 98 | 128 | 5 | 116 | 1 |
| QX-2-2-7-21 |  | 799 |  | 663 | 1.20 | 0.052129 | 0.003514 | 0.123894 | 0.008241 | 0.017329 | 0.000272 | 0.235822 | 300 | 156 | 119 | 7 | 111 | 2 |
| QX-2-2-7-22 |  | 882 |  | 594 | 1.48 | 0.052856 | 0.004982 | 0.138157 | 0.011975 | 0.018846 | 0.000442 | 0.270716 | 324 | 212 | 131 | 11 | 120 | 3 |
| Yashan MME Dark zircons | | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-2-7-01 |  | 9385 |  | 3784 | 2.48 | 0.053604 | 0.001855 | 0.137850 | 0.004600 | 0.018611 | 0.000200 | 0.322454 | 354 | 78 | 131 | 4 | 119 | 1 |
| QX-2-2-7-03 |  | 9957 |  | 3714 | 2.68 | 0.048841 | 0.001469 | 0.123722 | 0.003581 | 0.018374 | 0.000164 | 0.309039 | 139 | 66 | 118 | 3 | 117 | 1 |
| QX-2-2-7-06 |  | 11844 |  | 3962 | 2.99 | 0.053560 | 0.001507 | 0.137961 | 0.003877 | 0.018633 | 0.000185 | 0.353296 | 354 | 65 | 131 | 3 | 119 | 1 |
| QX-2-2-7-08 |  | 6682 |  | 2940 | 2.27 | 0.048259 | 0.001390 | 0.121890 | 0.003596 | 0.018254 | 0.000207 | 0.384097 | 122 | 73 | 117 | 3 | 117 | 1 |
| QX-2-2-7-12 |  | 1879 |  | 1086 | 1.73 | 0.053293 | 0.003676 | 0.135927 | 0.009458 | 0.018348 | 0.000321 | 0.251156 | 343 | 162 | 129 | 8 | 117 | 2 |
| QX-2-2-7-13 |  | 13888 |  | 4784 | 2.90 | 0.051477 | 0.001240 | 0.130857 | 0.003173 | 0.018338 | 0.000176 | 0.395795 | 261 | 56 | 125 | 3 | 117 | 1 |
| QX-2-2-7-14 |  | 11995 |  | 3970 | 3.02 | 0.052210 | 0.001526 | 0.132414 | 0.003780 | 0.018326 | 0.000178 | 0.340607 | 295 | 64 | 126 | 3 | 117 | 1 |
| QX-2-2-7-15 |  | 10715 |  | 3290 | 3.26 | 0.052443 | 0.001731 | 0.133471 | 0.004265 | 0.018413 | 0.000204 | 0.346137 | 306 | 81 | 127 | 4 | 118 | 1 |
| QX-2-2-7-18 |  | 7553 |  | 2901 | 2.60 | 0.053543 | 0.001818 | 0.135044 | 0.004604 | 0.018234 | 0.000216 | 0.347029 | 350 | 78 | 129 | 4 | 116 | 1 |

**Table S4 Major and trace elements of Yashan host and its MMEs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Detection limits | QX-2-1-1 | QX-2-1-2 | QX-2-4-3 | QX-1-1 | QX-2-2-6 | QX-2-3-5 | QX-2-3-6 | QX-2-3-7 | QX-3 | NCSDC47009 | OREAS 120 |
|  | Host | Host | Host | MME | MME | MME | MME | MME | MME | Standard | Standard |
| SiO2 (wt%) | 0.01 | 67.63 | 67.63 | 66.93 | 55.64 | 58.74 | 59.90 | 59.72 | 59.37 | 58.98 | 15.66 | - |
| TiO2 | 0.01 | 0.35 | 0.36 | 0.38 | 0.87 | 0.77 | 0.73 | 0.74 | 0.74 | 0.62 | 0.15 | - |
| Al2O3 | 0.01 | 15.48 | 15.28 | 15.42 | 17.26 | 17.28 | 16.84 | 16.88 | 16.91 | 14.99 | 2.49 | - |
| Fe2O3T | 0.01 | 3.29 | 3.28 | 3.45 | 6.80 | 6.03 | 5.72 | 5.68 | 5.76 | 5.54 | 2.89 | - |
