**Table captions**.

Table1 Phenocryst and groundmass mineralogy of the high-Mg volcanic rocks from the Boza area of the Nangqian basin

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sample no. | Lithology | Texture | Phenocrysts | Groundmass |
| Boza, the Nangqian basin |  |  |  |  |
| BZ04-5-1 | potassic trachybasalt | porphyritic | Opx(2), Cpx(2) | Cpx, Phl, Sa, Ap,Ti-Mt |
| BZ05-1 | potassic trachybasalt | porphyritic | Opx(12), Cpx(6) | Cpx, Phl, Sa, Zr, Ti-Mt |
| BZ05-2 | potassic trachybasalt | porphyritic | Opx(3), Cpx(2),Phl(1) | Cpx, Phl, Sa, Ti-Mt |
| BZ05-3 | potassic trachybasalt | porphyritic | Opx(2), Cpx(1), Phl(1) | Cpx, Phl, Sa, Ti-Mt |
| BZ05-4 | potassic trachybasalt | porphyritic | Opx(4), Cpx(3) | Cpx, Phl, Sa, Ti-Mt |
| BZ05-5 | potassic trachybasalt | porphyritic | Opx(8), Cpx(4) | Cpx, Phl, Sa, Zr, Ti-Mt |
| BZ05-6 | potassic trachybasalt | porphyritic | Opx(3), Cpx(2) | Cpx, Phl, Sa, Ti-Mt |
| BZ05-7 | potassic trachybasalt | porphyritic | Opx(7), Cpx(3), Phl(1) | Cpx, Phl, Sa, Zr, Ti-Mt |
| BZ04-2 | shoshonite | porphyritic | Opx(3), Cpx(10), Sa (1) | Cpx, Sa, Zr, Ti-Mt |
| BZ04-3 | shoshonite | porphyritic | Opx(1), Cpx(3) , Phl(1) | Cpx, Sa, Ap, Ti-Mt |
| BZ04-5 | latite | porphyritic | Opx(2), Cpx(4), Sa (1) | Cpx, Phl, Sa, Ap,Ti-Mt |
| BZ04-6 | shoshonite | porphyritic | Opx(3), Cpx(2), Sa (2), Phl(1) | Cpx, Phl, Sa, Ap, Ti-Mt |
| BZ04-7 | latite | porphyritic | Opx(3), Cpx(6), Phl(1) | Cpx, Sa, Ti-Mt |
| BZ03-3 | latite | porphyritic | Opx(2), Cpx(12), Sa(3), Phl (1) | Cpx, Sa, Ap, Zr, Ti-Mt |
| BZ03-4 | latite | porphyritic | Opx(1), Cpx(9), Sa(3) | Cpx, Sa, Ap, Ti-Mt |
| BZ03-5 | latite | porphyritic | Cpx(2), Sa(1) | Cpx, Sa, Ap, Ti-Mt |
| BZ03-6 | latite | porphyritic | Cpx(8), Sa(3), Phl (1) | Cpx, Sa, Zr, Ti-Mt |
| BZ03-7 | latite | porphyritic | Opx(2), Cpx(7) | Cpx, Sa, Ti-Mt |

Opx, orthopyroxene; Cpx, clinopyroxene; Phl, phlogopite; Sa, sanidine; Zr, zircon; Ap, apatite; Ti-Mt, Ti-magnetite; proportions in percent of phenocrysts shown in parentheses (vol. %)

Table 2 Zircon U-Pb isotopic data obtained by LA-ICPMS for the high-Mg volcanic rocks from the Boza area of the Nangqian basin

