表1 老挝表层沉积物地球化学参数

Table 1 Geochemical parameters of surface sediments collected in Laos

| **元素** | **原始数据** | | | | | | | | **剔除三倍离差数据** | | | | | | | | **大陆地壳元素丰度** | **RCC** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **最小值** | **25%** | **平均值** | **50%** | **75%** | **85%** | **97.50%** | **最大值** | **最小值** | **25%** | **平均值** | **50%**  **（背景值）** | **75%** | **85%** | **97.50%** | **最大值** |
| Ag | 19 | 50 | 78 | 61 | 75 | 87 | 153 | 10000 | 19 | 50 | 69 | 61 | 75 | 87 | 153 | 718 | 56 | 1.09 |
| As | 0.5 | 2.3 | 10.2 | 4.9 | 9.1 | 11.7 | 31.9 | 2755.1 | 0.5 | 2.3 | 7.4 | 4.9 | 9.1 | 11.7 | 29.8 | 248.0 | 2.5 | 1.95 |
| Au | 0.10 | 0.57 | 2.44 | 1.00 | 1.53 | 1.99 | 6.36 | 913.70 | 0.10 | 0.57 | 1.55 | 1.00 | 1.52 | 1.97 | 5.70 | 68.55 | 1.30 | 0.77 |
| B | 2.2 | 21.3 | 39.7 | 34.0 | 52.0 | 62.5 | 106.5 | 334.1 | 2.2 | 21.2 | 37.9 | 33.8 | 50.9 | 61.1 | 92.5 | 121.1 | 11.0 | 3.07 |
| Ba | 11 | 151 | 270 | 243 | 345 | 421 | 673 | 4673 | 11 | 151 | 264 | 242 | 342 | 417 | 645 | 870 | 456 | 0.53 |
| Be | 0.11 | 0.78 | 1.28 | 1.16 | 1.65 | 1.96 | 2.91 | 7.06 | 0.11 | 0.77 | 1.25 | 1.15 | 1.63 | 1.94 | 2.72 | 3.40 | 1.90 | 0.61 |
| Bi | 0.03 | 0.10 | 0.28 | 0.18 | 0.29 | 0.36 | 0.73 | 46.62 | 0.03 | 0.10 | 0.23 | 0.18 | 0.29 | 0.36 | 0.69 | 3.95 | 0.18 | 0.97 |
| Br | 0.10 | 1.10 | 2.06 | 1.50 | 2.10 | 2.80 | 7.21 | 36.60 | 0.10 | 1.10 | 1.83 | 1.50 | 2.00 | 2.70 | 5.78 | 9.00 | 0.88 | 1.70 |
| Cd | 1 | 37 | 140 | 63 | 107 | 150 | 473 | 41650 | 1 | 37 | 103 | 63 | 105 | 148 | 435 | 2941 | 80 | 0.79 |
| Cl | 21 | 51 | 72 | 61 | 73 | 81 | 150 | 5615 | 21 | 51 | 66 | 61 | 73 | 81 | 145 | 356 | 244 | 0.25 |
| Co | 0.2 | 4.8 | 11.8 | 9.0 | 14.3 | 18.1 | 41.6 | 242.7 | 0.2 | 4.7 | 10.5 | 8.8 | 13.9 | 17.2 | 31.9 | 52.8 | 27.0 | 0.33 |
| Cr | 2 | 26 | 70 | 43 | 62 | 78 | 284 | 24101 | 2 | 26 | 58 | 43 | 62 | 78 | 284 | 963 | 135 | 0.32 |
| Cs | 0.14 | 1.84 | 4.02 | 3.42 | 5.34 | 6.64 | 11.48 | 25.91 | 0.14 | 1.80 | 3.84 | 3.37 | 5.20 | 6.37 | 10.54 | 12.77 | 2.00 | 1.68 |
| Cu | 1.2 | 9.7 | 21.6 | 16.2 | 25.7 | 32.5 | 72.9 | 459.0 | 1.2 | 9.6 | 20.0 | 16.0 | 25.3 | 31.7 | 65.9 | 95.2 | 27.0 | 0.59 |
| F | 21 | 182 | 303 | 271 | 374 | 441 | 723 | 2717 | 21 | 182 | 293 | 270 | 371 | 435 | 678 | 862 | 553 | 0.49 |
| Ga | 0.7 | 6.5 | 10.8 | 10.3 | 14.1 | 16.3 | 24.3 | 44.1 | 0.7 | 6.4 | 10.5 | 10.2 | 13.9 | 16.0 | 22.1 | 28.4 | 16.0 | 0.64 |
| Ge | 0.27 | 1.11 | 1.26 | 1.25 | 1.40 | 1.48 | 1.73 | 2.48 | 0.57 | 1.11 | 1.25 | 1.25 | 1.40 | 1.48 | 1.71 | 1.93 | 1.30 | 0.96 |
| Hf | 0.77 | 3.88 | 7.60 | 6.05 | 9.80 | 12.40 | 19.97 | 76.20 | 0.77 | 3.85 | 7.21 | 6.00 | 9.59 | 11.96 | 18.19 | 23.40 | 3.70 | 1.62 |
| Hg | 3.0 | 17.7 | 45.8 | 29.1 | 49.6 | 67.8 | 192.9 | 805.6 | 3.0 | 17.5 | 39.4 | 28.4 | 47.9 | 65.4 | 145.3 | 226.9 | 30.0 | 0.95 |
| I | 0.18 | 0.47 | 1.29 | 0.70 | 1.18 | 1.77 | 6.64 | 32.55 | 0.18 | 0.47 | 1.05 | 0.69 | 1.12 | 1.64 | 4.40 | 7.76 | 0.70 | 0.99 |
