**Supplementary table 2. Major and trace element concentrations of the Paleoproterozoic granitoids from the Liaodong Peninsula.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pluton name | Hupiyu | | | Simenzi | | | | Muniu | | Niejiaweizi | | | | Longjiapu | | |
| Sample | 18YK03-1 | 18YK02-1 | 18YK01-1 | 18DD26-2 | 18DD25-3 | 18DD25-2 | 18DD22-1 | 18XY11-3 | 18XY11-2 | 18DD30-3 | NJW-TY1 | NJW-TY2 | NJW-TY3 | NJW-TY4 | 18XY13-3 | 18XY13-2 |
| SiO2 | 75.18 | 77.61 | 75.29 | 75.42 | 72.25 | 71.71 | 71.05 | 76.82 | 76.53 | 73.38 | 73.86 | 73.46 | 73.04 | 73.78 | 74.01 | 77.38 |
| TiO2 | 0.16 | 0.15 | 0.22 | 0.21 | 0.27 | 0.28 | 0.39 | 0.28 | 0.26 | 0.07 | 0.13 | 0.06 | 0.13 | 0.12 | 0.04 | 0.04 |
| Al2O3 | 12.10 | 10.52 | 10.86 | 11.34 | 12.42 | 12.60 | 12.55 | 11.00 | 11.07 | 14.22 | 14.28 | 14.20 | 14.45 | 14.33 | 15.08 | 12.71 |
| TFe2O3 | 1.65 | 1.73 | 3.09 | 2.81 | 3.67 | 3.67 | 4.90 | 2.06 | 2.41 | 0.75 | 0.85 | 0.85 | 0.85 | 0.83 | 0.30 | 0.30 |
| FeO | 0.71 | 0.41 | 1.04 | 1.29 | 2.09 | 2.23 | 1.76 | 1.16 | 0.96 | 0.48 | 0.55 | 0.64 | 0.68 | 0.71 | 0.14 | 0.45 |
| MnO | 0.03 | 0.02 | 0.04 | 0.04 | 0.05 | 0.06 | 0.07 | 0.02 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 |
| MgO | 0.10 | 0.04 | 0.08 | 0.05 | 0.05 | 0.06 | 0.13 | 0.36 | 0.41 | 0.29 | 0.40 | 0.41 | 0.38 | 0.35 | 0.14 | 0.13 |
| CaO | 0.92 | 0.77 | 0.90 | 1.11 | 1.63 | 1.60 | 0.96 | 0.90 | 1.05 | 1.26 | 1.92 | 2.03 | 2.11 | 1.98 | 1.62 | 1.87 |
| Na2O | 3.34 | 3.16 | 3.44 | 2.87 | 3.27 | 3.08 | 3.46 | 2.86 | 2.96 | 4.61 | 4.16 | 4.47 | 4.59 | 4.29 | 4.79 | 4.18 |
| K2O | 4.84 | 4.25 | 4.17 | 5.04 | 5.02 | 5.62 | 4.96 | 3.95 | 3.66 | 4.09 | 3.64 | 3.57 | 3.33 | 3.48 | 2.70 | 2.16 |
| P2O5 | 0.02 | 0.01 | 0.02 | 0.02 | 0.03 | 0.02 | 0.04 | 0.04 | 0.03 | 0.02 | 0.04 | 0.03 | 0.02 | 0.09 | 0.01 | 0.01 |
| LOl | 0.69 | 0.85 | 0.89 | 0.33 | 0.48 | 0.38 | 0.62 | 0.86 | 0.76 | 0.84 | 0.32 | 0.24 | 0.39 | 0.43 | 0.94 | 0.83 |
| Mg# | 0.11 | 0.04 | 0.05 | 0.03 | 0.03 | 0.03 | 0.05 | 0.26 | 0.25 | 0.44 | 0.48 | 0.49 | 0.47 | 0.46 | 0.47 | 0.47 |
| K2O/Na2O | 1.45 | 1.34 | 1.21 | 1.76 | 1.54 | 1.83 | 1.43 | 1.38 | 1.24 | 0.89 | 0.88 | 0.80 | 0.73 | 0.81 | 0.56 | 0.52 |
| A/CNK | 0.98 | 0.94 | 0.92 | 0.93 | 0.90 | 0.90 | 0.98 | 1.04 | 1.03 | 0.99 | 1.00 | 0.95 | 0.96 | 0.99 | 1.10 | 1.01 |
| A/NK | 1.13 | 1.07 | 1.07 | 1.12 | 1.15 | 1.13 | 1.13 | 1.22 | 1.25 | 1.18 | 1.32 | 1.27 | 1.30 | 1.32 | 1.40 | 1.38 |
| La | 66.17 | 67.61 | 33.98 | 27.58 | 25.64 | 19.88 | 29.04 | 61.25 | 52.32 | 4.82 | 5.08 | 4.19 | 2.86 | 1.77 | 1.67 | 1.88 |
| Ce | 142.56 | 141.77 | 81.43 | 68.56 | 70.36 | 55.26 | 62.86 | 141.95 | 122.62 | 8.92 | 11.80 | 9.52 | 6.53 | 4.84 | 2.72 | 3.16 |
