|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 附表 1 关门山地区花岗斑岩和碱长花岗岩的锆石LA-ICP-MS U-Pb测年数据 | | | | | | | | | | | | | | | | | |
| Table 1 LA-ICP-MS zicron U-Pb dating data for granite porphyry and alkali-feldspar granite of the Guanmenshan pluton | | | | | | | | | | | | | | | | | |
| 测点号 | Pb | Th | U | Th/U | 同位素比值 | | | | | |  | 年龄（Ma） | | | | | |
| (10-6） | | | 207Pb | 1*σ* | 207Pb | 1*σ* | 206Pb | 1*σ* |  | 206Pb | 1*σ* | 207Pb | 1*σ* | 206Pb | 1σ |
| 206Pb | 235U | 238U |  | 207Pb | 235U | 238U |
| ND015-1.1 | 2.61 | 68 | 132 | 0.41 | 0.047 2 | 0.008 4 | 0.111 5 | 0.019 3 | 0.019 4 | 0.000 6 |  | 58 | 426 | 107 | 18 | 124 | 4 |
| ND015-1.2 | 3.68 | 93 | 181 | 0.48 | 0.046 0 | 0.008 0 | 0.114 0 | 0.017 2 | 0.019 7 | 0.000 7 |  | 0 | 0 | 110 | 16 | 126 | 5 |
| ND015-1.3 | 2.36 | 46 | 111 | 0.46 | 0.048 3 | 0.009 1 | 0.117 6 | 0.019 2 | 0.020 0 | 0.000 7 |  | 115 | 445 | 113 | 17 | 128 | 5 |
| ND015-1.4 | 2.47 | 51 | 122 | 0.54 | 0.047 5 | 0.008 3 | 0.123 2 | 0.020 0 | 0.019 8 | 0.000 6 |  | 76 | 413 | 118 | 18 | 126 | 4 |
| ND015-1.5 | 3.08 | 67 | 147 | 0.54 | 0.050 5 | 0.008 4 | 0.133 7 | 0.020 4 | 0.020 7 | 0.000 7 |  | 219 | 385 | 127 | 18 | 132 | 4 |
| ND015-1.6 | 3.41 | 77 | 166 | 0.45 | 0.049 9 | 0.006 2 | 0.128 6 | 0.015 7 | 0.019 9 | 0.000 6 |  | 192 | 290 | 123 | 14 | 127 | 4 |
| ND015-1.7 | 4.75 | 116 | 212 | 0.46 | 0.049 3 | 0.007 6 | 0.136 4 | 0.019 7 | 0.020 7 | 0.000 7 |  | 164 | 358 | 130 | 18 | 132 | 4 |
| ND015-1.8 | 3.85 | 102 | 190 | 0.55 | 0.056 9 | 0.010 3 | 0.131 0 | 0.020 6 | 0.019 7 | 0.000 8 |  | 489 | 399 | 125 | 19 | 126 | 5 |
| ND015-1.9 | 2.92 | 66 | 143 | 0.57 | 0.054 3 | 0.008 4 | 0.132 7 | 0.021 5 | 0.019 9 | 0.000 8 |  | 385 | 347 | 126 | 19 | 127 | 5 |
| ND015-1.10 | 3.26 | 76 | 148 | 0.44 | 0.050 0 | 0.008 7 | 0.134 6 | 0.022 6 | 0.020 1 | 0.000 8 |  | 197 | 402 | 128 | 20 | 128 | 5 |
| ND015-1.11 | 4.14 | 95 | 190 | 0.46 | 0.051 6 | 0.007 1 | 0.133 9 | 0.017 7 | 0.020 0 | 0.000 5 |  | 268 | 315 | 128 | 16 | 128 | 3 |
| ND015-1.12 | 3.02 | 66 | 158 | 0.45 | 0.051 6 | 0.007 0 | 0.126 0 | 0.017 2 | 0.018 8 | 0.000 6 |  | 269 | 310 | 121 | 15 | 120 | 4 |
| ND015-1.13 | 3.28 | 70 | 172 | 0.53 | 0.048 2 | 0.006 3 | 0.129 9 | 0.017 0 | 0.019 4 | 0.000 5 |  | 107 | 309 | 124 | 15 | 124 | 3 |
| ND015-1.14 | 3.57 | 75 | 169 | 0.41 | 0.049 1 | 0.006 4 | 0.134 7 | 0.017 5 | 0.020 0 | 0.000 7 |  | 150 | 307 | 128 | 16 | 128 | 4 |
