表1 西藏松多地区龙崖松多蛇纹岩全岩主(wt.%)、微量(ppm)元素测试结果统计表

Table 1 Whole-rock major (wt.%) and trace element (ppm) of the Longyasongduo serpentinite in Sumdo area, Tibet

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品号 | SiO2 | Al2O3 | TFeO | CaO | MgO | K2O | Na2O | TiO2 | P2O5 | MnO | LOI | 总 合 | Mg# | Cr | Rb | Sr | Y | Zr | Nb | Ba | La |
| S20T38H1 | 39.24  | 1.06  | 7.27  | 2.00  | 36.67  | 0.00  | 0.05  | 0.03  | 0.00  | 0.11  | 13.54  | 99.97  | 92.2  | 1879 | 0.236  | 138  | 1.61  | 1.28  | 0.132  | 2.43  | 0.386  |
| S20T38H2 | 38.60  | 1.03  | 7.02  | 2.48  | 36.36  | 0.00  | 0.05  | 0.03  | 0.01  | 0.11  | 14.20  | 99.89  | 92.3  | 1937 | 0.330  | 202  | 2.04  | 1.00  | 0.177  | 3.18  | 0.497  |
| S20T38H3 | 39.08  | 1.03  | 7.06  | 1.99  | 36.61  | 0.00  | 0.05  | 0.03  | 0.01  | 0.10  | 13.64  | 99.60  | 92.4  | 1931 | 0.362  | 152  | 1.80  | 1.03  | 0.178  | 2.89  | 0.399  |
| S20T38H4 | 38.94  | 1.04  | 7.18  | 2.18  | 36.46  | 0.01  | 0.06  | 0.03  | 0.00  | 0.11  | 13.85  | 99.86  | 92.2  | 1846 | 0.479  | 160  | 1.83  | 1.24  | 0.191  | 3.48  | 0.470  |
| S20T38H5 | 36.88  | 0.99  | 6.61  | 3.68  | 35.68  | 0.01  | 0.04  | 0.03  | 0.00  | 0.12  | 15.70  | 99.74  | 92.6  | 1868 | 0.579  | 295  | 2.62  | 1.20  | 0.208  | 5.81  | 0.684  |

续表1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品号 | Ce | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | Hf | Ta | Pb | Th | U |
| S20T38H1 | 0.99  | 0.142  | 0.711  | 0.198  | 0.103  | 0.237  | 0.0481  | 0.275  | 0.0666  | 0.192  | 0.0295  | 0.1983 | 0.0325  | 0.0446  | 0.0241  | 1.23  | 0.0342  | 0.0745  |
| S20T38H2 | 1.19  | 0.178  | 0.851  | 0.265  | 0.126  | 0.310  | 0.0565  | 0.348  | 0.0799  | 0.226  | 0.0365  | 0.2259 | 0.0362  | 0.0356  | 0.0305  | 1.55  | 0.0418  | 0.0789  |
| S20T38H3 | 1.05  | 0.150  | 0.741  | 0.216  | 0.105  | 0.275  | 0.0512  | 0.314  | 0.0691  | 0.202  | 0.0331  | 0.2032 | 0.0330  | 0.0382  | 0.0337  | 1.35  | 0.0405  | 0.0781  |
| S20T38H4 | 1.19  | 0.166  | 0.813  | 0.243  | 0.108  | 0.306  | 0.0550  | 0.335  | 0.0777  | 0.220  | 0.0357  | 0.2138 | 0.0337  | 0.0474  | 0.0310  | 1.35  | 0.0590  | 0.0846  |
| S20T38H5 | 1.67  | 0.246  | 1.190  | 0.350  | 0.152  | 0.406  | 0.0731  | 0.442  | 0.0984  | 0.302  | 0.0437  | 0.2901 | 0.0470  | 0.0459  | 0.0336  | 2.12  | 0.1043  | 0.0836  |

表2 西藏松多地区龙崖松多蛇纹岩锆石U-Pb同位素测试结果

Table 2 Zircon U-Pb isotope data of the Longyasongduo serpentinite in Sumdo area, Tibet