| In | 0.002 | 0.026 | 0.055 | 0.041 | 0.059 | 0.070 | 0.110 | 10.160 | 0.002 | 0.026 | 0.045 | 0.041 | 0.058 | 0.070 | 0.108 | 0.443 | 0.052 | 0.79 |
| Li | 1.0 | 14.4 | 23.7 | 21.6 | 30.4 | 35.2 | 53.2 | 133.8 | 1.0 | 14.3 | 23.0 | 21.5 | 30.1 | 34.7 | 49.2 | 63.8 | 16.0 | 1.34 |
| Mn | 75 | 262 | 535 | 391 | 622 | 809 | 1751 | 14212 | 75 | 261 | 494 | 386 | 614 | 788 | 1529 | 2255 | 774 | 0.50 |
| Mo | 0.05 | 0.26 | 0.58 | 0.42 | 0.65 | 0.85 | 2.02 | 25.44 | 0.05 | 0.26 | 0.52 | 0.42 | 0.64 | 0.82 | 1.73 | 3.05 | 0.80 | 0.52 |
| N | 67 | 266 | 577 | 411 | 725 | 989 | 1853 | 5290 | 67 | 252 | 536 | 403 | 704 | 940 | 1584 | 1987 | 56 | 7.19 |
| Nb | 0.3 | 6.1 | 9.7 | 8.7 | 11.9 | 14.3 | 22.7 | 64.4 | 0.3 | 6.1 | 9.3 | 8.6 | 11.7 | 13.8 | 20.2 | 26.0 | 8.0 | 1.07 |
| Ni | 0.5 | 8.5 | 21.0 | 15.2 | 23.9 | 29.6 | 97.9 | 236.7 | 0.5 | 8.4 | 17.8 | 14.9 | 23.3 | 28.0 | 53.5 | 98.6 | 59.0 | 0.25 |
| P | 42 | 199 | 358 | 312 | 439 | 526 | 987 | 4157 | 42 | 198 | 334 | 308 | 433 | 510 | 803 | 1173 | 436 | 0.71 |
| Pb | 2.2 | 9.8 | 23.0 | 14.7 | 21.7 | 26.7 | 52.0 | 4695.0 | 2.2 | 9.8 | 18.0 | 14.7 | 21.6 | 26.5 | 50.9 | 197.3 | 11.0 | 1.33 |
| Rb | 3 | 31 | 63 | 52 | 83 | 103 | 186 | 381 | 3 | 30 | 59 | 51 | 81 | 99 | 156 | 201 | 49 | 1.04 |
| S | 19 | 52 | 100 | 72 | 113 | 153 | 335 | 2346 | 19 | 49 | 92 | 72 | 112 | 148 | 285 | 408 | 404 | 0.18 |
| Sb | 0.05 | 0.30 | 1.85 | 0.50 | 0.88 | 1.23 | 3.23 | 1284.94 | 0.05 | 0.30 | 0.80 | 0.50 | 0.88 | 1.23 | 3.19 | 43.90 | 0.20 | 2.50 |
| Sc | 0.2 | 4.5 | 8.8 | 7.9 | 11.7 | 14.0 | 24.3 | 48.6 | 0.2 | 4.5 | 8.5 | 7.9 | 11.5 | 13.7 | 21.9 | 26.3 | 22.0 | 0.36 |
| Se | 0.023 | 0.062 | 0.154 | 0.100 | 0.185 | 0.248 | 0.579 | 3.172 | 0.023 | 0.062 | 0.137 | 0.098 | 0.177 | 0.235 | 0.456 | 0.673 | 0.130 | 0.75 |
| Sn | 0.63 | 1.40 | 2.48 | 1.86 | 2.54 | 3.16 | 6.39 | 100.00 | 0.63 | 1.39 | 2.19 | 1.86 | 2.52 | 3.12 | 5.65 | 15.38 | 1.70 | 1.09 |
| Sr | 1 | 25 | 56 | 43 | 66 | 82 | 200 | 584 | 1 | 25 | 50 | 43 | 64 | 78 | 139 | 220 | 320 | 0.13 |
| Ta | 0.08 | 0.45 | 0.73 | 0.66 | 0.93 | 1.09 | 1.63 | 5.41 | 0.08 | 0.45 | 0.71 | 0.66 | 0.92 | 1.08 | 1.55 | 1.94 | 0.70 | 0.94 |
| Te | 0.001 | 0.015 | 0.033 | 0.027 | 0.042 | 0.054 | 0.096 | 1.249 | 0.001 | 0.015 | 0.031 | 0.027 | 0.042 | 0.053 | 0.091 | 0.157 | -- | -- |
| Th | 0.31 | 3.60 | 7.08 | 6.03 | 9.28 | 11.69 | 19.34 | 51.06 | 0.31 | 3.55 | 6.77 | 5.96 | 9.07 | 11.22 | 17.01 | 22.05 | 5.60 | 1.06 |
| Ti | 229 | 1921 | 3418 | 2888 | 4009 | 4771 | 10718 | 32015 | 229 | 1907 | 3082 | 2854 | 3926 | 4583 | 6881 | 12315 | 4200 | 0.68 |
| Tl | 0.03 | 0.19 | 0.40 | 0.32 | 0.52 | 0.67 | 1.16 | 2.63 | 0.03 | 0.19 | 0.37 | 0.31 | 0.50 | 0.64 | 0.97 | 1.29 | 0.50 | 0.62 |
| U | 0.18 | 0.99 | 1.83 | 1.47 | 2.26 | 2.84 | 5.12 | 17.75 | 0.18 | 0.98 | 1.72 | 1.46 | 2.20 | 2.72 | 4.30 | 5.88 | 1.30 | 1.12 |
| V | 4 | 36 | 72 | 59 | 89 | 109 | 248 | 569 | 4 | 36 | 65 | 58 | 85 | 105 | 175 | 245 | 138 | 0.42 |
| W | 0.10 | 0.58 | 1.13 | 0.88 | 1.36 | 1.75 | 3.28 | 37.23 | 0.10 | 0.57 | 1.06 | 0.87 | 1.34 | 1.72 | 2.95 | 4.63 | 1.00 | 0.87 |
