表1 玉树南部辉石闪长玢岩样品的锆石LA-ICP-MS U-Pb定年结果

Table1 Zircon LA-ICP-MS U-Pb dating results for the South Yushu diorite porphyrite

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测点号 | 元素含量 | | Th/U | 同位素比值 | | | | | | 同位素年龄（Ma） | | | | | |
| 232Th | 238U | 207Pb/206Pb | ±1σ | 207Pb/235U | ±1σ | 206Pb/238U | ±1σ | 207Pb/206Pb | ±1σ | 207Pb/235U | ±1σ | 206Pb/238U | ±1σ |
| 01 | 170 | 417 | 0.4 | 0.05763 | 0.00368 | 0.29244 | 0.01952 | 0.03658 | 0.00066 | 516 | 115 | 260 | 15 | 232 | 4 |
| 02 | 173 | 363 | 0.5 | 0.05642 | 0.00565 | 0.27637 | 0.02719 | 0.03552 | 0.00065 | 469 | 228 | 248 | 22 | 225 | 4 |
| 03 | 222 | 475 | 0.5 | 0.05966 | 0.00396 | 0.29785 | 0.01810 | 0.03681 | 0.00061 | 591 | 103 | 265 | 14 | 233 | 4 |
| 04 | 199 | 396 | 0.5 | 0.05095 | 0.01083 | 0.24572 | 0.05189 | 0.03498 | 0.00081 | 239 | 397 | 223 | 42 | 222 | 5 |
| 05 | 479 | 805 | 0.6 | 0.05326 | 0.00280 | 0.26627 | 0.01343 | 0.03640 | 0.00051 | 340 | 89 | 240 | 11 | 230 | 3 |
| 06 | 211 | 427 | 0.5 | 0.05259 | 0.00757 | 0.25438 | 0.03634 | 0.03508 | 0.00061 | 311 | 308 | 230 | 29 | 222 | 4 |
| 07 | 482 | 801 | 0.6 | 0.05375 | 0.00486 | 0.26034 | 0.02318 | 0.03513 | 0.00055 | 361 | 207 | 235 | 19 | 223 | 3 |
| 08 | 185 | 412 | 0.4 | 0.05695 | 0.00943 | 0.27918 | 0.04594 | 0.03555 | 0.00066 | 490 | 364 | 250 | 36 | 225 | 4 |
| 09 | 173 | 411 | 0.4 | 0.05277 | 0.00554 | 0.26434 | 0.02727 | 0.03633 | 0.00069 | 319 | 240 | 238 | 22 | 230 | 4 |
| 10 | 715 | 1046 | 0.7 | 0.05439 | 0.00412 | 0.26586 | 0.01975 | 0.03545 | 0.00052 | 387 | 175 | 239 | 16 | 225 | 3 |
| 11 | 181 | 387 | 0.5 | 0.05684 | 0.00341 | 0.27795 | 0.01583 | 0.03637 | 0.00063 | 485 | 95 | 249 | 13 | 230 | 4 |
| 12 | 157 | 348 | 0.5 | 0.07130 | 0.00532 | 0.35065 | 0.02497 | 0.03631 | 0.00071 | 966 | 114 | 305 | 19 | 230 | 4 |
| 13 | 253 | 482 | 0.5 | 0.04668 | 0.00562 | 0.22799 | 0.02715 | 0.03542 | 0.00063 | 33 | 239 | 209 | 22 | 224 | 4 |
| 14 | 168 | 369 | 0.5 | 0.05036 | 0.00657 | 0.26590 | 0.03430 | 0.03829 | 0.00075 | 212 | 278 | 239 | 28 | 242 | 5 |
| 15 | 429 | 687 | 0.6 | 0.05212 | 0.00458 | 0.25375 | 0.02193 | 0.03531 | 0.00054 | 291 | 201 | 230 | 18 | 224 | 3 |
| 16 | 257 | 508 | 0.5 | 0.06145 | 0.00396 | 0.30048 | 0.01826 | 0.0362 | 0.0006 | 655 | 102 | 267 | 14 | 229 | 4 |
| 17 | 149 | 324 | 0.5 | 0.06917 | 0.00434 | 0.33807 | 0.02129 | 0.03607 | 0.00081 | 904 | 93 | 296 | 16 | 228 | 5 |
| 18 | 151 | 327 | 0.5 | 0.05304 | 0.00403 | 0.25565 | 0.01681 | 0.0365 | 0.00072 | 330 | 113 | 231 | 14 | 231 | 4 |
| 19 | 383 | 626 | 0.6 | 0.055 | 0.00353 | 0.27255 | 0.01714 | 0.03602 | 0.00059 | 412 | 112 | 245 | 14 | 228 | 4 |