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Spot | Th(ppm) | U(ppm) | Th/U | 238U/206Pb | 1σ | 207Pb/206Pb | 1σ | 206Pb/238U(Ma) | 1σ |
| Sample BZ05-1 (potassic trachybasalt) | | | | | | | | | |
| 1 | 2004 | 1727 | 1.16 | 169.56 | 2.32 | 0.0585 | 0.0032 | 37.9 | 0.5 |
| 2 | 804 | 667 | 1.20 | 169.93 | 3.04 | 0.0540 | 0.0048 | 37.8 | 0.7 |
| 3 | 701 | 500 | 1.40 | 169.59 | 3.92 | 0.0509 | 0.0061 | 37.9 | 0.9 |
| 4 | 1566 | 2651 | 0.59 | 166.19 | 2.08 | 0.0476 | 0.0024 | 38.7 | 0.5 |
| 5 | 1497 | 1497 | 1.00 | 166.40 | 2.50 | 0.0505 | 0.0035 | 38.6 | 0.6 |
| 6 | 435 | 1438 | 0.30 | 164.72 | 2.12 | 0.0491 | 0.0034 | 39.0 | 0.5 |
| 7 | 1572 | 1456 | 1.08 | 168.21 | 2.59 | 0.0457 | 0.0031 | 38.2 | 0.6 |
| 8 | 506 | 662 | 0.77 | 167.19 | 2.71 | 0.0471 | 0.0051 | 38.4 | 0.6 |
| 9 | 1124 | 989 | 1.14 | 165.10 | 2.80 | 0.0531 | 0.0042 | 38.9 | 0.7 |
| 10 | 548 | 422 | 1.30 | 166.80 | 3.98 | 0.0526 | 0.0073 | 38.5 | 0.9 |
| 11 | 747 | 990 | 0.75 | 168.88 | 2.78 | 0.0549 | 0.0040 | 38.1 | 0.6 |
| 12 | 617 | 834 | 0.74 | 168.17 | 2.86 | 0.0499 | 0.0057 | 38.2 | 0.6 |
| 13 | 395 | 494 | 0.80 | 166.75 | 3.86 | 0.0492 | 0.0062 | 38.5 | 0.9 |
| 14 | 677 | 729 | 0.93 | 169.77 | 3.09 | 0.0507 | 0.0050 | 37.9 | 0.7 |
| 15 | 503 | 364 | 1.38 | 165.98 | 3.74 | 0.0633 | 0.0083 | 38.7 | 0.9 |
| 16 | 966 | 1140 | 0.85 | 172.20 | 2.64 | 0.0576 | 0.0041 | 37.3 | 0.6 |
| 17 | 570 | 470 | 1.21 | 159.69 | 3.06 | 0.0491 | 0.0060 | 40.2 | 0.8 |
| 18 | 1049 | 1102 | 0.95 | 159.54 | 3.21 | 0.0684 | 0.0050 | 40.3 | 0.8 |
|  |  |  |  |  |  |  |  |  |  |
| Sample BZ04-2 (shoshonite) | | | | | | | | | |
| 1 | 1765 | 6376 | 0.28 | 158.74 | 1.52 | 0.0471 | 0.0017 | 40.5 | 0.4 |
| 2 | 968 | 1014 | 0.95 | 165.78 | 2.75 | 0.0435 | 0.0037 | 38.8 | 0.6 |
| 3 | 616 | 972 | 0.63 | 161.40 | 2.87 | 0.0447 | 0.0048 | 39.8 | 0.7 |
| 4 | 2551 | 4269 | 0.60 | 158.24 | 1.74 | 0.0459 | 0.0020 | 40.6 | 0.4 |
| 5 | 2539 | 5387 | 0.47 | 159.43 | 1.59 | 0.0471 | 0.0016 | 40.3 | 0.4 |
| 6 | 29081 | 2405 | 12.09 | 165.16 | 2.10 | 0.0488 | 0.0028 | 38.9 | 0.5 |
| 7 | 1310 | 3670 | 0.36 | 159.04 | 1.42 | 0.0476 | 0.0022 | 40.4 | 0.4 |
| 8 | 1501 | 3191 | 0.47 | 158.59 | 1.95 | 0.0480 | 0.0021 | 40.5 | 0.5 |
| 9 | 1083 | 4950 | 0.22 | 160.16 | 1.49 | 0.0493 | 0.0019 | 40.1 | 0.4 |
| 10 | 379 | 627 | 0.60 | 160.31 | 3.12 | 0.0566 | 0.0057 | 40.1 | 0.8 |
| 11 | 630 | 702 | 0.90 | 166.60 | 3.31 | 0.0451 | 0.0057 | 38.6 | 0.8 |
|  |  |  |  |  |  |  |  |  |  |
| Sample BZ03-3 (latite) | | | | | | | | | |
| 1 | 1727 | 3083 | 0.56 | 161.59 | 2.72 | 0.0524 | 0.0038 | 39.8 | 0.7 |
| 2 | 4037 | 8834 | 0.46 | 163.80 | 1.81 | 0.0489 | 0.0021 | 39.2 | 0.4 |
| 3 | 10196 | 8504 | 1.20 | 162.96 | 1.83 | 0.0497 | 0.0026 | 39.4 | 0.4 |
| 4 | 1118 | 3075 | 0.36 | 159.77 | 2.59 | 0.0487 | 0.0040 | 40.2 | 0.6 |
| 5 | 969 | 3116 | 0.31 | 162.66 | 2.42 | 0.0527 | 0.0038 | 39.5 | 0.6 |
| 6 | 1163 | 3093 | 0.38 | 158.32 | 2.67 | 0.0474 | 0.0045 | 40.6 | 0.7 |
| 7 | 1732 | 5537 | 0.31 | 161.24 | 2.04 | 0.0452 | 0.0027 | 39.9 | 0.5 |
| 8 | 1674 | 4438 | 0.38 | 162.63 | 2.20 | 0.0479 | 0.0032 | 39.5 | 0.5 |
| 9 | 1750 | 5769 | 0.30 | 162.68 | 1.98 | 0.0489 | 0.0031 | 39.5 | 0.5 |
| 10 | 713 | 2294 | 0.31 | 159.88 | 3.25 | 0.0494 | 0.0048 | 40.2 | 0.8 |
| 11 | 1687 | 4715 | 0.36 | 160.38 | 2.38 | 0.0476 | 0.0030 | 40.1 | 0.6 |
| 12 | 2244 | 6204 | 0.36 | 159.22 | 1.93 | 0.0514 | 0.0027 | 40.4 | 0.5 |
| 13 | 1089 | 3527 | 0.31 | 163.37 | 2.73 | 0.0455 | 0.0041 | 39.3 | 0.7 |
| 14 | 1522 | 4011 | 0.38 | 167.42 | 2.38 | 0.0468 | 0.0034 | 38.4 | 0.5 |
|  |  |  |  |  |  |  |  |  |  |

Table 3 Major (wt%) and trace element (ppm) concentrations for the high-Mg volcanic rocks from the Boza of the Nangqian basin