| Zn | 4 | 28 | 53 | 47 | 66 | 77 | 127 | 2524 | 4 | 28 | 50 | 46 | 66 | 77 | 124 | 238 | 72 | 0.64 |
| Zr | 23 | 119 | 215 | 188 | 268 | 323 | 539 | 1886 | 23 | 119 | 207 | 186 | 264 | 315 | 479 | 612 | 132 | 1.41 |
| Y | 1.6 | 10.8 | 18.0 | 16.0 | 22.6 | 26.3 | 40.2 | 340.3 | 1.6 | 10.8 | 17.3 | 16.0 | 22.5 | 26.1 | 38.3 | 57.1 | 19.0 | 0.84 |
| La | 2.3 | 13.7 | 22.4 | 19.5 | 28.2 | 33.2 | 51.3 | 319.1 | 2.3 | 13.7 | 21.7 | 19.4 | 28.0 | 32.8 | 48.7 | 68.0 | 20.0 | 0.97 |
| Ce | 4.3 | 25.1 | 41.9 | 36.0 | 53.3 | 63.1 | 101.1 | 384.8 | 4.3 | 24.9 | 40.2 | 35.7 | 52.2 | 61.5 | 91.2 | 115.4 | 43.0 | 0.83 |
| Pr | 0.47 | 3.20 | 5.19 | 4.54 | 6.60 | 7.71 | 11.80 | 57.70 | 0.47 | 3.20 | 5.04 | 4.51 | 6.50 | 7.60 | 11.17 | 14.70 | 4.90 | 0.92 |
| Nd | 1.7 | 11.9 | 19.1 | 17.0 | 24.1 | 28.3 | 43.4 | 177.6 | 1.7 | 11.9 | 18.5 | 16.9 | 23.8 | 28.0 | 39.9 | 51.9 | 20.0 | 0.84 |
| Sm | 0.33 | 2.27 | 3.67 | 3.31 | 4.66 | 5.45 | 8.17 | 37.60 | 0.33 | 2.26 | 3.56 | 3.29 | 4.62 | 5.40 | 7.63 | 10.08 | 3.90 | 0.84 |
| Eu | 0.06 | 0.51 | 0.79 | 0.74 | 1.03 | 1.18 | 1.64 | 7.82 | 0.06 | 0.50 | 0.77 | 0.74 | 1.02 | 1.17 | 1.57 | 2.09 | 1.10 | 0.67 |
| Gd | 0.33 | 2.12 | 3.37 | 3.07 | 4.31 | 4.90 | 7.39 | 34.86 | 0.33 | 2.11 | 3.27 | 3.06 | 4.26 | 4.86 | 6.93 | 9.05 | 3.70 | 0.83 |
| Tb | 0.05 | 0.35 | 0.56 | 0.52 | 0.72 | 0.82 | 1.19 | 6.08 | 0.05 | 0.35 | 0.54 | 0.52 | 0.71 | 0.81 | 1.13 | 1.52 | 0.60 | 0.86 |
| Dy | 0.31 | 2.02 | 3.26 | 3.00 | 4.19 | 4.81 | 6.91 | 38.31 | 0.31 | 2.00 | 3.17 | 2.98 | 4.15 | 4.76 | 6.67 | 9.05 | 3.60 | 0.83 |
| Ho | 0.06 | 0.40 | 0.65 | 0.60 | 0.83 | 0.94 | 1.37 | 7.40 | 0.06 | 0.40 | 0.63 | 0.59 | 0.82 | 0.94 | 1.29 | 1.81 | 0.77 | 0.77 |
| Er | 0.19 | 1.18 | 1.88 | 1.73 | 2.39 | 2.72 | 4.02 | 20.25 | 0.19 | 1.17 | 1.82 | 1.72 | 2.37 | 2.69 | 3.78 | 5.27 | 2.10 | 0.82 |
| Tm | 0.03 | 0.18 | 0.29 | 0.27 | 0.37 | 0.42 | 0.65 | 2.84 | 0.03 | 0.18 | 0.28 | 0.27 | 0.37 | 0.42 | 0.60 | 0.82 | 0.28 | 0.96 |
| Yb | 0.19 | 1.19 | 1.87 | 1.73 | 2.35 | 2.68 | 4.12 | 16.69 | 0.19 | 1.18 | 1.81 | 1.73 | 2.31 | 2.65 | 3.78 | 5.06 | 1.90 | 0.91 |
| Lu | 0.03 | 0.18 | 0.29 | 0.27 | 0.37 | 0.42 | 0.63 | 2.41 | 0.03 | 0.18 | 0.28 | 0.27 | 0.36 | 0.41 | 0.59 | 0.80 | 0.30 | 0.89 |
| SiO2 | 12.07 | 69.27 | 74.95 | 76.43 | 82.79 | 85.68 | 90.85 | 94.34 | 41.79 | 69.74 | 75.80 | 76.61 | 82.93 | 85.83 | 90.85 | 94.34 | 60.65 | 1.26 |
| Al2O3 | 0.55 | 6.50 | 9.94 | 10.21 | 12.89 | 14.42 | 19.79 | 27.72 | 0.55 | 6.47 | 9.81 | 10.18 | 12.86 | 14.29 | 19.28 | 23.77 | 15.88 | 0.64 |
| TFe2O3 | 0.20 | 2.10 | 4.26 | 3.60 | 5.41 | 6.56 | 12.65 | 29.09 | 0.20 | 2.08 | 3.96 | 3.55 | 5.25 | 6.33 | 10.08 | 13.68 | 7.59 | 0.47 |
| MgO | 0.02 | 0.39 | 0.69 | 0.60 | 0.89 | 1.09 | 1.81 | 7.00 | 0.02 | 0.38 | 0.66 | 0.59 | 0.87 | 1.05 | 1.61 | 2.13 | 4.72 | 0.13 |
| CaO | 0.01 | 0.15 | 0.73 | 0.24 | 0.46 | 0.78 | 4.31 | 42.83 | 0.01 | 0.15 | 0.52 | 0.24 | 0.45 | 0.74 | 3.14 | 7.65 | 6.39 | 0.04 |