表2 玉树南部辉石闪长玢岩样品的辉石矿物电子探针结果

Table2 Results of Pyroxene Mineral Electron Probes of the South Yushu diorite porphyrite

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 岩石名称 | 闪长玢岩 | | | | | | | | | | | | | |  |
| 样品号 | YS34-1 | | | | | | | | | | | | | |  |
| 编号 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| SiO2 | 52.38 | 52.96 | 52.48 | 53.09 | 51.77 | 51.76 | 52.86 | 52.66 | 52.15 | 52.04 | 52.39 | 52.60 | 51.74 | 52.46 | 51.57 |
| TiO2 | 0.211 | 0.213 | 0.231 | 0.22 | 0.207 | 0.19 | 0.256 | 0.246 | 0.211 | 0.236 | 0.214 | 0.247 | 0.207 | 0.213 | 0.238 |
| Al2O3 | 1.022 | 1.001 | 1.079 | 1.002 | 1.127 | 1.23 | 1.183 | 1.088 | 0.98 | 0.972 | 1.193 | 1.066 | 1.198 | 1.165 | 1.15 |
| Cr2O3 | 0 | 0 | 0 | 0 | 0.001 | 0 | 0 | 0 | 0 | 0 | 0 | 0.009 | 0 | 0 | 0 |
| FeOt | 11.68 | 11.89 | 11.83 | 11.93 | 11.81 | 11.80 | 11.82 | 12.16 | 11.72 | 11.75 | 12.10 | 12.08 | 11.89 | 12.10 | 12.08 |
| MnO | 0.318 | 0.305 | 0.348 | 0.382 | 0.323 | 0.323 | 0.339 | 0.361 | 0.321 | 0.327 | 0.324 | 0.366 | 0.313 | 0.331 | 0.398 |
| MgO | 12.24 | 12.35 | 12.36 | 12.55 | 11.89 | 12.05 | 12.61 | 12.44 | 12.27 | 12.02 | 12.21 | 12.27 | 12.09 | 12.38 | 12.09 |
| CaO | 20.24 | 20.25 | 20.20 | 20.31 | 19.93 | 20.01 | 20.24 | 20.31 | 20.35 | 20.20 | 20.19 | 20.18 | 20.04 | 20.15 | 19.89 |
| Na2O | 0.262 | 0.245 | 0.246 | 0.28 | 0.222 | 0.297 | 0.291 | 0.211 | 0.189 | 0.229 | 0.291 | 0.203 | 0.266 | 0.253 | 0.265 |
| K2O | 0.000 | 0.007 | 0.014 | 0.017 | 0.002 | 0.020 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.013 | 0.013 | 0.003 |
| Si | 2.0004 | 2.0039 | 1.9966 | 1.9992 | 2.0003 | 1.9930 | 1.9930 | 1.9922 | 1.9969 | 2.0010 | 1.9931 | 1.9975 | 1.9916 | 1.9922 | 1.9890 |
| Al(ⅳ) | 0.0000 | 0.0000 | 0.0034 | 0.0008 | 0.0000 | 0.0070 | 0.0070 | 0.0078 | 0.0031 | 0.0000 | 0.0070 | 0.0025 | 0.0084 | 0.0078 | 0.0110 |