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 点号 | Th(ppm) | U(ppm) | Th/U | 同位素比值 | 同位素年龄(Ma) |
| 207Pb/206Pb | 1σ | 207Pb/235U | 1σ | 206Pb/238U | 1σ | 207Pb/206Pb | 1σ | 207Pb/235U | 1σ | 206Pb/238U | 1σ |
| S20T38-01 | 77.8  | 948.8  | 0.08  | 0.05034  | 0.00182  | 0.25443  | 0.00954  | 0.03666  | 0.00093  | 211 | 44 | 230 | 8 | 232 | 6 |
| S20T38-02 | 73.9  | 1071.0  | 0.07  | 0.05193  | 0.00197  | 0.26174  | 0.01031  | 0.03656  | 0.00090  | 282 | 48 | 236 | 8 | 231 | 6 |
| S20T38-03 | 77.6  | 918.8  | 0.08  | 0.05070  | 0.00157  | 0.25588  | 0.00838  | 0.03659  | 0.00090  | 227 | 36 | 231 | 7 | 232 | 6 |
| S20T38-04 | 141.0  | 2232.8  | 0.06  | 0.05163  | 0.00248  | 0.26404  | 0.01288  | 0.03708  | 0.00095  | 269 | 66 | 238 | 10 | 235 | 6 |
| S20T38-05 | 91.7  | 1834.1  | 0.05  | 0.05155  | 0.00182  | 0.26109  | 0.00963  | 0.03672  | 0.00090  | 266 | 43 | 236 | 8 | 232 | 6 |
| S20T38-06 | 134.0  | 1831.8  | 0.07  | 0.05109  | 0.00247  | 0.25826  | 0.01261  | 0.03665  | 0.00095  | 245 | 66 | 233 | 10 | 232 | 6 |
| S20T38-07 | 115.5  | 1456.0  | 0.08  | 0.05078  | 0.00189  | 0.25663  | 0.00988  | 0.03664  | 0.00091  | 231 | 46 | 232 | 8 | 232 | 6 |
| S20T38-08 | 104.9  | 1712.1  | 0.06  | 0.05087  | 0.00160  | 0.25700  | 0.00856  | 0.03663  | 0.00089  | 235 | 37 | 232 | 7 | 232 | 6 |
| S20T38-09 | 72.6  | 1492.3  | 0.05  | 0.05145  | 0.00179  | 0.25889  | 0.00946  | 0.03648  | 0.00088  | 261 | 43 | 234 | 8 | 231 | 5 |
| S20T38-10 | 120.5  | 1977.0  | 0.06  | 0.05076  | 0.00199  | 0.25453  | 0.01035  | 0.03635  | 0.00089  | 230 | 51 | 230 | 8 | 230 | 6 |
| S20T38-11 | 165.2  | 2132.1  | 0.08  | 0.05084  | 0.00194  | 0.25513  | 0.01002  | 0.03638  | 0.00090  | 234 | 48 | 231 | 8 | 230 | 6 |
| S20T38-12 | 111.1  | 1972.8  | 0.06  | 0.05074  | 0.00187  | 0.25314  | 0.00962  | 0.03617  | 0.00090  | 229 | 45 | 229 | 8 | 229 | 6 |
| S20T38-13 | 90.2  | 1625.2  | 0.06  | 0.05040  | 0.00170  | 0.25260  | 0.00891  | 0.03633  | 0.00089  | 213 | 40 | 229 | 7 | 230 | 6 |
| S20T38-14 | 113.1  | 1381.2  | 0.08  | 0.05371  | 0.00560  | 0.27748  | 0.02844  | 0.03745  | 0.00125  | 359 | 170 | 249 | 23 | 237 | 8 |
| S20T38-15 | 121.1  | 2669.5  | 0.05  | 0.05080  | 0.00205  | 0.25182  | 0.01044  | 0.03593  | 0.00089  | 232 | 52 | 228 | 8 | 228 | 6 |
| S20T38-16 | 198.2  | 2345.3  | 0.08  | 0.05066  | 0.00181  | 0.25312  | 0.00936  | 0.03622  | 0.00089  | 225 | 43 | 229 | 8 | 229 | 6 |
| S20T38-17 | 102.4  | 1895.4  | 0.05  | 0.05070  | 0.00190  | 0.25201  | 0.00981  | 0.03604  | 0.00087  | 227 | 48 | 228 | 8 | 228 | 5 |
| S20T38-18 | 185.8  | 1596.0  | 0.12  | 0.05224  | 0.00188  | 0.25958  | 0.00974  | 0.03602  | 0.00087  | 296 | 44 | 234 | 8 | 228 | 5 |
| S20T38-19 | 122.4  | 1457.2  | 0.08  | 0.05198  | 0.00291  | 0.26635  | 0.01493  | 0.03715  | 0.00098  | 285 | 80 | 240 | 12 | 235 | 6 |
| S20T38-20 | 225.8  | 2069.0  | 0.11  | 0.05169  | 0.00171  | 0.25471  | 0.00885  | 0.03573  | 0.00085  | 272 | 40 | 230 | 7 | 226 | 5 |
| S20T38-21 | 165.0  | 2103.0  | 0.08  | 0.05331  | 0.00246  | 0.26609  | 0.01250  | 0.03620  | 0.00089  | 342 | 63 | 240 | 10 | 229 | 6 |
| S20T38-22 | 269.1  | 2686.1  | 0.10  | 0.05098  | 0.00326  | 0.26042  | 0.01653  | 0.03705  | 0.00102  | 240 | 96 | 235 | 13 | 235 | 6 |
| S20T38-23 | 190.3  | 3012.1  | 0.06  | 0.05082  | 0.00261  | 0.24784  | 0.01281  | 0.03537  | 0.00091  | 233 | 72 | 225 | 10 | 224 | 6 |
| S20T38-24 | 340.2  | 3277.5  | 0.10  | 0.05252  | 0.00248  | 0.26051  | 0.01247  | 0.03597  | 0.00089  | 308 | 65 | 235 | 10 | 228 | 6 |
| S20T38-25 | 365.6  | 4382.7  | 0.08  | 0.05187  | 0.00234  | 0.25831  | 0.01187  | 0.03612  | 0.00088  | 280 | 62 | 233 | 10 | 229 | 5 |