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Locality | Boza, the Nangqian basin | | | | | | | | | | | | | | |  |  |  |
| Sample no. | BZ04-5-1 | BZ05-1 | BZ05-2 | BZ05-3 | BZ05-4 | BZ05-5 | BZ05-6 | BZ05-7 | BZ04-2 | BZ04-3 | BZ04-5 | BZ04-6 | BZ04-7 | BZ03-3 | BZ03-4 | BZ03-5 | BZ03-6 | BZ03-7 |
| Rock type | PTB | PTB | PTB | PTB | PTB | PTB | PTB | PTB | SH | SH | LAT | SH | LAT | LAT | LAT | LAT | LAT | LAT |
| SiO2 | 48.36 | 48.16 | 48.04 | 48.18 | 48.30 | 48.38 | 48.36 | 48.39 | 53.88 | 53.76 | 53.46 | 53.94 | 53.75 | 56.89 | 55.93 | 55.35 | 55.98 | 56.18 |
| TiO2 | 1.05 | 1.05 | 1.05 | 1.06 | 1.05 | 1.05 | 1.05 | 1.06 | 0.93 | 0.93 | 0.92 | 0.93 | 0.92 | 0.76 | 0.78 | 0.79 | 0.77 | 0.79 |
| Al2O3 | 12.85 | 12.69 | 12.64 | 12.59 | 12.71 | 12.70 | 12.73 | 12.78 | 13.84 | 13.76 | 13.59 | 13.82 | 13.7 | 13.57 | 13.31 | 12.99 | 13.22 | 13.31 |
| Fe2O3\* | 7.23 | 7.2 | 7.14 | 7.13 | 7.13 | 7.18 | 7.17 | 7.19 | 6.09 | 6.11 | 6.08 | 6.09 | 6.02 | 5.46 | 5.72 | 5.87 | 5.8 | 5.49 |
| MnO | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.08 | 0.09 | 0.08 | 0.08 | 0.08 | 0.07 | 0.08 | 0.09 | 0.08 | 0.08 |
| MgO | 10.17 | 10.41 | 10.54 | 10.34 | 10.43 | 10.34 | 10.37 | 10.36 | 6.74 | 6.81 | 6.49 | 6.72 | 6.79 | 7.24 | 7.67 | 8.4 | 7.95 | 7.37 |
| CaO | 8.67 | 8.66 | 8.59 | 8.70 | 8.69 | 8.74 | 8.73 | 8.71 | 7.29 | 7.33 | 7.28 | 7.24 | 7.45 | 6.04 | 6.4 | 6.52 | 6.33 | 6.15 |
| Na2O | 2.85 | 2.76 | 2.75 | 2.81 | 2.81 | 2.83 | 2.84 | 2.84 | 3.58 | 3.55 | 3.51 | 3.53 | 3.5 | 3.85 | 3.75 | 3.6 | 3.72 | 3.78 |
| K2O | 3.36 | 3.43 | 3.38 | 3.40 | 3.40 | 3.39 | 3.36 | 3.39 | 4.09 | 4.07 | 4.14 | 4.13 | 4.11 | 3.74 | 3.6 | 3.4 | 3.61 | 3.8 |
| P2O5 | 0.84 | 0.84 | 0.84 | 0.84 | 0.83 | 0.85 | 0.84 | 0.85 | 0.77 | 0.78 | 0.77 | 0.78 | 0.77 | 0.52 | 0.53 | 0.53 | 0.53 | 0.55 |
| LOI | 3.69 | 3.72 | 3.98 | 3.92 | 3.93 | 3.93 | 3.93 | 4.03 | 2.27 | 2.29 | 2.26 | 2.32 | 2.54 | 1.32 | 1.59 | 1.7 | 1.45 | 1.43 |
| Total | 99.68 | 99.5 | 99.51 | 99.56 | 99.87 | 99.98 | 100.00 | 100.20 | 100.01 | 99.92 | 99.02 | 100.04 | 100.09 | 99.87 | 99.8 | 99.67 | 99.86 | 99.36 |
| Mg# | 75 | 75 | 76 | 75 | 76 | 75 | 75 | 75 | 70 | 70 | 69 | 70 | 70 | 74 | 74 | 75 | 74 | 74 |
| Cr | 329 | 347 | 356 | 395 | 401 | 399 | 388 | 399 | 188 | 197 | 187 | 199 | 200 | 291 | 324 | 367 | 343 | 315 |
| Co | 42.7 | 43.3 | 46 | 44.3 | 42.6 | 42.8 | 42.6 | 42.6 | 44.4 | 43.4 | 44.1 | 47.4 | 41.5 | 44.3 | 48 | 47.1 | 47.5 | 48.4 |
| Ni | 237 | 250 | 252 | 276 | 277 | 277 | 271 | 275 | 149 | 154 | 150 | 156 | 152 | 198 | 213 | 239 | 218 | 214 |
| Rb | 79.0 | 82.9 | 85.2 | 89.1 | 88.0 | 91.6 | 90.4 | 92.3 | 104 | 108 | 106 | 111 | 108 | 104 | 99.3 | 94.3 | 99.2 | 109 |
| Sr | 1870 | 1860 | 1840 | 1610 | 1650 | 1650 | 1690 | 1700 | 1900 | 1960 | 1910 | 2000 | 1930 | 1780 | 1840 | 1760 | 1780 | 1840 |
| Y | 18.6 | 18.5 | 19.7 | 19.2 | 19.1 | 19.5 | 19.6 | 19.7 | 19.4 | 19.7 | 18.9 | 20.1 | 19.5 | 19.2 | 19.4 | 19.2 | 19.1 | 19.4 |
| Zr | 316 | 321 | 341 | 360 | 359 | 364 | 366 | 364 | 308 | 314 | 307 | 321 | 312 | 288 | 285 | 272 | 284 | 302 |