| Al(ⅵ) | 0.0460 | 0.0446 | 0.0450 | 0.0436 | 0.0513 | 0.0488 | 0.0456 | 0.0407 | 0.0412 | 0.0441 | 0.0465 | 0.0452 | 0.0459 | 0.0444 | 0.0413 |
| Ti | 0.0061 | 0.0061 | 0.0066 | 0.0062 | 0.0060 | 0.0055 | 0.0073 | 0.0070 | 0.0061 | 0.0068 | 0.0061 | 0.0071 | 0.0060 | 0.0061 | 0.0069 |
| Cr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0000 | 0.0000 |
| Fe3+ | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Fe2+ | 0.3748 | 0.3786 | 0.3781 | 0.3772 | 0.3838 | 0.3815 | 0.3741 | 0.3864 | 0.3771 | 0.3799 | 0.3865 | 0.3856 | 0.3840 | 0.3858 | 0.3909 |
| Mn | 0.0103 | 0.0098 | 0.0112 | 0.0122 | 0.0106 | 0.0105 | 0.0108 | 0.0116 | 0.0104 | 0.0107 | 0.0104 | 0.0118 | 0.0102 | 0.0107 | 0.0130 |
| Mg | 0.6971 | 0.6969 | 0.7007 | 0.7045 | 0.6849 | 0.6917 | 0.7087 | 0.7015 | 0.7002 | 0.6889 | 0.6924 | 0.6947 | 0.6940 | 0.7006 | 0.6950 |
| Ca | 0.8282 | 0.8208 | 0.8233 | 0.8196 | 0.8251 | 0.8254 | 0.8177 | 0.8232 | 0.8347 | 0.8324 | 0.8228 | 0.8212 | 0.8263 | 0.8199 | 0.8221 |
| Na | 0.0194 | 0.0180 | 0.0181 | 0.0204 | 0.0166 | 0.0222 | 0.0213 | 0.0155 | 0.0140 | 0.0171 | 0.0215 | 0.0150 | 0.0199 | 0.0186 | 0.0198 |
| K | 0.0000 | 0.0003 | 0.0007 | 0.0008 | 0.0001 | 0.0010 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0006 | 0.0006 | 0.0002 |
| Wo | 42.92 | 42.66 | 42.63 | 42.38 | 42.95 | 42.74 | 42.31 | 42.47 | 43.11 | 43.15 | 42.55 | 42.59 | 42.72 | 42.36 | 42.36 |
| En | 36.12 | 36.22 | 36.28 | 36.43 | 35.65 | 35.82 | 36.67 | 36.19 | 36.16 | 35.71 | 35.81 | 36.03 | 35.88 | 36.2 | 35.81 |
| Fs | 19.96 | 20.18 | 20.15 | 20.13 | 20.53 | 20.3 | 19.92 | 20.53 | 20.01 | 20.25 | 20.53 | 20.61 | 20.38 | 20.48 | 20.81 |
| Ac | 1.01 | 0.93 | 0.94 | 1.06 | 0.87 | 1.15 | 1.1 | 0.8 | 0.72 | 0.89 | 1.11 | 0.78 | 1.03 | 0.96 | 1.02 |