表3 西藏松多地区龙崖松多蛇纹岩锆石微量元素(ppm)测试结果

Table 3 Zircon trace element (ppm) data of the Longyasongduo serpentinite in Sumdo area, Tibet

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 点号 | Ti | Y | Zr | Nb | La | Ce | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | Hf | Ta | tTi(°C) |
| S20T38-01 | 5.44  | 4558.20  | 7796.11  | 0.50  | 0.09  | 34.14  | 0.03  | 0.73  | 3.40  | 4.36  | 51.17  | 23.10  | 358.57  | 156.52  | 772.85  | 171.82  | 1674.84  | 303.08  | 6981.70  | 0.10  | 692  |
| S20T38-02 | 1.80  | 5044.09  | 3910.66  | 0.37  | 0.03  | 29.71  | 0.03  | 0.91  | 4.25  | 4.74  | 57.51  | 26.42  | 408.00  | 181.30  | 890.61  | 196.46  | 1877.18  | 348.58  | 5056.26  | 0.07  | 607  |
| S20T38-03 | 8.07  | 4735.38  | 2640.45  | 0.33  | 0.14  | 32.05  | 0.10  | 1.04  | 4.74  | 4.48  | 58.85  | 27.01  | 385.11  | 171.81  | 825.89  | 180.55  | 1700.62  | 305.15  | 3702.36  | 0.07  | 726  |
| S20T38-04 | 1.81  | 5665.39  | 1974.83  | 0.67  | 0.05  | 41.75  | 0.05  | 1.34  | 5.85  | 6.00  | 71.71  | 32.82  | 495.49  | 211.56  | 1011.36  | 222.26  | 2069.36  | 383.03  | 3392.29  | 0.23  | 607  |
| S20T38-05 | 1.95  | 4874.99  | 1549.58  | 0.64  | 0.12  | 30.58  | 0.14  | 1.05  | 4.27  | 4.43  | 56.07  | 27.88  | 423.67  | 188.42  | 916.11  | 205.97  | 1983.47  | 379.57  | 2922.48  | 0.09  | 612  |
| S20T38-06 | 1.32  | 5100.20  | 1092.64  | 0.53  | 0.04  | 40.33  | 0.06  | 0.75  | 5.05  | 4.42  | 62.79  | 31.27  | 465.51  | 203.14  | 983.46  | 219.07  | 1992.54  | 382.68  | 2276.11  | 0.15  | 586  |
| S20T38-07 | 1.76  | 5098.20  | 977.10  | 0.78  | 0.04  | 40.85  | 0.07  | 1.02  | 5.75  | 5.82  | 67.94  | 30.39  | 461.10  | 201.33  | 981.52  | 222.73  | 1980.08  | 383.03  | 1881.75  | 0.13  | 605  |
| S20T38-08 | 7.04  | 4703.11  | 872.68  | 0.67  | 0.07  | 33.42  | 0.04  | 0.87  | 4.27  | 4.89  | 59.28  | 28.16  | 426.40  | 195.57  | 946.25  | 215.00  | 2015.38  | 391.08  | 1859.92  | 0.09  | 714  |
| S20T38-09 | 3.33  | 4732.08  | 770.00  | 0.64  | 0.01  | 30.19  | 0.04  | 0.69  | 3.23  | 4.69  | 54.71  | 27.35  | 438.34  | 199.36  | 980.56  | 223.85  | 2080.27  | 412.63  | 1617.94  | 0.18  | 652  |
| S20T38-10 | 2.08  | 5153.98  | 712.94  | 0.97  | 0.02  | 39.77  | 0.01  | 0.62  | 5.45  | 5.45  | 68.11  | 32.70  | 486.48  | 219.59  | 1056.63  | 245.30  | 2163.51  | 428.99  | 1477.23  | 0.13  | 617  |
| S20T38-11 | 3.00  | 5545.60  | 564.15  | 1.03  | 0.07  | 50.03  | 0.03  | 0.95  | 5.47  | 6.30  | 80.32  | 39.04  | 570.22  | 255.78  | 1196.41  | 275.43  | 2323.04  | 487.67  | 1279.72  | 0.14  | 644  |
| S20T38-12 | 4.20  | 4606.34  | 524.09  | 0.83  | 0.01  | 39.54  | 0.01  | 0.36  | 4.34  | 4.82  | 59.34  | 29.66  | 469.95  | 217.73  | 1048.28  | 248.11  | 2166.30  | 457.08  | 1174.81  | 0.18  | 670  |