| Nb | 16.7 | 16.9 | 17.8 | 13.4 | 13.2 | 13.3 | 13.3 | 13.3 | 17.2 | 17.4 | 17.0 | 18.1 | 17.8 | 17.9 | 17.0 | 16.3 | 16.7 | 18.1 |
| Ba | 1640 | 1460 | 1490 | 1540 | 1580 | 1520 | 1660 | 1530 | 1480 | 1500 | 1440 | 1580 | 1480 | 1280 | 1270 | 1220 | 1260 | 1300 |
| Ta | 0.723 | 0.697 | 0.781 | 0.793 | 0.752 | 0.757 | 0.778 | 0.783 | 0.797 | 0.834 | 0.808 | 0.829 | 0.845 | 0.950 | 0.871 | 0.861 | 0.908 | 0.924 |
| Pb | 47.2 | 20.5 | 27.0 | 36.0 | 38.6 | 35.2 | 45.0 | 28.3 | 18.4 | 19.5 | 17.6 | 20.5 | 20.3 | 20.5 | 20.1 | 19.6 | 21.0 | 21.7 |
| Th | 11.6 | 11.8 | 12.6 | 12.2 | 12.0 | 12.1 | 12.6 | 12.2 | 14.7 | 15.2 | 14.7 | 15.8 | 15.3 | 14.9 | 14.4 | 13.5 | 14.2 | 15.1 |
| U | 2.94 | 3.01 | 3.19 | 3.22 | 3.11 | 3.22 | 3.17 | 3.22 | 3.90 | 4.09 | 3.97 | 4.34 | 4.24 | 4.76 | 4.43 | 4.09 | 4.23 | 4.61 |
| La | 85.5 | 86.8 | 90.5 | 88.1 | 86.9 | 88.8 | 89.8 | 88.6 | 85.8 | 88.4 | 86.0 | 90.7 | 88.2 | 71.9 | 73.3 | 70.6 | 72.7 | 74.2 |
| Ce | 170 | 171 | 180 | 179 | 177 | 181 | 181 | 181 | 170 | 174 | 171 | 180 | 176 | 142 | 146 | 140 | 143 | 146 |
| Pr | 19.4 | 19.7 | 20.6 | 20.8 | 20.6 | 21.1 | 21.5 | 21.2 | 19.6 | 20.3 | 19.6 | 20.8 | 20.5 | 16.2 | 16.6 | 16.3 | 16.5 | 16.6 |
| Nd | 74.8 | 74.6 | 78.2 | 75.7 | 75.6 | 77.2 | 78.0 | 77.4 | 75.6 | 76.8 | 74.9 | 81.6 | 77.1 | 62.2 | 62.5 | 61.7 | 62.6 | 63.5 |
| Sm | 10.9 | 11.3 | 11.5 | 11.5 | 11.7 | 11.9 | 11.8 | 11.7 | 11.7 | 11.9 | 11.7 | 12.6 | 11.7 | 10 | 9.95 | 9.35 | 9.55 | 9.73 |
| Eu | 2.90 | 2.94 | 3.03 | 2.96 | 2.95 | 3.01 | 3.06 | 3.03 | 2.98 | 3.07 | 3.06 | 3.17 | 3.15 | 2.53 | 2.51 | 2.40 | 2.45 | 2.48 |
| Gd | 8.39 | 8.03 | 8.77 | 7.99 | 8.18 | 8.10 | 8.12 | 8.17 | 8.27 | 8.45 | 8.32 | 8.84 | 8.38 | 7.34 | 6.82 | 6.93 | 7.16 | 7.21 |
| Tb | 1.09 | 1.10 | 1.15 | 1.05 | 1.02 | 1.05 | 1.08 | 1.06 | 1.10 | 1.19 | 1.14 | 1.18 | 1.20 | 1.02 | 1.07 | 1.00 | 0.97 | 1.00 |
| Dy | 3.81 | 4.01 | 4.29 | 4.12 | 4.03 | 4.19 | 4.08 | 4.08 | 4.12 | 4.30 | 3.91 | 4.20 | 4.30 | 3.97 | 3.92 | 3.78 | 3.86 | 4.17 |
| Ho | 0.68 | 0.68 | 0.71 | 0.75 | 0.71 | 0.74 | 0.75 | 0.73 | 0.70 | 0.74 | 0.68 | 0.75 | 0.70 | 0.70 | 0.72 | 0.68 | 0.68 | 0.71 |
| Er | 2.13 | 2.21 | 2.29 | 2.04 | 1.98 | 2.05 | 2.05 | 2.08 | 2.13 | 2.23 | 2.06 | 2.27 | 2.17 | 2.22 | 2.26 | 2.23 | 2.17 | 2.12 |
| Tm | 0.21 | 0.23 | 0.24 | 0.26 | 0.25 | 0.25 | 0.25 | 0.25 | 0.22 | 0.21 | 0.22 | 0.24 | 0.24 | 0.25 | 0.26 | 0.24 | 0.24 | 0.26 |
| Yb | 1.46 | 1.50 | 1.62 | 1.56 | 1.57 | 1.56 | 1.56 | 1.55 | 1.51 | 1.57 | 1.45 | 1.61 | 1.50 | 1.69 | 1.64 | 1.60 | 1.72 | 1.87 |
| Lu | 0.230 | 0.218 | 0.241 | 0.225 | 0.213 | 0.223 | 0.218 | 0.230 | 0.200 | 0.248 | 0.217 | 0.242 | 0.222 | 0.240 | 0.257 | 0.246 | 0.262 | 0.259 |
| Hf | 7.41 | 7.38 | 7.90 | 7.46 | 7.25 | 7.74 | 7.74 | 7.71 | 6.92 | 7.18 | 7.04 | 7.49 | 6.86 | 6.96 | 6.82 | 6.44 | 7.05 | 7.60 |
| [La/Yb]N | 42.0 | 41.5 | 40.1 | 40.5 | 39.7 | 40.8 | 41.3 | 41.0 | 40.8 | 40.4 | 42.5 | 40.4 | 42.2 | 30.5 | 32.1 | 31.7 | 30.3 | 28.5 |
| [Er/Yb]N | 1.46 | 1.47 | 1.41 | 1.34 | 1.30 | 1.35 | 1.35 | 1.38 | 1.41 | 1.42 | 1.42 | 1.41 | 1.45 | 1.31 | 1.38 | 1.39 | 1.26 | 1.13 |