| Na2O | 0.03 | 0.20 | 0.48 | 0.41 | 0.65 | 0.82 | 1.52 | 3.31 | 0.03 | 0.19 | 0.45 | 0.40 | 0.63 | 0.78 | 1.24 | 1.65 | 3.10 | 0.13 |
| K2O | 0.07 | 0.80 | 1.46 | 1.30 | 1.95 | 2.36 | 3.70 | 6.88 | 0.07 | 0.80 | 1.42 | 1.28 | 1.93 | 2.32 | 3.48 | 4.25 | 1.79 | 0.72 |
| TC | 0.04 | 0.22 | 0.66 | 0.38 | 0.79 | 1.17 | 2.55 | 9.95 | 0.04 | 0.22 | 0.59 | 0.37 | 0.76 | 1.11 | 2.26 | 2.95 | -- | -- |

注：样品数：2079件；含量单位：Ag、Au、Cd、Hg为10-9，氧化物为%，其它元素为10-6；累计频率百分位数；大陆地壳元素丰度引自Rudnick and Gao（2003）；RCC=背景值/大陆地壳元素丰度

表2 老挝各构造单元表层沉积物地球化学参数

Table 2Geochemical parameters of surface sediments collected in tectonic of Laos

| **元素** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **RCC1** | **RCC2** | **RCC3** | **RCC4** | **RCC5** | **RCC6** | **RCC7** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ag | 60 | 63 | 55 | 54 | 79 | 66 | 60 | 0.98 | 1.03 | 0.90 | 0.89 | 1.30 | 1.08 | 0.98 |
| As | 5.2 | 6.0 | 6.3 | 2.3 | 6.4 | 6.5 | 5.8 | 1.06 | 1.22 | 1.30 | 0.48 | 1.31 | 1.34 | 1.18 |
| Au | 1.12 | 1.10 | 1.13 | 0.70 | 0.74 | 1.05 | 0.65 | 1.12 | 1.10 | 1.13 | 0.70 | 0.74 | 1.05 | 0.65 |
| B | 39.2 | 34.5 | 41.3 | 25.4 | 32.9 | 41.9 | 22.8 | 1.16 | 1.02 | 1.22 | 0.75 | 0.97 | 1.24 | 0.68 |
| Ba | 253 | 273 | 282 | 183 | 278 | 250 | 276 | 1.05 | 1.13 | 1.17 | 0.76 | 1.15 | 1.04 | 1.14 |
| Be | 1.21 | 1.19 | 1.66 | 0.98 | 1.54 | 1.27 | 1.09 | 1.05 | 1.03 | 1.44 | 0.85 | 1.34 | 1.10 | 0.95 |
| Bi | 0.18 | 0.18 | 0.26 | 0.13 | 0.28 | 0.20 | 0.23 | 1.01 | 1.02 | 1.49 | 0.72 | 1.61 | 1.17 | 1.34 |
| Br | 1.00 | 1.30 | 1.80 | 1.50 | 1.90 | 1.60 | 1.75 | 0.67 | 0.87 | 1.20 | 1.00 | 1.27 | 1.07 | 1.17 |
| Cd | 73 | 68 | 80 | 37 | 99 | 82 | 75 | 1.16 | 1.08 | 1.27 | 0.59 | 1.57 | 1.30 | 1.19 |
| Cl | 39 | 60 | 64 | 62 | 63 | 62 | 69 | 0.64 | 0.98 | 1.05 | 1.02 | 1.03 | 1.03 | 1.13 |
| Co | 10.6 | 9.6 | 11.6 | 6.0 | 7.9 | 9.9 | 9.4 | 1.21 | 1.09 | 1.32 | 0.68 | 0.90 | 1.12 | 1.07 |
| Cr | 42 | 40 | 53 | 36 | 52 | 49 | 35 | 0.99 | 0.94 | 1.24 | 0.84 | 1.22 | 1.15 | 0.83 |
| Cs | 3.95 | 3.48 | 5.85 | 2.42 | 5.09 | 3.74 | 2.88 | 1.17 | 1.03 | 1.74 | 0.72 | 1.51 | 1.11 | 0.86 |
| Cu | 16.2 | 16.5 | 19.6 | 12.2 | 17.4 | 19.1 | 15.0 | 1.01 | 1.03 | 1.23 | 0.76 | 1.09 | 1.19 | 0.94 |
| F | 278 | 288 | 335 | 202 | 460 | 296 | 300 | 1.03 | 1.07 | 1.24 | 0.75 | 1.70 | 1.10 | 1.11 |
| Ga | 10.2 | 10.7 | 12.4 | 8.0 | 10.5 | 11.0 | 11.2 | 1.00 | 1.05 | 1.21 | 0.78 | 1.03 | 1.08 | 1.10 |
| Ge | 1.31 | 1.26 | 1.35 | 1.16 | 1.20 | 1.28 | 1.29 | 1.04 | 1.01 | 1.08 | 0.93 | 0.96 | 1.02 | 1.03 |
| Hf | 4.52 | 5.02 | 6.12 | 8.65 | 8.65 | 5.62 | 5.29 | 0.75 | 0.84 | 1.02 | 1.44 | 1.44 | 0.94 | 0.88 |
| Hg | 23.9 | 28.1 | 42.9 | 21.5 | 79.8 | 38.6 | 21.5 | 0.84 | 0.99 | 1.51 | 0.76 | 2.81 | 1.36 | 0.76 |
| I | 0.62 | 0.62 | 0.73 | 0.70 | 1.72 | 0.74 | 0.60 | 0.90 | 0.90 | 1.06 | 1.01 | 2.49 | 1.07 | 0.86 |
| In | 0.034 | 0.042 | 0.052 | 0.033 | 0.040 | 0.047 | 0.047 | 0.83 | 1.02 | 1.27 | 0.80 | 0.98 | 1.15 | 1.13 |