| S20T38-13 | 5.10  | 4822.18  | 489.78  | 0.46  | 0.06  | 39.74  | 0.01  | 0.38  | 4.89  | 5.25  | 61.50  | 32.55  | 503.70  | 237.32  | 1116.88  | 267.08  | 2268.71  | 474.55  | 1053.54  | 0.13  | 686  |
| S20T38-14 | 5.74  | 5720.72  | 450.79  | 0.96  | 0.03  | 52.08  | 0.05  | 1.25  | 7.27  | 8.29  | 84.53  | 44.21  | 633.23  | 285.96  | 1302.24  | 303.14  | 2462.63  | 517.94  | 927.45  | 0.17  | 696  |
| S20T38-15 | 4.28  | 4812.15  | 444.71  | 1.43  | 0.11  | 43.15  | 0.08  | 0.53  | 5.29  | 5.60  | 74.30  | 34.71  | 533.43  | 245.21  | 1179.06  | 285.18  | 2347.69  | 512.04  | 925.34  | 0.17  | 672  |
| S20T38-16 | 2.78  | 6067.36  | 376.02  | 1.19  | 0.00  | 66.98  | 0.03  | 0.99  | 7.94  | 9.63  | 111.47  | 57.23  | 775.37  | 355.61  | 1577.78  | 371.76  | 2871.07  | 643.32  | 849.62  | 0.22  | 638  |
| S20T38-17 | 1.60  | 4863.53  | 358.27  | 0.75  | 0.08  | 45.02  | 0.11  | 1.03  | 7.56  | 6.71  | 79.16  | 40.57  | 637.66  | 293.12  | 1344.18  | 340.81  | 2596.81  | 621.87  | 797.68  | 0.14  | 599  |
| S20T38-18 | 5.52  | 6034.06  | 331.99  | 0.78  | 0.11  | 85.88  | 0.07  | 1.21  | 11.35  | 11.53  | 128.51  | 59.67  | 824.01  | 369.12  | 1605.56  | 391.11  | 2808.87  | 637.59  | 672.88  | 0.27  | 693  |
| S20T38-19 | 2.43  | 5449.69  | 329.50  | 0.74  | 0.14  | 62.41  | 0.07  | 1.33  | 10.01  | 9.93  | 104.97  | 48.61  | 750.53  | 348.89  | 1576.13  | 394.82  | 2877.48  | 696.42  | 673.80  | 0.18  | 628  |
| S20T38-20 | 10.68  | 6572.63  | 314.62  | 1.48  | 0.05  | 101.75  | 0.10  | 1.73  | 14.34  | 13.32  | 149.89  | 71.89  | 988.38  | 455.17  | 1934.39  | 474.60  | 3248.61  | 793.15  | 667.11  | 0.36  | 752  |
| S20T38-21 | 2.11  | 6483.96  | 291.27  | 1.05  | 0.03  | 86.51  | 0.10  | 1.80  | 11.67  | 12.75  | 147.20  | 75.36  | 1042.20  | 499.74  | 2161.30  | 579.26  | 3793.97  | 995.71  | 612.90  | 0.21  | 618  |
| S20T38-22 | 3.10  | 6985.54  | 279.71  | 2.10  | 0.03  | 111.74  | 0.06  | 1.91  | 15.46  | 17.58  | 192.08  | 92.29  | 1247.48  | 574.23  | 2312.99  | 613.98  | 3738.86  | 1000.84  | 624.03  | 0.19  | 647  |
| S20T38-23 | 3.02  | 5804.22  | 269.81  | 1.89  | 0.04  | 86.27  | 0.05  | 1.33  | 11.11  | 12.11  | 151.91  | 78.51  | 1084.58  | 524.09  | 2126.75  | 594.08  | 3595.44  | 1022.48  | 610.67  | 0.37  | 645  |
| S20T38-24 | 5.38  | 7564.30  | 259.17  | 2.14  | 0.04  | 140.72  | 0.07  | 2.01  | 17.64  | 20.58  | 236.89  | 120.73  | 1584.50  | 746.94  | 2830.42  | 777.36  | 4238.38  | 1218.90  | 597.34  | 0.45  | 691  |
| S20T38-25 | 9.74  | 7730.16  | 253.15  | 3.30  | 0.08  | 148.29  | 0.09  | 3.24  | 24.25  | 24.62  | 284.63  | 136.91  | 1732.10  | 838.39  | 3064.26  | 875.94  | 4532.13  | 1367.49  | 571.79  | 0.78  | 743  |