PTB, potassic trachybasalt; SH, shoshonite; LAT, latite. Mg-number =100\*Mg/(Mg+Fe2+), calculated assuming Fe2O3/(FeO+Fe2O3)=0.15. \*Total Fe is given as Fe2O3.

Table 4 Sr-Nd isotopic data for the high-Mg volcanic rocks from Boza area of the Nangqian basin

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample no. | Rock type | Age(Ma) | 87Rb/86Sr | 87Sr/86Sr | ±2σ | (87Sr/86Sr)i | 147Sm/144Nd | 143Nd/144Nd | ±2σ | (143Nd/144Nd)i | εNd（t） | TDM (Ma) |
| BZ04-5-1 | PTB | 38.3 | 0.1223 | 0.705586 | 10 | 0.705521 | 0.0881 | 0.512588 | 3 | 0.512567 | -0.56 | 682 |
| BZ05-1 | PTB | 38.3 | 0.1290 | 0.705547 | 12 | 0.705479 | 0.0916 | 0.512593 | 5 | 0.512571 | -0.49 | 696 |
| BZ05-2 | PTB | 38.3 | 0.1340 | 0.705559 | 10 | 0.705488 | 0.0889 | 0.512585 | 3 | 0.512563 | -0.64 | 691 |
| BZ03-3 | LAT | 39.7 | 0.1691 | 0.705126 | 14 | 0.705034 | 0.0972 | 0.512615 | 1 | 0.512591 | 0.04 | 701 |
| BZ03-4 | LAT | 39.7 | 0.1562 | 0.705114 | 16 | 0.705029 | 0.0963 | 0.512618 | 2 | 0.512594 | 0.10 | 691 |
| BZ03-5 | LAT | 39.7 | 0.1551 | 0.705122 | 10 | 0.705038 | 0.0916 | 0.512615 | 1 | 0.512592 | 0.07 | 669 |
| BZ03-6 | LAT | 39.7 | 0.1613 | 0.705118 | 18 | 0.705030 | 0.0922 | 0.512614 | 1 | 0.512591 | 0.04 | 673 |
| BZ04-2 | SH | 40.1 | 0.1584 | 0.705554 | 14 | 0.705472 | 0.0936 | 0.512562 | 1 | 0.512540 | -1.00 | 747 |
| BZ04-3 | SH | 40.1 | 0.1595 | 0.705523 | 12 | 0.705440 | 0.0937 | 0.512568 | 2 | 0.512546 | -0.89 | 740 |
| BZ04-5 | LAT | 40.1 | 0.1606 | 0.705531 | 16 | 0.705448 | 0.0944 | 0.512588 | 1 | 0.512565 | -0.50 | 719 |
| BZ04-6 | SH | 40.1 | 0.1606 | 0.705537 | 10 | 0.705454 | 0.0934 | 0.512559 | 2 | 0.512537 | -1.06 | 749 |

87Sr/86Sr and 147Sm/144Nd are calculated using whole-rock Rb, Sr, Sm and Nd values in Table 3. Chondritic Uniform Reservoir (CHUR) at the present day [(87Rb/86Sr)CHUR=0.0847 ; McCulloch and Black, 1984]; (87Sr/86Sr)CHUR=0.7045 (DePaolo, 2012); (147Sm/144Nd)CHUR=0.1967 (Jacobsen and Wasserburg, 1980); (143Nd/144Nd)CHUR=0.512638 (Goldstein et al., 1984)] was used for the calculations. Nd depleted mantle model ages (TDM) were calculated using (147Sm/144Nd)DM=0.2137 and (143Nd/144Nd)DM=0.51315 (Peucat et al., 1989) at the present day. Initial 87Sr/86Sr ratios and εNd(t) values are corrected using zircon U-Pb ages. PTB, potassic trachybasalt; SH, shoshonite; LAT, latite.