| Li | 25.3 | 22.3 | 29.1 | 16.6 | 22.4 | 24.7 | 16.4 | 1.18 | 1.04 | 1.35 | 0.77 | 1.04 | 1.15 | 0.76 |
| Mn | 471 | 416 | 413 | 313 | 257 | 440 | 400 | 1.22 | 1.08 | 1.07 | 0.81 | 0.66 | 1.14 | 1.04 |
| Mo | 0.42 | 0.41 | 0.48 | 0.35 | 0.97 | 0.47 | 0.34 | 1.01 | 0.99 | 1.15 | 0.83 | 2.33 | 1.12 | 0.81 |
| N | 365 | 351 | 617 | 349 | 644 | 548 | 312 | 0.91 | 0.87 | 1.53 | 0.87 | 1.60 | 1.36 | 0.77 |
| Nb | 8.8 | 8.4 | 9.9 | 8.6 | 9.4 | 8.6 | 8.2 | 1.03 | 0.97 | 1.15 | 1.00 | 1.10 | 1.00 | 0.95 |
| Ni | 16.3 | 15.0 | 24.2 | 9.9 | 21.8 | 18.0 | 14.7 | 1.10 | 1.01 | 1.62 | 0.66 | 1.46 | 1.21 | 0.98 |
| P | 325 | 306 | 349 | 228 | 318 | 360 | 305 | 1.05 | 0.99 | 1.13 | 0.74 | 1.03 | 1.17 | 0.99 |
| Pb | 13.7 | 15.2 | 19.0 | 13.4 | 20.8 | 15.1 | 18.6 | 0.93 | 1.04 | 1.30 | 0.92 | 1.42 | 1.03 | 1.27 |
| Rb | 56 | 55 | 83 | 38 | 71 | 57 | 64 | 1.09 | 1.08 | 1.63 | 0.74 | 1.39 | 1.12 | 1.25 |
| S | 68 | 72 | 84 | 60 | 112 | 84 | 61 | 0.95 | 1.00 | 1.17 | 0.83 | 1.56 | 1.17 | 0.85 |
| Sb | 0.63 | 0.51 | 0.73 | 0.30 | 0.76 | 0.64 | 0.38 | 1.26 | 1.02 | 1.45 | 0.60 | 1.52 | 1.28 | 0.76 |
| Sc | 8.7 | 8.4 | 9.1 | 5.5 | 8.6 | 8.9 | 7.8 | 1.10 | 1.07 | 1.16 | 0.70 | 1.09 | 1.13 | 0.99 |
| Se | 0.075 | 0.086 | 0.158 | 0.086 | 0.282 | 0.133 | 0.083 | 0.77 | 0.88 | 1.61 | 0.88 | 2.88 | 1.35 | 0.84 |
| Sn | 1.87 | 1.90 | 2.13 | 1.64 | 2.23 | 1.94 | 1.67 | 1.01 | 1.02 | 1.15 | 0.88 | 1.20 | 1.04 | 0.90 |
| Sr | 57 | 50 | 47 | 30 | 28 | 46 | 38 | 1.34 | 1.18 | 1.10 | 0.70 | 0.65 | 1.08 | 0.88 |
| Ta | 0.79 | 0.69 | 0.75 | 0.58 | 0.82 | 0.65 | 0.59 | 1.20 | 1.04 | 1.14 | 0.88 | 1.25 | 0.98 | 0.90 |
| Te | 0.033 | 0.034 | 0.032 | 0.017 | 0.023 | 0.029 | 0.020 | 1.22 | 1.26 | 1.17 | 0.63 | 0.85 | 1.07 | 0.72 |
| Th | 6.00 | 6.14 | 9.06 | 5.33 | 8.54 | 6.12 | 3.55 | 1.01 | 1.03 | 1.52 | 0.90 | 1.43 | 1.03 | 0.60 |
| Ti | 2966 | 2930 | 3105 | 2418 | 2636 | 3074 | 2389 | 1.04 | 1.03 | 1.09 | 0.85 | 0.92 | 1.08 | 0.84 |
| Tl | 0.32 | 0.33 | 0.46 | 0.24 | 0.48 | 0.34 | 0.30 | 1.03 | 1.06 | 1.48 | 0.78 | 1.55 | 1.11 | 0.95 |
| U | 1.32 | 1.49 | 1.96 | 1.50 | 2.16 | 1.40 | 1.25 | 0.90 | 1.02 | 1.34 | 1.03 | 1.48 | 0.96 | 0.86 |
| V | 61 | 59 | 65 | 44 | 66 | 70 | 63 | 1.05 | 1.02 | 1.13 | 0.75 | 1.13 | 1.21 | 1.08 |
| W | 0.83 | 0.91 | 1.21 | 0.74 | 0.98 | 0.95 | 1.12 | 0.95 | 1.04 | 1.39 | 0.85 | 1.12 | 1.08 | 1.28 |
| Zn | 55 | 51 | 58 | 32 | 46 | 52 | 54 | 1.18 | 1.09 | 1.25 | 0.68 | 0.99 | 1.12 | 1.17 |
| Zr | 149 | 162 | 178 | 246 | 249 | 185 | 124 | 0.80 | 0.87 | 0.96 | 1.32 | 1.34 | 0.99 | 0.67 |
| Y | 14.4 | 16.5 | 19.9 | 13.8 | 20.4 | 17.8 | 15.5 | 0.90 | 1.03 | 1.25 | 0.86 | 1.28 | 1.12 | 0.97 |
| La | 17.5 | 19.5 | 25.8 | 17.7 | 23.6 | 21.8 | 15.8 | 0.90 | 1.01 | 1.33 | 0.91 | 1.21 | 1.12 | 0.81 |
| Ce | 30.5 | 35.3 | 49.2 | 33.7 | 40.6 | 40.3 | 28.6 | 0.85 | 0.99 | 1.38 | 0.94 | 1.14 | 1.13 | 0.80 |
| Pr | 4.50 | 4.56 | 5.98 | 4.00 | 5.65 | 4.91 | 3.66 | 1.00 | 1.01 | 1.32 | 0.89 | 1.25 | 1.09 | 0.81 |
| Nd | 17.1 | 17.1 | 20.9 | 14.5 | 20.8 | 18.5 | 14.1 | 1.01 | 1.01 | 1.24 | 0.86 | 1.23 | 1.10 | 0.83 |