| ND015-1.15 | 5.03 | 148 | 258 | 0.50 | 0.053 5 | 0.009 6 | 0.132 6 | 0.023 1 | 0.019 7 | 0.000 8 |  | 349 | 405 | 126 | 21 | 126 | 5 |
| ND015-1.16 | 3.70 | 78 | 178 | 0.42 | 0.057 9 | 0.011 2 | 0.138 2 | 0.021 3 | 0.020 3 | 0.000 6 |  | 525 | 426 | 131 | 19 | 130 | 4 |
| ND015-1.17 | 4.62 | 113 | 215 | 0.55 | 0.053 3 | 0.008 3 | 0.139 7 | 0.018 9 | 0.020 3 | 0.000 7 |  | 340 | 355 | 133 | 17 | 130 | 4 |
| ND015-1.18 | 4.66 | 122 | 228 | 0.41 | 0.052 2 | 0.007 6 | 0.136 9 | 0.018 8 | 0.019 8 | 0.000 6 |  | 295 | 330 | 130 | 17 | 126 | 4 |
| ND015-1.19 | 5.53 | 143 | 262 | 0.55 | 0.052 3 | 0.007 4 | 0.139 6 | 0.020 2 | 0.020 0 | 0.000 6 |  | 299 | 322 | 133 | 18 | 127 | 4 |
| ND015-1.20 | 2.64 | 70 | 131 | 0.54 | 0.055 9 | 0.008 1 | 0.138 0 | 0.018 2 | 0.019 7 | 0.000 6 |  | 447 | 321 | 131 | 16 | 126 | 3 |
| ND015-1.21 | 5.52 | 111 | 271 | 0.41 | 0.050 7 | 0.006 0 | 0.143 4 | 0.018 2 | 0.020 2 | 0.000 6 |  | 228 | 272 | 136 | 16 | 129 | 4 |
| ND015-1.22 | 3.91 | 105 | 192 | 0.55 | 0.056 4 | 0.008 5 | 0.141 7 | 0.020 5 | 0.019 9 | 0.000 6 |  | 468 | 334 | 135 | 18 | 127 | 4 |
| ND015-1.23 | 2.70 | 60 | 131 | 0.46 | 0.063 5 | 0.013 7 | 0.152 5 | 0.024 5 | 0.020 7 | 0.000 8 |  | 725 | 458 | 144 | 22 | 132 | 5 |
| ND015-1.24 | 3.62 | 84 | 176 | 0.48 | 0.056 1 | 0.005 8 | 0.153 0 | 0.016 3 | 0.020 3 | 0.000 5 |  | 454 | 231 | 145 | 14 | 130 | 3 |
| ND015-1.25 | 4.02 | 97 | 192 | 0.51 | 0.058 0 | 0.007 0 | 0.146 2 | 0.017 3 | 0.019 4 | 0.000 5 |  | 530 | 264 | 139 | 15 | 124 | 3 |
| ND015-1.26 | 3.84 | 92 | 191 | 0.48 | 0.057 5 | 0.007 9 | 0.142 0 | 0.018 9 | 0.018 4 | 0.000 5 |  | 512 | 303 | 135 | 17 | 117 | 3 |
| NP52.1 | 4.00 | 99 | 202 | 0.49 | 0.048 0 | 0.009 1 | 0.118 9 | 0.020 6 | 0.019 9 | 0.000 6 |  | 101 | 450 | 114 | 19 | 127 | 4 |
| NP52.2 | 20.91 | 101 | 208 | 0.49 | 0.047 8 | 0.010 6 | 0.126 1 | 0.028 9 | 0.020 7 | 0.000 8 |  | 90 | 527 | 121 | 26 | 132 | 5 |
| NP52.3 | 4.44 | 108 | 216 | 0.50 | 0.046 3 | 0.006 0 | 0.123 1 | 0.016 0 | 0.020 0 | 0.000 5 |  | 11 | 313 | 118 | 14 | 128 | 3 |
| NP52.4 | 5.01 | 140 | 246 | 0.57 | 0.046 3 | 0.006 4 | 0.122 5 | 0.016 4 | 0.019 8 | 0.000 7 |  | 14 | 330 | 117 | 15 | 126 | 4 |
| NP52.5 | 4.16 | 102 | 196 | 0.52 | 0.049 1 | 0.006 7 | 0.128 3 | 0.017 8 | 0.020 3 | 0.000 7 |  | 152 | 321 | 123 | 16 | 130 | 4 |
| NP52.6 | 4.59 | 98 | 215 | 0.46 | 0.049 1 | 0.008 3 | 0.124 6 | 0.021 8 | 0.019 7 | 0.000 8 |  | 153 | 398 | 119 | 20 | 126 | 5 |