表3玉树南部闪长玢岩的全岩主量元素（wt/%）、微量元素（wt/10-6）以及Sr-Nd同位素组成

Table3 Whole rock major (wt/%), trace element (wt/10-6) and Sr-Nd isotopic compositions of the South Yushu diorite porphyrite

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 样品号 | YS34-1 | YS34-5 | YS35-1 | YS37-1 | YS39-1 | YS40-1 |
| SiO2 | 59.68 | 59.91 | 60.11 | 60.30 | 59.14 | 57.62 |
| TiO2 | 0.61 | 0.58 | 0.58 | 0.60 | 0.60 | 0.57 |
| Al2O3 | 15.37 | 15.50 | 15.36 | 15.43 | 15.61 | 15.66 |
| Fe2O3 | 2.00 | 4.56 | 2.43 | 2.11 | 2.84 | 2.20 |
| FeO | 5.22 | 2.57 | 4.35 | 4.65 | 4.40 | 5.50 |
| FeOt | 7.02 | 6.67 | 6.54 | 6.55 | 6.96 | 7.48 |
| MnO | 0.10 | 0.10 | 0.06 | 0.12 | 0.12 | 0.13 |
| MgO | 3.17 | 3.10 | 2.96 | 3.22 | 3.48 | 4.06 |
| CaO | 4.48 | 5.81 | 5.66 | 5.86 | 6.11 | 6.26 |
| Na2O | 4.93 | 2.86 | 3.44 | 3.13 | 2.73 | 3.25 |
| K2O | 0.96 | 1.88 | 1.99 | 0.82 | 1.29 | 1.25 |
| P2O5 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.10 |
| Mg# | 45 | 45 | 45 | 47 | 47 | 49 |
| LOI | 102.38 | 102.41 | 102.22 | 102.91 | 102.79 | 102.52 |
| Sc | 22.78 | 23.10 | 22.55 | 23.41 | 23.20 | 26.95 |
| V | 131.28 | 136.83 | 129.82 | 125.80 | 136.16 | 148.04 |
| Cr | 15.32 | 30.63 | 15.05 | 18.63 | 16.22 | 32.69 |
| Co | 38.63 | 40.43 | 46.05 | 41.02 | 47.95 | 40.98 |
| Ni | 5.19 | 6.32 | 5.11 | 5.56 | 5.50 | 7.53 |
| Cu | 31.80 | 20.42 | 5.27 | 13.24 | 58.49 | 19.44 |
| Zn | 51.55 | 54.35 | 27.63 | 48.95 | 66.11 | 54.32 |
| Ga | 15.64 | 15.95 | 15.48 | 14.39 | 15.55 | 15.62 |
| Rb | 37.49 | 70.82 | 77.29 | 26.66 | 47.26 | 58.36 |
| Sr | 471.13 | 227.59 | 273.88 | 188.90 | 285.19 | 251.68 |
| Y | 21.53 | 21.31 | 20.80 | 20.51 | 20.23 | 20.10 |
| Zr | 109.69 | 98.75 | 100.41 | 89.10 | 84.56 | 75.24 |
| Nb | 4.46 | 4.44 | 4.24 | 4.34 | 4.14 | 3.99 |
| Cs | 2.25 | 2.29 | 2.28 | 0.80 | 1.28 | 1.92 |
| Ba | 270.54 | 415.93 | 370.51 | 200.38 | 319.80 | 284.45 |
| La | 17.70 | 16.94 | 17.03 | 15.08 | 15.13 | 14.67 |
| Ce | 34.56 | 32.88 | 32.59 | 29.75 | 29.95 | 28.61 |
| Pr | 4.07 | 3.80 | 3.77 | 3.48 | 3.49 | 3.35 |
| Nd | 15.42 | 14.60 | 14.38 | 13.88 | 13.64 | 12.92 |
| Sm | 3.35 | 3.36 | 3.32 | 3.11 | 3.15 | 3.04 |
| Eu | 0.87 | 0.82 | 0.82 | 0.78 | 0.84 | 0.85 |
| Gd | 3.28 | 3.35 | 3.22 | 3.12 | 3.11 | 3.07 |
| Tb | 0.53 | 0.56 | 0.54 | 0.53 | 0.53 | 0.51 |
| Dy | 3.53 | 3.60 | 3.41 | 3.42 | 3.24 | 3.19 |
| Ho | 0.73 | 0.73 | 0.74 | 0.72 | 0.72 | 0.70 |
| Er | 2.18 | 2.20 | 2.16 | 2.07 | 2.08 | 2.00 |
| Tm | 0.36 | 0.34 | 0.33 | 0.33 | 0.31 | 0.30 |
| Yb | 2.25 | 2.20 | 2.12 | 2.08 | 2.08 | 1.98 |
| Lu | 0.33 | 0.34 | 0.33 | 0.32 | 0.32 | 0.31 |
| Hf | 2.98 | 2.85 | 2.81 | 2.57 | 2.43 | 2.18 |
| Ta | 0.38 | 0.41 | 0.41 | 0.41 | 0.38 | 0.37 |
| Pb | 5.02 | 7.06 | 4.73 | 4.22 | 12.87 | 7.88 |
| Th | 7.50 | 7.82 | 7.82 | 7.28 | 6.49 | 5.92 |
| U | 1.93 | 1.69 | 1.74 | 1.54 | 1.18 | 1.19 |
| ΣREE | 89.14674 | 85.71724 | 84.74433 | 78.66855 | 78.57197 | 75.495 |
| LREE | 75.95734 | 72.38513 | 71.89679 | 66.08725 | 66.19633 | 63.43483 |
| HREE | 13.1894 | 13.33211 | 12.84754 | 12.5813 | 12.37564 | 12.06017 |
| LREE/HREE | 5.758967 | 5.429383 | 5.596154 | 5.252817 | 5.348923 | 5.259861 |
| LaN/YbN | 5.649404 | 5.509846 | 5.758917 | 5.209449 | 5.229674 | 5.312511 |
| δEu | 0.789436 | 0.740505 | 0.757284 | 0.753766 | 0.808311 | 0.841307 |
| δCe | 0.961251 | 0.96425 | 0.955368 | 0.969775 | 0.973101 | 0.96249 |