| MnO | 0.01 | 0.06 | 0.06 | 0.06 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.12 | 20.30 | - |
| MgO | 0.01 | 1.70 | 1.67 | 1.66 | 4.11 | 3.56 | 3.34 | 3.39 | 3.37 | 5.25 | 3.77 | - |
| CaO | 0.01 | 3.14 | 3.06 | 3.41 | 5.25 | 4.67 | 4.92 | 4.78 | 4.70 | 5.21 | 19.80 | - |
| Na2O | 0.01 | 3.95 | 3.88 | 4.10 | 4.95 | 4.59 | 4.65 | 4.61 | 4.50 | 3.37 | 0.03 | - |
| K2O | 0.01 | 3.98 | 3.93 | 3.24 | 2.13 | 2.87 | 2.31 | 2.41 | 2.74 | 4.28 | 0.70 | - |
| P2O5 | 0.01 | 0.15 | 0.16 | 0.15 | 0.45 | 0.27 | 0.26 | 0.26 | 0.27 | 0.26 | 0.13 | - |
| LOI | 0.01 | 0.56 | 0.48 | 0.45 | 1.54 | 0.46 | 0.70 | 0.55 | 0.66 | 0.70 | - | - |
| Total | - | 100.29 | 99.79 | 99.25 | 99.11 | 99.35 | 99.48 | 99.13 | 99.13 | 99.32 | - | - |
| Mg# | - | 54.63 | 54.27 | 52.86 | 58.48 | 57.91 | 57.64 | 58.17 | 57.69 | 68.83 | - | - |
| La (ppm) | 0.1 | 44.40 | 51.10 | 51.80 | 41.40 | 34.10 | 55.30 | 34.70 | 37.00 | 52.20 | - | 0.47 |
| Ce | 0.1 | 74.30 | 80.90 | 85.90 | 96.30 | 71.00 | 103.00 | 71.50 | 75.80 | 102.50 | - | 42.60 |
| Pr | 0.03 | 8.05 | 8.14 | 9.95 | 11.45 | 8.11 | 10.85 | 8.11 | 8.58 | 11.03 | - | 5.21 |
| Nd | 0.1 | 26.00 | 25.70 | 33.10 | 43.10 | 30.50 | 37.90 | 29.90 | 31.80 | 39.80 | - | 19.00 |
| Sm | 0.03 | 3.45 | 3.49 | 4.82 | 7.38 | 5.04 | 5.74 | 5.26 | 5.30 | 6.06 | - | 3.58 |
| Eu | 0.03 | 1.10 | 1.05 | 1.34 | 1.54 | 1.29 | 1.45 | 1.24 | 1.31 | 1.48 | - | 1.04 |
| Gd | 0.05 | 2.51 | 2.40 | 3.44 | 5.30 | 3.80 | 4.43 | 3.78 | 3.99 | 4.17 | - | 2.96 |
| Tb | 0.01 | 0.32 | 0.31 | 0.44 | 0.74 | 0.51 | 0.57 | 0.52 | 0.54 | 0.55 | - | 0.43 |
| Dy | 0.05 | 1.74 | 1.77 | 2.44 | 4.06 | 2.79 | 3.23 | 2.71 | 2.91 | 3.06 | - | 2.55 |
| Ho | 0.01 | 0.32 | 0.34 | 0.45 | 0.83 | 0.57 | 0.64 | 0.52 | 0.56 | 0.57 | - | 0.47 |
| Er | 0.03 | 0.96 | 0.95 | 1.18 | 2.33 | 1.61 | 1.75 | 1.47 | 1.53 | 1.50 | - | 1.39 |
| Tm | 0.01 | 0.14 | 0.14 | 0.16 | 0.35 | 0.24 | 0.26 | 0.22 | 0.23 | 0.22 | - | 0.21 |
| Yb | 0.03 | 0.96 | 0.86 | 0.99 | 2.44 | 1.61 | 1.66 | 1.43 | 1.46 | 1.48 | - | 1.32 |
| Lu | 0.01 | 0.15 | 0.14 | 0.15 | 0.37 | 0.25 | 0.26 | 0.25 | 0.23 | 0.23 | - | 0.20 |
| Rb | 0.2 | 105.00 | 104.50 | 85.50 | 163.50 | 138.00 | 114.50 | 119.50 | 127.50 | 167.50 | - | 92.70 |
| Ba | 0.5 | 2060 | 2300 | 2290 | 695 | 865 | 761 | 799 | 854 | 1715 | - | 973 |
| Th | 0.05 | 13.85 | 14.60 | 7.83 | 10.35 | 11.80 | 14.35 | 12.00 | 12.60 | 11.05 | - | 5.29 |
| U | 0.05 | 2.36 | 2.52 | 4.62 | 3.68 | 5.24 | 11.15 | 8.25 | 7.56 | 2.19 | - | 41.40 |
