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。