Table 5 Pb isotopic data for the high-Mg volcanic rocks from Boza area of the Nangqian basin

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Pb | Th | U | 206Pb/204Pb | 2σ | 207Pb/204Pb | 2σ | 208Pb/204Pb | 2σ | 238U/204Pb | 232Th/204Pb | t (Ma) | (206Pb/204Pb)i | (207Pb/204Pb)i | (208Pb/204Pb)i |
| BZ04-5-1 | 47.2 | 11.6 | 2.94 | 18.697 | 8 | 15.522 | 8 | 38.504 | 7 | 4.60 | 18.1 | 38.3 | 18.670 | 15.521 | 38.470 |
| BZ05-1 | 20.5 | 11.8 | 3.01 | 18.703 | 6 | 15.522 | 4 | 38.531 | 8 | 10.8 | 42.5 | 38.3 | 18.639 | 15.519 | 38.450 |
| BZ05-2 | 27 | 12.6 | 3.19 | 18.742 | 14 | 15.535 | 12 | 38.561 | 12 | 8.70 | 34.5 | 38.3 | 18.690 | 15.533 | 38.496 |
| BZ03-3 | 20.5 | 14.9 | 4.76 | 18.758 | 12 | 15.545 | 8 | 38.605 | 12 | 17.0 | 53.7 | 39.7 | 18.653 | 15.540 | 38.499 |
| BZ03-4 | 20.1 | 14.4 | 4.43 | 18.793 | 10 | 15.577 | 8 | 38.693 | 8 | 16.2 | 53.1 | 39.7 | 18.693 | 15.572 | 38.589 |
| BZ03-5 | 19.6 | 13.5 | 4.09 | 18.775 | 16 | 15.559 | 12 | 38.623 | 14 | 15.3 | 50.9 | 39.7 | 18.680 | 15.555 | 38.523 |
| BZ03-6 | 21 | 14.2 | 4.23 | 18.792 | 14 | 15.579 | 12 | 38.687 | 12 | 14.8 | 50.1 | 39.7 | 18.700 | 15.575 | 38.588 |
| BZ04-2 | 18.4 | 14.7 | 3.9 | 18.744 | 12 | 15.527 | 6 | 38.609 | 7 | 15.5 | 59.0 | 40.1 | 18.647 | 15.522 | 38.492 |
| BZ04-3 | 19.5 | 15.2 | 4.09 | 18.772 | 12 | 15.557 | 6 | 38.705 | 11 | 15.4 | 57.7 | 40.1 | 18.676 | 15.552 | 38.590 |
| BZ04-5 | 17.6 | 14.7 | 3.97 | 18.793 | 6 | 15.567 | 6 | 38.708 | 6 | 16.6 | 61.9 | 40.1 | 18.690 | 15.562 | 38.585 |
| BZ04-6 | 20.5 | 15.8 | 4.34 | 18.788 | 8 | 15.555 | 6 | 38.667 | 7 | 15.6 | 57.0 | 40.1 | 18.691 | 15.550 | 38.554 |

Note: (1) 238U/204Pb and 232Th/204Pb ratios are calculated by using measured whole-rock Pb, Th and U contents (Table 3) and present-day whole-rock Pb isotopic ratios. (2) Initial Pb isotopic ratios were obtained by using the zircon U-Pb ages of the volcanic rocks (Table 2).

Table 6 Hf isotopic data for the magmatic zircons in the high-Mg volcanic rocks from the Boza area of the Nangqian basin