| NP52.7 | 4.80 | 90 | 228 | 0.39 | 0.048 3 | 0.006 8 | 0.126 1 | 0.016 6 | 0.019 8 | 0.000 7 |  | 113 | 334 | 121 | 15 | 127 | 4 |
| NP52.8 | 6.16 | 146 | 277 | 0.53 | 0.046 7 | 0.009 0 | 0.128 5 | 0.022 6 | 0.020 0 | 0.000 7 |  | 34 | 463 | 123 | 20 | 128 | 5 |
| NP52.9 | 3.91 | 83 | 191 | 0.43 | 0.049 5 | 0.005 9 | 0.131 3 | 0.015 4 | 0.020 4 | 0.000 7 |  | 174 | 277 | 125 | 14 | 130 | 4 |
| NP52.10 | 3.71 | 83 | 184 | 0.45 | 0.047 4 | 0.005 6 | 0.128 0 | 0.014 5 | 0.019 9 | 0.000 5 |  | 71 | 279 | 122 | 13 | 127 | 3 |
| NP52.11 | 4.78 | 125 | 236 | 0.53 | 0.049 5 | 0.005 5 | 0.128 1 | 0.013 3 | 0.019 7 | 0.000 5 |  | 173 | 259 | 122 | 12 | 126 | 3 |
| NP52.12 | 3.64 | 76 | 178 | 0.43 | 0.052 8 | 0.007 8 | 0.132 8 | 0.016 4 | 0.020 2 | 0.000 6 |  | 318 | 336 | 127 | 15 | 129 | 4 |
| NP52.13 | 3.86 | 82 | 192 | 0.42 | 0.052 6 | 0.007 4 | 0.132 6 | 0.017 4 | 0.020 1 | 0.000 6 |  | 312 | 319 | 126 | 16 | 128 | 4 |
| NP52.14 | 3.62 | 81 | 178 | 0.46 | 0.051 4 | 0.007 6 | 0.130 6 | 0.019 0 | 0.019 5 | 0.000 6 |  | 258 | 338 | 125 | 17 | 124 | 4 |
| NP52.15 | 4.46 | 107 | 215 | 0.49 | 0.050 2 | 0.005 9 | 0.139 7 | 0.015 4 | 0.020 7 | 0.000 5 |  | 204 | 274 | 133 | 14 | 132 | 3 |
| NP52.16 | 4.93 | 148 | 238 | 0.62 | 0.051 3 | 0.005 4 | 0.136 5 | 0.013 8 | 0.020 1 | 0.000 5 |  | 255 | 240 | 130 | 12 | 128 | 3 |
| NP52.17 | 3.74 | 95 | 190 | 0.50 | 0.053 9 | 0.007 9 | 0.133 2 | 0.017 2 | 0.019 6 | 0.000 5 |  | 365 | 330 | 127 | 15 | 125 | 3 |
| NP52.18 | 3.48 | 84 | 175 | 0.48 | 0.051 5 | 0.007 2 | 0.136 3 | 0.018 8 | 0.019 9 | 0.000 7 |  | 263 | 319 | 130 | 17 | 127 | 4 |
| NP52.19 | 4.16 | 112 | 208 | 0.54 | 0.050 8 | 0.006 1 | 0.133 5 | 0.016 6 | 0.019 5 | 0.000 5 |  | 233 | 278 | 127 | 15 | 125 | 3 |
| NP52.20 | 4.98 | 123 | 241 | 0.51 | 0.051 6 | 0.005 8 | 0.142 9 | 0.015 2 | 0.020 7 | 0.000 6 |  | 269 | 258 | 136 | 14 | 132 | 4 |
| NP52.21 | 3.76 | 98 | 188 | 0.52 | 0.058 1 | 0.007 6 | 0.139 6 | 0.016 5 | 0.019 3 | 0.000 6 |  | 533 | 287 | 133 | 15 | 123 | 4 |
| NP52.22 | 4.48 | 118 | 225 | 0.52 | 0.057 6 | 0.008 4 | 0.145 9 | 0.017 5 | 0.019 9 | 0.000 8 |  | 515 | 320 | 138 | 15 | 127 | 5 |
| NP52.23 | 4.43 | 92 | 205 | 0.45 | 0.060 1 | 0.009 2 | 0.151 3 | 0.021 9 | 0.020 1 | 0.000 8 |  | 608 | 330 | 143 | 19 | 128 | 5 |
| NP52.24 | 4.65 | 127 | 232 | 0.55 | 0.058 9 | 0.007 0 | 0.149 1 | 0.017 4 | 0.019 2 | 0.000 6 |  | 563 | 260 | 141 | 15 | 122 | 4 |