| Nb | 0.2 | 7.50 | 7.00 | 7.50 | 21.10 | 13.70 | 12.10 | 11.60 | 12.80 | 9.80 | - | 7.50 |
| Ta | 0.1 | 0.60 | 0.80 | 0.80 | 1.50 | 0.70 | 0.80 | 0.70 | 0.80 | 0.60 | - | 0.70 |
| K | 100 | 33040 | 32625 | 26897 | 17682 | 23825 | 19176 | 20007 | 22746 | 35530 | - | - |
| Pb | 0.5 | 20.30 | 19.80 | 20.20 | 18.30 | 21.00 | 18.60 | 19.30 | 19.60 | 26.80 | - | - |
| Sr | 0.2 | 809 | 799 | 927 | 800 | 741 | 784 | 759 | 760 | 659 | - | 131.5 |
| P | 10 | 655 | 698 | 655 | 1964 | 1178 | 1135 | 1135 | 1178 | 1135 | - | - |
| Zr | 2 | 190.00 | 162.00 | 140.00 | 228.00 | 179.00 | 183.00 | 162.00 | 155.00 | 184.00 | - | 274 |
| Hf | 0.2 | 4.40 | 3.90 | 3.20 | 6.40 | 4.90 | 5.00 | 4.80 | 4.40 | 4.70 | - | 6.7 |
| Ti | 50 | 2098 | 2158 | 2278 | 5215 | 4615 | 4376 | 4436 | 4436 | 3716 | - | - |
| Y | 0.5 | 9.70 | 9.30 | 11.60 | 22.60 | 15.30 | 16.70 | 14.80 | 15.80 | 15.50 | - | 12 |
| V | 1 | 62.00 | 66.00 | 68.00 | 137.00 | 109.00 | 97.00 | 103.00 | 103.00 | 106.00 | - | 12 |
| Cr | 1 | 45.00 | 46.00 | 45.00 | 111.00 | 78.00 | 74.00 | 81.00 | 74.00 | 245.00 | - | - |
| Co | 0.1 | 6.80 | 7.10 | 6.90 | 19.10 | 16.60 | 15.00 | 15.40 | 15.20 | 19.80 | - | - |
| Ni | 0.2 | 13.00 | 13.50 | 11.90 | 36.80 | 26.90 | 24.00 | 25.20 | 24.80 | 91.20 | - | - |
| Sr/Y | - | 83.40 | 85.91 | 79.91 | 35.40 | 48.43 | 46.95 | 51.28 | 48.10 | 42.52 | - | - |
| Eu/Eu\* | - | 1.14 | 1.11 | 1.01 | 0.75 | 0.90 | 0.88 | 0.85 | 0.87 | 0.90 | - | - |
| Dy/Yb | - | 1.81 | 2.06 | 2.46 | 1.66 | 1.73 | 1.95 | 1.90 | 1.99 | 2.07 | - | - |
| La/Yb | - | 46.25 | 59.42 | 52.32 | 16.97 | 21.18 | 33.31 | 24.27 | 25.34 | 35.27 | - | - |
| Nb/U | - | 3.18 | 2.78 | 1.62 | 5.73 | 2.61 | 1.09 | 1.41 | 1.69 | 4.47 | - | - |
| Ce/Pb | - | 3.66 | 4.09 | 4.25 | 5.26 | 3.38 | 5.54 | 3.70 | 3.87 | 3.82 | - | - |
| Rb/Ba | - | 0.05 | 0.05 | 0.04 | 0.24 | 0.16 | 0.15 | 0.15 | 0.15 | 0.10 | - | - |

Note: Mg# = 100× molar Mg/(Mg + Fe). Eu/Eu\* = EuN/ (SmN × GdN)1/2

**Table S5 Sr–Nd isotopic compositions of Yashan host and its MMEs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Age | Rb | Sr | 87Rb/86Sr | 87Sr/86Sr | ±2σ | (87Sr/86Sr)i | Sm | Nd | 147Sm/144Nd | 143Nd/144Nd | ±2σ | ɛNd(t) | T1DM (Ma) | T2DM (Ma) |
|  | (ppm) | (ppm) |  |  |  |  | (ppm) | (ppm) |  |  |  |  |  |  |
| *Felsic host-rocks* | | | |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-1-1 | 117 | 105 | 809 | 0.37555 | 0.710104 | 0.000016 | 0.70948 | 3.45 | 26 | 0.08018 | 0.511646 | 0.000003 | -17.62 | 1715 | 2343 |