| Sm | 3.17 | 3.39 | 4.13 | 2.83 | 3.89 | 3.57 | 3.07 | 0.96 | 1.03 | 1.26 | 0.86 | 1.18 | 1.08 | 0.93 |
| Eu | 0.74 | 0.75 | 0.87 | 0.60 | 0.81 | 0.80 | 0.71 | 1.00 | 1.02 | 1.18 | 0.81 | 1.09 | 1.08 | 0.96 |
| Gd | 3.07 | 3.17 | 3.67 | 2.64 | 3.52 | 3.20 | 2.79 | 1.00 | 1.04 | 1.20 | 0.86 | 1.15 | 1.05 | 0.91 |
| Tb | 0.48 | 0.55 | 0.61 | 0.43 | 0.59 | 0.56 | 0.50 | 0.93 | 1.06 | 1.19 | 0.83 | 1.13 | 1.09 | 0.97 |
| Dy | 2.71 | 3.21 | 3.72 | 2.52 | 3.36 | 3.28 | 3.02 | 0.91 | 1.08 | 1.25 | 0.85 | 1.13 | 1.10 | 1.01 |
| Ho | 0.56 | 0.63 | 0.73 | 0.49 | 0.72 | 0.64 | 0.57 | 0.94 | 1.08 | 1.24 | 0.84 | 1.21 | 1.08 | 0.97 |
| Er | 1.54 | 1.84 | 2.08 | 1.46 | 2.17 | 1.85 | 1.71 | 0.90 | 1.07 | 1.21 | 0.85 | 1.26 | 1.08 | 1.00 |
| Tm | 0.24 | 0.28 | 0.33 | 0.23 | 0.35 | 0.29 | 0.26 | 0.89 | 1.04 | 1.21 | 0.85 | 1.28 | 1.07 | 0.96 |
| Yb | 1.55 | 1.81 | 2.07 | 1.49 | 2.21 | 1.83 | 1.60 | 0.90 | 1.05 | 1.20 | 0.86 | 1.28 | 1.06 | 0.93 |
| Lu | 0.23 | 0.28 | 0.32 | 0.23 | 0.34 | 0.29 | 0.24 | 0.87 | 1.04 | 1.21 | 0.88 | 1.29 | 1.10 | 0.91 |
| SiO2 | 78.07 | 76.17 | 74.46 | 80.61 | 76.08 | 74.22 | 76.53 | 1.02 | 0.99 | 0.97 | 1.05 | 0.99 | 0.97 | 1.00 |
| Al2O3 | 10.18 | 10.35 | 11.23 | 8.01 | 9.96 | 10.72 | 8.90 | 1.00 | 1.02 | 1.10 | 0.79 | 0.98 | 1.05 | 0.87 |
| TFe2O3 | 3.95 | 3.70 | 3.91 | 2.45 | 3.75 | 4.16 | 3.59 | 1.11 | 1.04 | 1.10 | 0.69 | 1.06 | 1.17 | 1.01 |
| MgO | 0.65 | 0.67 | 0.58 | 0.48 | 0.48 | 0.63 | 0.50 | 1.09 | 1.14 | 0.98 | 0.81 | 0.81 | 1.07 | 0.84 |
| CaO | 0.26 | 0.29 | 0.20 | 0.20 | 0.28 | 0.25 | 0.36 | 1.07 | 1.21 | 0.83 | 0.83 | 1.17 | 1.04 | 1.48 |
| Na2O | 0.60 | 0.46 | 0.31 | 0.28 | 0.14 | 0.42 | 0.50 | 1.50 | 1.15 | 0.78 | 0.70 | 0.35 | 1.05 | 1.24 |
| K2O | 1.37 | 1.44 | 1.66 | 0.87 | 1.57 | 1.39 | 1.66 | 1.07 | 1.12 | 1.29 | 0.68 | 1.22 | 1.08 | 1.29 |
| TC | 0.27 | 0.32 | 0.41 | 0.37 | 0.74 | 0.48 | 0.31 | 0.72 | 0.86 | 1.11 | 1.00 | 2.00 | 1.30 | 0.82 |

注：样品数：2079件；含量单位：Ag、Au、Cd、Hg为10-9，氧化物为%，其它元素为10-6；累计频率百分位数；大陆地壳元素丰度引自Rudnick and Gao（2003）；RCC=背景值/大陆地壳元素丰度，1. 景洪–素可泰火山弧（样品数166件）；2. 思茅–彭世洛地块（样品数586件）；3. 奠边府–黎府缝合带（样品数22件）；4. 万象–嵩地块（样品数664件）；5. 色潘–三岐缝合带（样品数22件）；6. 长山地块（样品数609件）；7. 哀牢山–马江缝合带（样品数10件）；RCC1-RCC7为各构造单元背景值与全国背景值比值。

表3 老挝各成矿带表层沉积物地球化学参数

Table 3 Geochemical parameters of surface sediments collected in Metallogenic Belt of Laos

| **元素** | **1** | **2** | **3** | **4** | **5** | **6** | **RCC8** | **RCC9** | **RCC10** | **RCC11** | **RCC12** | **RCC13** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ag | 58 | 60 | 64 | 54 | 70 | 60 | 0.95 | 0.98 | 1.05 | 0.89 | 1.15 | 0.98 |
| As | 4.8 | 6.0 | 6.0 | 2.3 | 6.8 | 3.1 | 0.99 | 1.23 | 1.23 | 0.46 | 1.40 | 0.64 |
| Au | 0.98 | 1.17 | 1.09 | 0.66 | 1.09 | 0.66 | 0.98 | 1.17 | 1.09 | 0.66 | 1.09 | 0.66 |
| B | 28.7 | 38.9 | 35.5 | 25.4 | 42.5 | 21.3 | 0.85 | 1.15 | 1.05 | 0.75 | 1.26 | 0.63 |
| Ba | 346 | 230 | 276 | 175 | 252 | 325 | 1.43 | 0.95 | 1.14 | 0.72 | 1.04 | 1.35 |
