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| 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  |

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| 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 |