| NP52.25 | 6.29 | 225 | 305 | 0.74 | 0.050 3 | 0.004 9 | 0.121 9 | 0.011 3 | 0.018 4 | 0.000 4 |  | 208 | 226 | 117 | 10 | 117 | 3 |
| NP52.26 | 3.89 | 105 | 198 | 0.53 | 0.058 3 | 0.010 7 | 0.127 6 | 0.019 5 | 0.018 4 | 0.000 6 |  | 540 | 402 | 122 | 18 | 118 | 4 |
| NP52.27 | 4.07 | 87 | 195 | 0.45 | 0.051 9 | 0.006 6 | 0.125 5 | 0.015 2 | 0.018 5 | 0.000 5 |  | 282 | 292 | 120 | 14 | 118 | 3 |
| NP52.28 | 8.01 | 132 | 213 | 0.62 | 0.053 7 | 0.007 8 | 0.141 2 | 0.020 3 | 0.019 2 | 0.000 6 |  | 359 | 328 | 134 | 18 | 122 | 4 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 附表2 花岗斑岩和碱长花岗岩的主量元素(%)、稀土元素(10-6)和微量元素(10-6)分析结果  Table 2 Major elements (%), rare earth elements (10-6) and trace elements (10-6) analysis results for granite porphyry and alkali-feldspar granite | | | | | | | | | | |
| 样品号 | 花岗斑岩 | | | | |  | 碱长花岗岩 | | | |
| D011-1 | D012-1 | D013-1 | D014-1 | D015-1 |  | NP52 | NP52-1 | NP52-2 | P52b10-3 |
| SiO2 | 73.82 | 73.43 | 76.44 | 73.08 | 73.40 |  | 70.64 | 71.84 | 71.60 | 70.74 |
| Al2O3 | 12.81 | 12.93 | 12.45 | 13.19 | 13.61 |  | 14.13 | 14.70 | 12.75 | 13.90 |
| FeO | 0.80 | 1.13 | 0.29 | 0.70 | 0.68 |  | 1.77 | 0.39 | 1.80 | 0.82 |
| Fe2O3 | 1.31 | 1.74 | 1.51 | 1.65 | 2.22 |  | 1.42 | 2.46 | 2.10 | 2.33 |
| TiO2 | 0.12 | 0.21 | 0.11 | 0.26 | 0.22 |  | 0.44 | 0.38 | 0.47 | 0.42 |
| P2O5 | 0.42 | 0.02 | 0.01 | 0.42 | 0.26 |  | 0.10 | 0.09 | 0.12 | 0.12 |
| MnO | 0.10 | 0.07 | 0.04 | 0.13 | 0.07 |  | 0.12 | 0.07 | 0.12 | 0.09 |
| CaO | 0.61 | 0.69 | 0.13 | 0.28 | 0.26 |  | 1.03 | 0.38 | 1.50 | 0.70 |
| MgO | 0.21 | 0.16 | 0.19 | 0.15 | 0.23 |  | 0.67 | 0.46 | 0.84 | 0.50 |
| K2O | 4.14 | 4.51 | 4.12 | 4.62 | 4.74 |  | 4.18 | 4.59 | 3.89 | 4.58 |
| Na2O | 4.08 | 4.02 | 4.05 | 4.10 | 4.14 |  | 4.93 | 4.88 | 3.97 | 4.77 |
| 烧失量 | 0.91 | 0.74 | 0.61 | 0.84 | 0.82 |  | 0.28 | 0.91 | 0.85 | 0.90 |
| 总计 | 99.33 | 99.65 | 99.96 | 99.42 | 100.65 |  | 99.71 | 101.15 | 100.10 | 99.87 |
| K2O/Na2O | 1.01 | 1.12 | 1.02 | 1.12 | 1.14 |  | 0.85 | 0.94 | 0.98 | 0.96 |
| K2O+Na2O | 8.22 | 8.53 | 8.17 | 8.72 | 8.88 |  | 9.11 | 9.47 | 7.86 | 9.35 |
| A/CNK | 1.04 | 1.12 | 1.02 | 1.08 | 1.10 |  | 0.97 | 1.07 | 0.95 | 0.99 |
| A/NK | 1.14 | 1.12 | 1.12 | 1.12 | 1.14 |  | 1.12 | 1.13 | 1.19 | 1.09 |
| Mg# | 47.26 | 20.15 | 53.87 | 43.16 | 37.61 |  | 40.29 | 67.77 | 45.41 | 52.08 |