注：锆石Ti温度计(tTi(℃)计算方法(Log(ppm Ti-in-zircon) = (5.711±0.072)-(4800±86)/T(K)-logαSiO2+logαTiO2; Ferry and Watson, 2007)

表4 西藏松多地区龙崖松多蛇纹岩锆石Lu-Hf同位素测试结果

Table 4 Zircon Lu–Hf isotope data of the Longyasongduo serpentinite in Sumdo area, Tibet

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 点号 | Age (Ma) | 176Yb/177Hf | 2σ | 176Lu/177Hf | 2σ | 176Hf/177Hf | 2σ | 176Hf/177Hfi | eHf(0) | eHf(t) | eHf(t)' | 2σ | TDM (Ma) | TDMC (Ma) | fLu/Hf |
| 20T38-1 | 230.3 | 0.145556  | 0.000581  | 0.003739  | 0.000020  | 0.283067  | 0.000020  | 0.283050  | 10.4  | 14.9  | 15.6  | 0.7  | 283  | 308  | -0.89  |
| 20T38-2 | 230.3 | 0.156978  | 0.001022  | 0.004077  | 0.000038  | 0.283075  | 0.000021  | 0.283057  | 10.7  | 15.1  | 15.9  | 0.8  | 273  | 293  | -0.88  |
| 20T38-3 | 230.3 | 0.131942  | 0.000823  | 0.003547  | 0.000024  | 0.283024  | 0.000017  | 0.283009  | 8.9  | 13.4  | 14.0  | 0.6  | 346  | 403  | -0.89  |
| 20T38-4 | 230.3 | 0.123235  | 0.000551  | 0.003270  | 0.000022  | 0.283038  | 0.000019  | 0.283024  | 9.4  | 14.0  | 14.6  | 0.7  | 323  | 369  | -0.90  |
| 20T38-5 | 230.3 | 0.129227  | 0.001025  | 0.003460  | 0.000032  | 0.283062  | 0.000018  | 0.283047  | 10.3  | 14.8  | 15.4  | 0.6  | 287  | 315  | -0.90  |
| 20T38-6 | 230.3 | 0.126511  | 0.001395  | 0.003316  | 0.000027  | 0.283067  | 0.000019  | 0.283053  | 10.4  | 15.0  | 15.7  | 0.7  | 279  | 303  | -0.90  |
| 20T38-7 | 230.3 | 0.144753  | 0.001026  | 0.003856  | 0.000023  | 0.283037  | 0.000016  | 0.283020  | 9.4  | 13.8  | 14.4  | 0.6  | 330  | 377  | -0.88  |
| 20T38-8 | 230.3 | 0.148802  | 0.000645  | 0.003848  | 0.000024  | 0.283099  | 0.000019  | 0.283082  | 11.6  | 16.0  | 16.7  | 0.7  | 234  | 236  | -0.88  |