| QX-2-1-2 | 117 | 104.5 | 799 | 0.37844 | 0.710145 | 0.000006 | 0.70952 | 3.49 | 25.7 | 0.08206 | 0.511634 | 0.000002 | -17.88 | 1753 | 2364 |
| QX-2-4-3 | 117 | 85.5 | 927 | 0.26687 | 0.709828 | 0.000006 | 0.70939 | 4.82 | 33.1 | 0.08799 | 0.511669 | 0.000008 | -17.29 | 1793 | 2316 |
| *Mafic microgranular enclaves* | | | |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-2-6 | 117 | 138 | 741 | 0.5389 | 0.71059 | 0.00001 | 0.70970 | 5.04 | 30.5 | 0.09985 | 0.511723 | 0.000006 | -16.41 | 1908 | 2245 |
| QX-2-3-5 | 117 | 114.5 | 784 | 0.4226 | 0.71046 | 0.00001 | 0.70976 | 5.74 | 37.9 | 0.09152 | 0.511689 | 0.000003 | -16.95 | 1820 | 2289 |
| QX-2-3-6 | 117 | 119.5 | 759 | 0.45559 | 0.71062 | 0.00001 | 0.70987 | 5.26 | 29.9 | 0.1063 | 0.511671 | 0.000005 | -17.52 | 2095 | 2335 |
| QX-2-3-7 | 117 | 127.5 | 760 | 0.48545 | 0.71052 | 0.00001 | 0.70972 | 5.3 | 31.8 | 0.10071 | 0.511701 | 0.000005 | -16.85 | 1951 | 2281 |

Note: λRb= 1.42×10-11 yr-1 (Steiger and Jäger 1977); λSm= 6.54×10-11 yr-1 (Lugmair and Marti 1978); (147Sm/144Nd)CHUR= 0.1967; (143Nd/144Nd)CHUR= 0.512638 (Wasserburg *et al.* 1981); (147Sm/144Nd)DM= 0.2136; (143Nd/144Nd)DM= 0.513151 (Liew and Hofmann 1988); (147Sm/144Nd)crust= 0.118 (Jahn and Condie 1995); CHUR: Chondritic Uniform Reservoir; DM: Depleted Mantle.

**Table S6 Hf isotopic compositions of Yashan host and its MMEs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Age(Ma) | 176Hf/177Hf | 176Lu/177Hf | 176Yb/177Hf | ±2σ | εHf(0) | εHf(t) | ±2σ | TDM1 | ±2σ | TDM2 | ±2σ | fLu/Hf |
| Yashan host |  |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-1-4-06 | 117 | 0.282221 | 0.000747 | 0.016551 | 0.000222 | -19.47 | -16.98 | 0.5 | 1444 | 37 | 2252 | 59 | -0.98 |
| QX-2-1-4-08 | 117 | 0.282202 | 0.000587 | 0.012830 | 0.000256 | -20.14 | -17.63 | 0.7 | 1464 | 56 | 2293 | 91 | -0.98 |
| QX-2-1-4-10 | 117 | 0.282216 | 0.000917 | 0.020349 | 0.000373 | -19.67 | -17.19 | 0.6 | 1458 | 43 | 2265 | 69 | -0.97 |
| QX-2-1-4-12 | 117 | 0.282222 | 0.000989 | 0.022288 | 0.000342 | -19.45 | -16.97 | 0.6 | 1452 | 50 | 2251 | 80 | -0.97 |
| QX-2-1-4-13 | 117 | 0.282264 | 0.000906 | 0.020737 | 0.000277 | -17.98 | -15.50 | 0.6 | 1391 | 49 | 2159 | 78 | -0.97 |
| QX-2-1-4-17 | 117 | 0.282199 | 0.000905 | 0.019377 | 0.000331 | -20.27 | -17.79 | 0.7 | 1481 | 53 | 2303 | 84 | -0.97 |
| QX-2-1-4-18 | 117 | 0.282238 | 0.001076 | 0.024931 | 0.000597 | -18.89 | -16.42 | 0.6 | 1433 | 49 | 2217 | 78 | -0.97 |