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Spots | 176Yb/177Hf | 176Lu/177Hf | 176Hf/177Hf | 1 σ | εHf(t) | 1σ | TDM2(Ma) | 1σ |
| BZ05-1 (potassic trachybasalt; 38.31±0.31 Ma) | | | | | | | | |
| 1 | 0.032796 | 0.001050 | 0.282917 | 0.000012 | 5.96 | 0.44 | 734 | 28 |
| 2 | 0.033564 | 0.001086 | 0.282950 | 0.000011 | 7.12 | 0.38 | 660 | 25 |
| 3 | 0.032679 | 0.001100 | 0.282966 | 0.000013 | 7.67 | 0.47 | 624 | 30 |
| 4 | 0.038212 | 0.001093 | 0.282956 | 0.000013 | 7.33 | 0.47 | 646 | 30 |
| 5 | 0.038887 | 0.001133 | 0.282937 | 0.000011 | 6.65 | 0.40 | 690 | 26 |
| 6 | 0.042003 | 0.001512 | 0.282925 | 0.000014 | 6.22 | 0.48 | 718 | 31 |
| 7 | 0.037566 | 0.001177 | 0.282900 | 0.000011 | 5.32 | 0.39 | 774 | 25 |
| 8 | 0.033910 | 0.001044 | 0.282967 | 0.000012 | 7.72 | 0.41 | 622 | 26 |
| 9 | 0.027783 | 0.000852 | 0.282876 | 0.000011 | 4.51 | 0.39 | 827 | 25 |
| 10 | 0.032682 | 0.000999 | 0.282939 | 0.000010 | 6.71 | 0.35 | 686 | 22 |
| 11 | 0.038026 | 0.001122 | 0.282928 | 0.000011 | 6.32 | 0.38 | 711 | 24 |
| 12 | 0.037947 | 0.001155 | 0.282874 | 0.000010 | 4.41 | 0.35 | 833 | 22 |
| 13 | 0.031720 | 0.000972 | 0.282947 | 0.000010 | 7.00 | 0.35 | 668 | 23 |
| 14 | 0.036114 | 0.001077 | 0.282905 | 0.000011 | 5.51 | 0.40 | 763 | 26 |
| 15 | 0.037211 | 0.001122 | 0.282892 | 0.000012 | 5.05 | 0.43 | 792 | 27 |
| 16 | 0.041908 | 0.001280 | 0.282890 | 0.000010 | 5.00 | 0.34 | 796 | 22 |
| 17 | 0.036897 | 0.001266 | 0.282903 | 0.000014 | 5.45 | 0.49 | 767 | 31 |
| 18 | 0.035177 | 0.001085 | 0.282937 | 0.000009 | 6.65 | 0.33 | 690 | 21 |
| BZ04-2 (shoshonite; 40.09±0.43 Ma) | | | | | | | | |
| 1 | 0.051221 | 0.001894 | 0.282945 | 0.000011 | 6.94 | 0.39 | 673 | 25 |
| 2 | 0.042009 | 0.001515 | 0.282975 | 0.000012 | 8.03 | 0.41 | 603 | 26 |
| 3 | 0.061984 | 0.001824 | 0.282869 | 0.000015 | 4.27 | 0.53 | 843 | 34 |
| 4 | 0.038554 | 0.001223 | 0.282901 | 0.000010 | 5.42 | 0.34 | 769 | 22 |
| 5 | 0.037219 | 0.001336 | 0.282902 | 0.000009 | 5.44 | 0.31 | 768 | 20 |
| 6 | 0.022169 | 0.000620 | 0.282981 | 0.000007 | 8.24 | 0.25 | 589 | 16 |
| 7 | 0.093638 | 0.003178 | 0.282922 | 0.000017 | 6.12 | 0.61 | 725 | 39 |
| 8 | 0.088817 | 0.002842 | 0.282864 | 0.000009 | 4.07 | 0.30 | 856 | 19 |
| 9 | 0.061899 | 0.002078 | 0.282975 | 0.000010 | 8.01 | 0.37 | 604 | 23 |
| 10 | 0.068591 | 0.002253 | 0.282940 | 0.000008 | 6.75 | 0.27 | 685 | 17 |
| 11 | 0.048435 | 0.001629 | 0.282941 | 0.000010 | 6.80 | 0.35 | 682 | 22 |
| 12 | 0.036830 | 0.001135 | 0.282917 | 0.000010 | 5.99 | 0.36 | 733 | 23 |
| 13 | 0.028987 | 0.000896 | 0.282944 | 0.000009 | 6.95 | 0.32 | 672 | 21 |
| 14 | 0.053673 | 0.001877 | 0.282912 | 0.000007 | 5.77 | 0.25 | 748 | 16 |
| 15 | 0.055325 | 0.001714 | 0.282896 | 0.000008 | 5.21 | 0.29 | 783 | 18 |
| 16 | 0.051774 | 0.001812 | 0.282897 | 0.000009 | 5.26 | 0.33 | 780 | 21 |
| 17 | 0.028670 | 0.000911 | 0.282930 | 0.000008 | 6.46 | 0.30 | 704 | 19 |
| 18 | 0.091320 | 0.002897 | 0.282955 | 0.000008 | 7.28 | 0.28 | 651 | 18 |
| BZ03-3 (latite; 39.74±0.30 Ma) | | | | | | | | |
| 1 | 0.040324 | 0.001207 | 0.282921 | 0.000009 | 6.10 | 0.33 | 726 | 21 |
| 2 | 0.040461 | 0.001215 | 0.282918 | 0.000010 | 6.00 | 0.35 | 733 | 22 |
| 3 | 0.032315 | 0.000983 | 0.282978 | 0.000011 | 8.14 | 0.37 | 596 | 24 |
| 4 | 0.038498 | 0.001177 | 0.282964 | 0.000010 | 7.63 | 0.34 | 628 | 22 |
| 5 | 0.054605 | 0.001567 | 0.282965 | 0.000010 | 7.67 | 0.36 | 626 | 23 |
| 6 | 0.036344 | 0.001151 | 0.282944 | 0.000010 | 6.94 | 0.36 | 672 | 23 |
| 7 | 0.034985 | 0.001110 | 0.282927 | 0.000011 | 6.31 | 0.39 | 712 | 25 |
| 8 | 0.032006 | 0.001030 | 0.282905 | 0.000011 | 5.55 | 0.38 | 761 | 24 |
| 9 | 0.043886 | 0.001353 | 0.282883 | 0.000011 | 4.75 | 0.40 | 812 | 25 |
| 10 | 0.032878 | 0.001096 | 0.282945 | 0.000010 | 6.96 | 0.35 | 671 | 22 |
| 11 | 0.042596 | 0.001390 | 0.282958 | 0.000011 | 7.41 | 0.37 | 642 | 24 |
| 12 | 0.038950 | 0.001340 | 0.282955 | 0.000011 | 7.31 | 0.37 | 649 | 24 |
| 13 | 0.041365 | 0.001289 | 0.282944 | 0.000011 | 6.91 | 0.38 | 674 | 24 |
| 14 | 0.037562 | 0.001258 | 0.282974 | 0.000011 | 7.97 | 0.41 | 606 | 26 |
| 15 | 0.038315 | 0.001247 | 0.283014 | 0.000011 | 9.40 | 0.40 | 515 | 26 |
| 16 | 0.038007 | 0.001237 | 0.282930 | 0.000012 | 6.42 | 0.41 | 705 | 26 |
| 17 | 0.037650 | 0.001228 | 0.282976 | 0.000010 | 8.06 | 0.34 | 601 | 22 |
| 18 | 0.044953 | 0.001465 | 0.282950 | 0.000009 | 7.11 | 0.32 | 661 | 20 |
| 19 | 0.050420 | 0.001583 | 0.282971 | 0.000010 | 7.87 | 0.35 | 613 | 22 |
| 20 | 0.041148 | 0.001319 | 0.282943 | 0.000010 | 6.89 | 0.37 | 676 | 23 |

