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 |