| QX-2-1-4-19 | 117 | 0.282246 | 0.001216 | 0.028601 | 0.000675 | -18.60 | -16.14 | 0.5 | 1427 | 43 | 2199 | 68 | -0.96 |
| QX-2-1-4-22 | 117 | 0.282233 | 0.000951 | 0.021138 | 0.000283 | -19.06 | -16.58 | 0.6 | 1435 | 50 | 2227 | 79 | -0.97 |
| QX-2-1-4-23 | 117 | 0.282178 | 0.000838 | 0.018462 | 0.000163 | -21.00 | -18.52 | 0.6 | 1507 | 48 | 2349 | 77 | -0.97 |
| MMEs |  |  |  |  |  |  |  |  |  |  |  |  |  |
| QX-2-2-7-01 | 117 | 0.282187 | 0.000810 | 0.017893 | 0.000574 | -20.69 | -18.19 | 0.5 | 1494 | 37 | 2328 | 59 | -0.98 |
| QX-2-2-7-03 | 117 | 0.282217 | 0.000822 | 0.018107 | 0.000138 | -19.62 | -17.12 | 0.6 | 1452 | 45 | 2261 | 71 | -0.98 |
| QX-2-2-7-05 | 117 | 0.282193 | 0.000851 | 0.018260 | 0.000121 | -20.47 | -17.98 | 0.7 | 1487 | 52 | 2315 | 82 | -0.97 |
| QX-2-2-7-07 | 117 | 0.282216 | 0.000755 | 0.016763 | 0.000761 | -19.67 | -17.17 | 0.6 | 1452 | 46 | 2264 | 74 | -0.98 |
| QX-2-2-7-10 | 117 | 0.282258 | 0.000952 | 0.021473 | 0.000682 | -18.19 | -15.70 | 0.6 | 1401 | 50 | 2172 | 80 | -0.97 |
| QX-2-2-7-11 | 117 | 0.282381 | 0.002310 | 0.057875 | 0.004567 | -13.84 | -11.45 | 0.9 | 1275 | 70 | 1903 | 107 | -0.93 |
| QX-2-2-7-12 | 117 | 0.282228 | 0.001058 | 0.023473 | 0.000342 | -19.22 | -16.74 | 0.7 | 1445 | 53 | 2237 | 84 | -0.97 |
| QX-2-2-7-13 | 117 | 0.282204 | 0.000694 | 0.015338 | 0.000299 | -20.09 | -17.58 | 0.6 | 1466 | 49 | 2290 | 78 | -0.98 |
| QX-2-2-7-14 | 117 | 0.282228 | 0.001122 | 0.025240 | 0.001281 | -19.24 | -16.77 | 0.6 | 1449 | 51 | 2239 | 81 | -0.97 |
| QX-2-2-7-15 | 117 | 0.282223 | 0.000873 | 0.019295 | 0.000151 | -19.43 | -16.93 | 0.6 | 1447 | 45 | 2249 | 73 | -0.97 |
| QX-2-2-7-19 | 117 | 0.282171 | 0.000643 | 0.014146 | 0.000095 | -21.25 | -18.74 | 0.6 | 1509 | 45 | 2363 | 72 | -0.98 |
| QX-2-2-7-20 | 117 | 0.282210 | 0.001316 | 0.029860 | 0.000441 | -19.88 | -17.42 | 0.8 | 1482 | 60 | 2280 | 95 | -0.96 |
| QX-2-2-7-21 | 117 | 0.282190 | 0.000836 | 0.018937 | 0.000605 | -20.58 | -18.08 | 0.7 | 1490 | 56 | 2322 | 90 | -0.97 |
| QX-2-2-7-22 | 117 | 0.282228 | 0.001028 | 0.023415 | 0.000418 | -19.24 | -16.76 | 0.7 | 1445 | 56 | 2238 | 90 | -0.97 |
| QX-2-2-7-23 | 117 | 0.282180 | 0.002338 | 0.066717 | 0.003523 | -20.93 | -18.54 | 0.4 | 1566 | 34 | 2350 | 53 | -0.93 |
| QX-2-2-7-24 | 117 | 0.282173 | 0.002912 | 0.082268 | 0.001759 | -21.17 | -18.83 | 0.4 | 1601 | 35 | 2367 | 52 | -0.91 |