| Ba | 1671 | 264 | 154 | 597 | 196 |  | 515 | 513 | 469 | 535 |
| Rb | 162 | 128 | 161 | 152 | 154 |  | 127 | 145 | 116 | 178 |
| Sr | 417.00 | 51.30 | 31.80 | 202.00 | 76.90 |  | 192.00 | 161.00 | 161.00 | 215.00 |
| Zr | 375.00 | 406.00 | 294.00 | 244.00 | 440.00 |  | 64.90 | 46.80 | 56.00 | 64.90 |
| Cr | 24.00 | 22.60 | 14.10 | 22.00 | 16.20 |  | 12.60 | 11.40 | 11.50 | 10.80 |
| Sc | 10.20 | 2.37 | 2.86 | 6.06 | 3.85 |  | 4.23 | 4.14 | 5.92 | 4.62 |
| Ta | 1.85 | 4.39 | 4.24 | 3.03 | 3.04 |  | 3.84 | 1.92 | 2.53 | 2.72 |
| Nb | 17.50 | 32.20 | 52.00 | 30.80 | 37.30 |  | 36.00 | 34.60 | 45.70 | 36.20 |
| Hf | 7.25 | 11.20 | 11.20 | 6.98 | 11.60 |  | 3.55 | 2.93 | 3.50 | 3.58 |
| Th | 7.60 | 16.30 | 25.50 | 8.38 | 14.90 |  | 14.00 | 9.85 | 15.60 | 13.60 |
| U | 2.29 | 3.84 | 4.80 | 2.77 | 4.29 |  | 3.18 | 2.82 | 2.94 | 3.71 |
| Y | 18.30 | 32.60 | 43.80 | 29.10 | 44.70 |  | 32.70 | 35.60 | 43.00 | 36.80 |
| V | 59.40 | 4.80 | 3.81 | 33.50 | 6.78 |  | 21.40 | 19.80 | 28.10 | 17.50 |
| La | 42.40 | 72.60 | 52.20 | 52.50 | 77.00 |  | 73.00 | 72.40 | 75.80 | 52.80 |
| Ce | 79.60 | 140.00 | 133.00 | 104.00 | 147.00 |  | 132.00 | 125.00 | 157.00 | 122.00 |
| Pr | 9.58 | 15.20 | 10.90 | 11.60 | 16.10 |  | 13.90 | 15.20 | 16.00 | 12.20 |
| Nd | 37.90 | 62.60 | 41.30 | 44.40 | 66.30 |  | 50.70 | 58.00 | 66.00 | 49.90 |
| Sm | 6.37 | 10.70 | 7.67 | 7.63 | 11.20 |  | 8.31 | 9.40 | 10.60 | 8.50 |
| Eu | 2.61 | 0.72 | 0.22 | 1.10 | 0.86 |  | 0.95 | 1.03 | 1.01 | 0.94 |
| Gd | 5.78 | 9.39 | 7.08 | 6.46 | 9.54 |  | 6.86 | 8.38 | 9.38 | 7.60 |
| Tb | 0.92 | 1.42 | 1.31 | 1.04 | 1.67 |  | 1.23 | 1.27 | 1.69 | 1.21 |
| Dy | 4.30 | 8.42 | 8.57 | 6.13 | 9.08 |  | 6.67 | 6.74 | 9.00 | 7.20 |
| Ho | 0.75 | 1.43 | 1.53 | 1.12 | 1.59 |  | 1.17 | 1.22 | 1.68 | 1.34 |
| Er | 1.96 | 4.34 | 4.61 | 3.21 | 4.90 |  | 3.59 | 3.72 | 4.86 | 3.97 |
| Tm | 0.29 | 0.63 | 0.76 | 0.46 | 0.71 |  | 0.56 | 0.51 | 0.76 | 0.60 |
| Yb | 1.65 | 3.96 | 4.62 | 2.93 | 4.15 |  | 3.36 | 3.23 | 4.41 | 3.94 |
| Lu | 0.25 | 0.58 | 0.65 | 0.44 | 0.67 |  | 0.54 | 0.49 | 0.69 | 0.61 |
| ∑REE | 194.36 | 331.99 | 274.42 | 243.02 | 350.77 |  | 302.84 | 306.59 | 358.88 | 272.81 |
| LREE/HREE | 4.92 | 4.33 | 3.36 | 4.35 | 4.14 |  | 4.92 | 4.59 | 4.33 | 3.89 |
| δEu | 1.32 | 0.22 | 0.09 | 0.48 | 0.25 |  | 0.38 | 0.35 | 0.31 | 0.36 |
| (La/Yb)N | 17.32 | 12.36 | 7.62 | 12.08 | 12.51 |  | 14.65 | 15.11 | 11.59 | 9.03 |