εHf(t)=10000[(176Hf/177Hf)S-(176Lu/177Hf)S(eλt-1)]/[(176Hf/177Hf)CHUR,0-(176Lu/177Hf)CHUR(eλt-1)]-1.



Values for (176Hf/177Hf)CHUR,0 (0.282785) and (176Lu/177Hf)CHUR (0.0336) are from Bouvier et al. (2008). εHf(t) calculated using a Lu decay constant of 1.865 ×10-11 a-1 (Scherer et al., 2001). Two-stage Hf model age (TDM2) calculated using the initial 176Hf/177Hf ratios of the zircons and the depleted mantle, the U-Pb age and the 176Lu/177Hf ratios of the average continental crust (176Lu/177Hf = 0.015; Griffin et al., 2002). Present-day 176Lu/177Hf ratio and 176Hf/177Hf ratio of the depleted mantle are 0.0384 and 0.28325, respectively (Griffin et al., 2000)

Table7 Zircon U-Pb and Ar-Ar age data of the high-Mg volcanic rocks in the Nangqian basin and western Yunnan region.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Locality | Rock type | Analyzed phase | Method | Age(Ma) | Reference |
| The Nangqian basin |  |  |  |  |  |
| BZ05-1  BZ04-2  BZ03-3 | PTB | Zircon | LA-ICPMS U-Pb | 38.5±0.4 | This study |
| BTA | Zircon | LA-ICPMS U-Pb | 40.1±0.4 | This study |
| BTA | Zircon | LA-ICPMS U-Pb | 39.6±0.3 | This study |
|  | SH | Phlog. | Ar-Ar | ~38.7 | Pan et al., 1990 |
| MS99-4-27-(1b) | TA | Biot | Ar-Ar | 37.2±0.1 | Spurlin et al., 2005 |
| MS99-4-18-(1) | TD | Biot | Ar-Ar | 37.3±0.2 | Spurlin et al., 2005 |
| MS00-5-9-(4) | TD | Biot | Ar-Ar | 37.4±0.1 | Spurlin et al., 2005 |
| MS00-5-25-(1) | TD | Biot | Ar-Ar | 37.6±0.1 | Spurlin et al., 2005 |
| MS99-4-16-(2) | BTA | Biot | Ar-Ar | 37.7±0.2 | Spurlin et al., 2005 |
| MS00-5-9-(3) | TD | Biot | Ar-Ar | 37.7±0.2 | Spurlin et al., 2005 |
| MS99-4-15-(3) | TA | Biot | Ar-Ar | 37.8±0.1 | Spurlin et al., 2005 |
| MS99-4-28-(1a) | TA | Biot | Ar-Ar | 38.2±0.1 | Spurlin et al., 2005 |
|  |  |  |  |  |  |
| The Western Yunnan |  |  |  |  |  |
| Wozhong | SH | Whole rock | Ar-Ar | 35.5±0.1 | Huang et al., 2010 |
| Houshan | PTB | Whole rock | Ar-Ar | 36.6±0.2 | Huang et al., 2010 |
| LAT | Whole rock | Ar-Ar | 36.3±0.2 | Huang et al., 2010 |
| Wase | SH | Whole rock | Ar-Ar | 35.1±0.2 | Huang et al., 2010 |
| DP1-1 | BTA | Biot. | Ar-Ar | 33.3±0.4 | Wang et al., 2001 |
| DP19-1 | BTA | Biot. | Ar-Ar | 34.0±1.2 | Wang et al., 2001 |
| G-1(Y86-172) | TA | Whole rock | Ar-Ar | 32.9±0.3 | Chung et al., 1998 |
| G-1(P9481) | SH | Whole rock | Ar-Ar | 30.0±1.1 | Chung et al., 1998 |
| G-1(Y86-71) | SH | Whole rock | Ar-Ar | 30.5±1.5 | Chung et al., 1998 |
| G-1(YN-131) | TA | Biot. | Ar-Ar | 32.8±0.2 | Chung et al., 1998 |
| G-1(96YN140) | SH | Phlog. | Ar-Ar | 32.9±0.2 | Chung et al., 1998 |
| Beiya | MT | Phlog. | Ar-Ar | 34.75±0.05 | Guo et al., 2005 |
| Yanyuan | MT | sanidine | Ar-Ar | 32.76±0.06 | Guo et al., 2005 |
|  |  |  |  |  |  |

Notes: Phase dated: Biot., biotite; Phlog, phlogopite. Rock type: PTB, potassic trachybasalt; BTA, basaltic trachyandesite; SH, shoshonite; TA, trachy-andesite; TD, trachydacite; LAT, latite; MT, minette. In order to overcome the influence of excess argon, all Ar-Ar isochron ages are adopted to represent the time of Cenozoic high-potassic volcanic eruption.