| Be | 1.42 | 1.10 | 1.29 | 0.96 | 1.29 | 1.02 | 1.24 | 0.96 | 1.12 | 0.84 | 1.13 | 0.89 |
| Bi | 0.22 | 0.16 | 0.20 | 0.12 | 0.21 | 0.22 | 1.26 | 0.92 | 1.11 | 0.70 | 1.19 | 1.25 |
| Br | 1.10 | 0.90 | 1.40 | 1.50 | 1.60 | 1.70 | 0.73 | 0.60 | 0.93 | 1.00 | 1.07 | 1.13 |
| Cd | 83 | 68 | 73 | 37 | 87 | 70 | 1.32 | 1.07 | 1.16 | 0.59 | 1.38 | 1.11 |
| Cl | 62 | 37 | 62 | 62 | 63 | 71 | 1.02 | 0.61 | 1.01 | 1.02 | 1.03 | 1.16 |
| Co | 8.0 | 11.1 | 9.7 | 5.6 | 10.3 | 9.1 | 0.91 | 1.26 | 1.11 | 0.64 | 1.17 | 1.03 |
| Cr | 36 | 43 | 42 | 34 | 51 | 33 | 0.85 | 1.00 | 0.99 | 0.79 | 1.21 | 0.78 |
| Cs | 5.23 | 3.58 | 3.70 | 2.37 | 3.82 | 1.66 | 1.55 | 1.06 | 1.10 | 0.70 | 1.13 | 0.49 |
| Cu | 13.4 | 17.0 | 17.5 | 11.6 | 19.2 | 11.9 | 0.84 | 1.06 | 1.10 | 0.72 | 1.20 | 0.74 |
| F | 264 | 283 | 300 | 198 | 303 | 261 | 0.98 | 1.05 | 1.11 | 0.73 | 1.12 | 0.97 |
| Ga | 10.8 | 10.1 | 11.1 | 7.7 | 11.2 | 11.1 | 1.05 | 0.99 | 1.09 | 0.75 | 1.10 | 1.09 |
| Ge | 1.31 | 1.29 | 1.27 | 1.15 | 1.29 | 1.22 | 1.04 | 1.03 | 1.02 | 0.92 | 1.03 | 0.98 |
| Hf | 4.69 | 4.27 | 5.25 | 8.30 | 5.86 | 4.55 | 0.78 | 0.71 | 0.87 | 1.38 | 0.98 | 0.76 |
| Hg | 23.0 | 26.4 | 30.2 | 21.4 | 38.1 | 16.3 | 0.81 | 0.93 | 1.06 | 0.75 | 1.34 | 0.57 |
| I | 0.75 | 0.60 | 0.64 | 0.67 | 0.80 | 0.56 | 1.09 | 0.86 | 0.93 | 0.98 | 1.16 | 0.81 |
| In | 0.036 | 0.033 | 0.045 | 0.031 | 0.048 | 0.046 | 0.87 | 0.80 | 1.10 | 0.76 | 1.17 | 1.12 |
| Li | 24.3 | 25.2 | 22.5 | 16.5 | 24.7 | 15.0 | 1.13 | 1.18 | 1.05 | 0.77 | 1.15 | 0.70 |
| Mn | 446 | 465 | 420 | 309 | 458 | 383 | 1.16 | 1.20 | 1.09 | 0.80 | 1.19 | 0.99 |
| Mo | 0.54 | 0.38 | 0.43 | 0.32 | 0.49 | 0.34 | 1.29 | 0.91 | 1.02 | 0.76 | 1.17 | 0.81 |
| N | 365 | 365 | 384 | 349 | 564 | 295 | 0.91 | 0.91 | 0.95 | 0.87 | 1.40 | 0.73 |
| Nb | 10.1 | 7.8 | 8.8 | 8.2 | 8.8 | 7.6 | 1.17 | 0.91 | 1.03 | 0.96 | 1.03 | 0.89 |
| Ni | 11.2 | 16.4 | 16.6 | 9.6 | 18.8 | 14.6 | 0.75 | 1.10 | 1.11 | 0.64 | 1.26 | 0.98 |
| P | 284 | 321 | 323 | 220 | 371 | 279 | 0.92 | 1.04 | 1.05 | 0.71 | 1.20 | 0.91 |
| Pb | 16.5 | 12.2 | 15.9 | 13.0 | 15.4 | 17.9 | 1.12 | 0.83 | 1.08 | 0.89 | 1.05 | 1.22 |
| Rb | 89 | 49 | 62 | 38 | 58 | 64 | 1.74 | 0.96 | 1.22 | 0.74 | 1.13 | 1.25 |
| S | 68 | 69 | 74 | 60 | 84 | 58 | 0.95 | 0.96 | 1.03 | 0.83 | 1.17 | 0.81 |
| Sb | 0.58 | 0.61 | 0.53 | 0.30 | 0.66 | 0.37 | 1.15 | 1.21 | 1.06 | 0.60 | 1.32 | 0.74 |
| Sc | 8.3 | 9.1 | 8.5 | 5.0 | 9.2 | 7.0 | 1.05 | 1.16 | 1.07 | 0.64 | 1.17 | 0.89 |
| Se | 0.084 | 0.071 | 0.099 | 0.082 | 0.145 | 0.074 | 0.85 | 0.72 | 1.01 | 0.84 | 1.48 | 0.76 |
| Sn | 2.30 | 1.74 | 2.03 | 1.58 | 1.98 | 1.61 | 1.24 | 0.94 | 1.09 | 0.85 | 1.07 | 0.87 |
| Sr | 60 | 57 | 48 | 30 | 45 | 37 | 1.41 | 1.34 | 1.13 | 0.69 | 1.06 | 0.87 |
| Ta | 1.07 | 0.73 | 0.69 | 0.56 | 0.67 | 0.59 | 1.63 | 1.11 | 1.05 | 0.85 | 1.02 | 0.90 |
| Te | 0.034 | 0.033 | 0.033 | 0.016 | 0.029 | 0.016 | 1.24 | 1.22 | 1.22 | 0.59 | 1.07 | 0.59 |
| Th | 8.33 | 5.29 | 6.54 | 5.17 | 6.23 | 3.48 | 1.40 | 0.89 | 1.10 | 0.87 | 1.05 | 0.58 |