表4 玉树南部辉石闪长玢岩样品的锆石Lu-Hf同位素组成

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Age (Ma) | 176Yb/177Hf | 1σ | 176Lu/177Hf | 1σ | 176Hf/177Hf | 1σ | TDM1 | TDM2 | εHf(0) | 1σ | εHf(t) | 1σ | fLu/Hf |
| 01 | 231 | 0.027324 | 0.000362 | 0.000922 | 0.000009 | 0.282661 | 0.000014 | 834.83 | 1075.03 | -3.92 | 0.72 | 1.02 | 0.73 | -0.97 |
| 02 | 228 | 0.031974 | 0.000455 | 0.001038 | 0.000015 | 0.282689 | 0.000014 | 798.20 | 1022.57 | -2.93 | 0.71 | 1.92 | 0.72 | -0.97 |
| 03 | 229 | 0.035097 | 0.000826 | 0.001203 | 0.000038 | 0.282661 | 0.000016 | 842.16 | 1079.68 | -3.94 | 0.77 | 0.91 | 0.79 | -0.96 |
| 04 | 242 | 0.021958 | 0.000669 | 0.000754 | 0.000020 | 0.282662 | 0.000015 | 830.10 | 1067.73 | -3.89 | 0.73 | 1.31 | 0.74 | -0.98 |
| 05 | 224 | 0.027996 | 0.001401 | 0.000954 | 0.000052 | 0.282674 | 0.000016 | 817.16 | 1052.42 | -3.45 | 0.76 | 1.33 | 0.77 | -0.97 |
| 06 | 230 | 0.027001 | 0.000566 | 0.000943 | 0.000022 | 0.282643 | 0.000014 | 861.35 | 1112.02 | -4.57 | 0.71 | 0.34 | 0.72 | -0.97 |
| 07 | 230 | 0.028769 | 0.002095 | 0.000927 | 0.000060 | 0.282703 | 0.000015 | 775.90 | 992.96 | -2.43 | 0.73 | 2.48 | 0.74 | -0.97 |
| 08 | 225 | 0.047240 | 0.001948 | 0.001633 | 0.000076 | 0.282644 | 0.000022 | 875.20 | 1116.67 | -4.52 | 0.92 | 0.18 | 0.94 | -0.95 |
| 09 | 230 | 0.023820 | 0.000590 | 0.000823 | 0.000017 | 0.282661 | 0.000012 | 833.40 | 1075.66 | -3.93 | 0.66 | 0.99 | 0.67 | -0.98 |
| 10 | 230 | 0.044088 | 0.000883 | 0.001482 | 0.000025 | 0.282658 | 0.000016 | 851.97 | 1086.45 | -4.03 | 0.75 | 0.80 | 0.77 | -0.96 |

Table4 Zircon Lu-Hf isotopic compositions of the South Yushu diorite porphyrite