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