| QX-2-2-7-25 | 117 | 0.282190 | 0.006996 | 0.213635 | 0.003211 | -20.57 | -18.55 | 0.5 | 1777 | 49 | 2345 | 65 | -0.79 |
| QX-2-2-7-26 | 117 | 0.282180 | 0.003941 | 0.110469 | 0.003320 | -20.95 | -18.69 | 0.5 | 1639 | 39 | 2358 | 56 | -0.88 |
| QX-2-2-7-27 | 117 | 0.282169 | 0.001903 | 0.059060 | 0.003502 | -21.32 | -18.90 | 0.3 | 1563 | 28 | 2372 | 43 | -0.94 |
| QX-2-2-7-28 | 117 | 0.282187 | 0.005695 | 0.176281 | 0.000826 | -20.67 | -18.55 | 0.5 | 1712 | 44 | 2347 | 61 | -0.83 |
| QX-2-2-7-29 | 117 | 0.282165 | 0.004496 | 0.140869 | 0.001754 | -21.46 | -19.24 | 0.6 | 1687 | 48 | 2391 | 70 | -0.86 |
| QX-2-2-7-30 | 117 | 0.282115 | 0.007798 | 0.244789 | 0.003339 | -23.23 | -21.27 | 0.7 | 1950 | 63 | 2515 | 82 | -0.77 |
| QX-2-2-7-31 | 117 | 0.282181 | 0.003140 | 0.096565 | 0.002151 | -20.89 | -18.57 | 0.4 | 1599 | 36 | 2351 | 54 | -0.91 |
| QX-2-2-7-32 | 117 | 0.282155 | 0.003597 | 0.111929 | 0.001213 | -21.81 | -19.52 | 0.4 | 1659 | 36 | 2410 | 53 | -0.89 |
| QX-2-2-7-33 | 117 | 0.282180 | 0.005356 | 0.160514 | 0.004335 | -20.93 | -18.78 | 0.5 | 1707 | 46 | 2362 | 65 | -0.84 |
| QX-2-2-7-34 | 117 | 0.282188 | 0.004403 | 0.130260 | 0.001775 | -20.64 | -18.42 | 0.6 | 1647 | 48 | 2340 | 70 | -0.87 |
| QX-2-2-7-35 | 117 | 0.282177 | 0.002572 | 0.077959 | 0.002122 | -21.03 | -18.67 | 0.4 | 1580 | 34 | 2357 | 52 | -0.92 |
| QX-2-2-7-36 | 117 | 0.282174 | 0.003041 | 0.089798 | 0.002925 | -21.16 | -18.84 | 0.4 | 1606 | 30 | 2367 | 46 | -0.91 |
| QX-2-2-7-37 | 117 | 0.282179 | 0.001971 | 0.061611 | 0.005215 | -20.96 | -18.55 | 0.4 | 1551 | 32 | 2350 | 50 | -0.94 |
| QX-2-2-7-38 | 117 | 0.282192 | 0.003777 | 0.113416 | 0.002917 | -20.51 | -18.23 | 0.4 | 1612 | 38 | 2329 | 56 | -0.89 |
| QX-2-2-7-39 | 117 | 0.282191 | 0.002499 | 0.075499 | 0.002049 | -20.56 | -18.19 | 0.4 | 1558 | 36 | 2328 | 54 | -0.92 |
| QX-2-2-7-40 | 117 | 0.282170 | 0.005052 | 0.150921 | 0.001243 | -21.29 | -19.12 | 0.5 | 1707 | 44 | 2383 | 63 | -0.85 |
| QX-2-2-7-41 | 117 | 0.282162 | 0.004345 | 0.136692 | 0.002461 | -21.56 | -19.33 | 0.5 | 1684 | 45 | 2397 | 65 | -0.87 |
| QX-2-2-7-42 | 117 | 0.282206 | 0.003984 | 0.119770 | 0.004003 | -20.02 | -17.77 | 0.5 | 1601 | 41 | 2299 | 60 | -0.88 |

Note: (176Hf/177Hf)CHUR=0.282772; (176Lu/177Hf)CHUR=0.0332 (Blichert-Toft and Albarede 1997); (176Hf/177Hf)DM=0.28325, and (176Lu/177Hf)DM=0.0384 (Griffin *et al.* 2000). λ= 1.867×10-11 a-1 (Söderlund *et al.* 2004). (176Lu/177Hf)crust = 0.015 (Griffin *et al.* 2002).

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