| Ti | 2755 | 2969 | 3002 | 2298 | 3155 | 2154 | 0.97 | 1.04 | 1.05 | 0.81 | 1.11 | 0.75 |
| Tl | 0.60 | 0.28 | 0.36 | 0.24 | 0.36 | 0.32 | 1.91 | 0.90 | 1.15 | 0.77 | 1.14 | 1.03 |
| U | 1.93 | 1.11 | 1.57 | 1.46 | 1.47 | 1.13 | 1.32 | 0.76 | 1.08 | 1.00 | 1.01 | 0.77 |
| V | 54 | 61 | 62 | 41 | 73 | 59 | 0.94 | 1.05 | 1.06 | 0.71 | 1.25 | 1.02 |
| W | 1.37 | 0.74 | 0.96 | 0.74 | 0.96 | 1.01 | 1.57 | 0.85 | 1.10 | 0.85 | 1.09 | 1.16 |
| Zn | 50 | 55 | 51 | 29 | 53 | 53 | 1.08 | 1.19 | 1.10 | 0.64 | 1.16 | 1.16 |
| Zr | 158 | 134 | 167 | 243 | 189 | 121 | 0.85 | 0.72 | 0.90 | 1.31 | 1.01 | 0.65 |
| Y | 13.6 | 14.4 | 17.8 | 13.3 | 18.3 | 14.6 | 0.85 | 0.90 | 1.12 | 0.83 | 1.15 | 0.91 |
| La | 18.4 | 16.6 | 20.7 | 17.5 | 22.4 | 14.1 | 0.95 | 0.85 | 1.06 | 0.90 | 1.15 | 0.73 |
| Ce | 31.1 | 28.9 | 38.3 | 33.1 | 40.7 | 26.0 | 0.87 | 0.81 | 1.07 | 0.93 | 1.14 | 0.73 |
| Pr | 4.04 | 4.35 | 4.91 | 3.90 | 5.11 | 3.41 | 0.90 | 0.96 | 1.09 | 0.86 | 1.13 | 0.75 |
| Nd | 15.3 | 16.6 | 18.0 | 14.2 | 19.2 | 13.8 | 0.90 | 0.98 | 1.07 | 0.84 | 1.13 | 0.82 |
| Sm | 2.84 | 3.09 | 3.57 | 2.70 | 3.72 | 3.02 | 0.86 | 0.94 | 1.08 | 0.82 | 1.13 | 0.92 |
| Eu | 0.66 | 0.74 | 0.78 | 0.58 | 0.82 | 0.66 | 0.89 | 1.00 | 1.05 | 0.78 | 1.11 | 0.90 |
| Gd | 2.77 | 3.05 | 3.30 | 2.57 | 3.29 | 2.76 | 0.91 | 1.00 | 1.08 | 0.84 | 1.07 | 0.90 |
| Tb | 0.43 | 0.48 | 0.57 | 0.42 | 0.58 | 0.48 | 0.83 | 0.93 | 1.11 | 0.81 | 1.12 | 0.93 |
| Dy | 2.46 | 2.73 | 3.36 | 2.40 | 3.34 | 2.85 | 0.82 | 0.92 | 1.13 | 0.81 | 1.12 | 0.96 |
| Ho | 0.51 | 0.56 | 0.67 | 0.47 | 0.66 | 0.53 | 0.86 | 0.95 | 1.13 | 0.80 | 1.12 | 0.90 |
| Er | 1.49 | 1.57 | 1.92 | 1.42 | 1.89 | 1.62 | 0.86 | 0.91 | 1.12 | 0.82 | 1.10 | 0.94 |
| Tm | 0.24 | 0.24 | 0.30 | 0.22 | 0.29 | 0.25 | 0.89 | 0.90 | 1.10 | 0.81 | 1.09 | 0.93 |
| Yb | 1.61 | 1.58 | 1.88 | 1.43 | 1.87 | 1.55 | 0.93 | 0.92 | 1.09 | 0.83 | 1.08 | 0.90 |
| Lu | 0.25 | 0.23 | 0.29 | 0.22 | 0.30 | 0.24 | 0.92 | 0.86 | 1.09 | 0.83 | 1.12 | 0.90 |
| SiO2 | 77.53 | 78.42 | 75.46 | 80.97 | 73.72 | 76.62 | 1.01 | 1.02 | 0.98 | 1.06 | 0.96 | 1.00 |
| Al2O3 | 10.84 | 9.12 | 10.66 | 7.70 | 10.82 | 7.36 | 1.06 | 0.90 | 1.05 | 0.76 | 1.06 | 0.72 |
| TFe2O3 | 3.19 | 4.12 | 3.77 | 2.27 | 4.34 | 3.08 | 0.90 | 1.16 | 1.06 | 0.64 | 1.22 | 0.87 |
| MgO | 0.55 | 0.65 | 0.68 | 0.47 | 0.64 | 0.46 | 0.93 | 1.10 | 1.15 | 0.80 | 1.08 | 0.78 |
| CaO | 0.28 | 0.24 | 0.27 | 0.20 | 0.28 | 0.32 | 1.17 | 1.00 | 1.13 | 0.83 | 1.17 | 1.33 |
| Na2O | 0.73 | 0.58 | 0.45 | 0.29 | 0.40 | 0.63 | 1.83 | 1.45 | 1.13 | 0.73 | 1.00 | 1.58 |
| K2O | 2.26 | 1.22 | 1.54 | 0.87 | 1.39 | 1.81 | 1.76 | 0.95 | 1.20 | 0.68 | 1.08 | 1.41 |
| TC | 0.28 | 0.26 | 0.36 | 0.36 | 0.54 | 0.30 | 0.76 | 0.70 | 0.97 | 0.97 | 1.46 | 0.81 |

注：样品数：2079件；含量单位：Ag、Au、Cd、Hg为10-9，氧化物为%，其它元素为10-6；累计频率百分位数；大陆地壳元素丰度引自Rudnick and Gao（2003）；RCC=背景值/大陆地壳元素丰度，1. 清迈成矿带（样品数33件）；2. 琅南塔–庄他武里成矿带（样品数189件）；3. 琅勃拉邦–大叻成矿带（样品数635件）；4. 万象–昆嵩成矿带（样品数678件）；5. 长山成矿带（样品数532件）；6. 红河成矿带（样品数12件）；RCC8-RCC13为各构造单元背景值与全国背景值比值。