| Pr | 14.70 | 15.03 | 9.67 | 7.04 | 6.74 | 5.93 | 7.23 | 16.59 | 13.80 | 0.99 | 1.64 | 1.42 | 1.03 | 0.77 | 0.32 | 0.36 |
| Nd | 51.46 | 52.58 | 37.61 | 26.22 | 25.80 | 23.64 | 27.34 | 62.12 | 51.36 | 3.46 | 5.88 | 5.02 | 3.45 | 2.73 | 1.10 | 1.22 |
| Sm | 8.99 | 9.25 | 8.13 | 5.59 | 5.99 | 5.76 | 5.30 | 12.05 | 10.75 | 0.67 | 0.84 | 0.85 | 0.58 | 0.43 | 0.22 | 0.24 |
| Eu | 1.11 | 1.14 | 1.32 | 1.02 | 1.17 | 1.14 | 1.67 | 2.03 | 1.99 | 0.41 | 1.01 | 1.01 | 1.00 | 1.06 | 0.41 | 0.48 |
| Gd | 8.06 | 8.33 | 8.04 | 5.71 | 6.25 | 6.20 | 5.07 | 9.72 | 9.34 | 0.60 | 0.68 | 0.69 | 0.56 | 0.41 | 0.22 | 0.25 |
| Tb | 1.19 | 1.21 | 1.25 | 0.89 | 0.99 | 1.01 | 0.73 | 1.14 | 1.15 | 0.08 | 0.11 | 0.09 | 0.09 | 0.06 | 0.03 | 0.04 |
| Dy | 7.47 | 7.67 | 8.08 | 5.87 | 6.53 | 6.75 | 4.64 | 5.19 | 5.25 | 0.46 | 0.64 | 0.62 | 0.45 | 0.38 | 0.23 | 0.33 |
| Ho | 1.55 | 1.59 | 1.70 | 1.24 | 1.38 | 1.41 | 0.95 | 0.77 | 0.75 | 0.09 | 0.13 | 0.12 | 0.12 | 0.10 | 0.05 | 0.08 |
| Er | 4.41 | 4.54 | 4.84 | 3.61 | 4.03 | 4.05 | 2.68 | 1.61 | 1.52 | 0.24 | 0.32 | 0.17 | 0.19 | 0.20 | 0.15 | 0.23 |
| Tm | 0.66 | 0.68 | 0.74 | 0.53 | 0.60 | 0.59 | 0.40 | 0.19 | 0.17 | 0.04 | 0.04 | 0.05 | 0.03 | 0.03 | 0.02 | 0.04 |
| Yb | 4.20 | 4.33 | 4.75 | 3.38 | 3.86 | 3.59 | 2.56 | 1.00 | 0.98 | 0.21 | 0.34 | 0.31 | 0.19 | 0.20 | 0.15 | 0.25 |
| Lu | 0.62 | 0.64 | 0.73 | 0.50 | 0.57 | 0.50 | 0.40 | 0.14 | 0.14 | 0.03 | 0.08 | 0.06 | 0.06 | 0.05 | 0.02 | 0.04 |
| Y | 47.22 | 48.32 | 51.66 | 31.46 | 36.62 | 36.72 | 23.24 | 19.84 | 20.07 | 2.85 | 4.02 | 3.92 | 3.64 | 3.33 | 1.75 | 2.51 |
| ΣREE | 313.1 | 316.4 | 202.3 | 157.7 | 159.9 | 135.7 | 150.9 | 315.7 | 272.1 | 21.0 | 28.6 | 24.1 | 17.1 | 13.0 | 7.3 | 8.6 |
| LREE/HREE | 10.12 | 9.91 | 5.71 | 6.26 | 5.61 | 4.63 | 7.65 | 14.99 | 13.10 | 11.01 | 11.26 | 10.40 | 9.16 | 8.09 | 7.28 | 5.89 |
| (La/Yb)N | 11.30 | 11.21 | 5.13 | 5.86 | 4.77 | 3.97 | 8.13 | 44.02 | 38.23 | 16.28 | 10.72 | 9.70 | 10.80 | 6.35 | 7.79 | 5.43 |
| δEu | 0.39 | 0.39 | 0.49 | 0.55 | 0.58 | 0.58 | 0.97 | 0.55 | 0.59 | 1.93 | 3.96 | 3.91 | 5.29 | 7.61 | 5.73 | 6.00 |
| δCe | 1.07 | 1.04 | 1.09 | 1.18 | 1.28 | 1.23 | 1.03 | 1.07 | 1.09 | 0.95 | 1.00 | 0.95 | 0.93 | 1.02 | 0.85 | 0.88 |
| Li | 4.80 | 4.63 | 5.84 | 2.33 | 3.63 | 4.41 | 3.83 | 35.58 | 30.02 | 17.38 | 12.2 | 11.7 | 12.7 | 14.8 | 19.57 | 25.70 |
| Sc | 1.93 | 1.93 | 4.16 | 2.72 | 3.37 | 3.36 | 4.35 | 2.70 | 3.41 | 1.20 | 2.57 | 1.54 | 2.33 | 2.33 | 0.63 | 0.83 |
| Ti | 1013 | 1034 | 1704 | 1105 | 1400 | 1418 | 2128 | 1804 | 1607 | 384 | 779.15 | 371.60 | 779.15 | 719.22 | 251 | 266 |
| V | 1.11 | 1.11 | 2.18 | 1.12 | 1.34 | 1.19 | 3.79 | 2.44 | 3.07 | 5.48 | 7.42 | 7.15 | 9.58 | 7.48 | 1.88 | 1.65 |
| Cr | - | - | - | 0.75 | 1.72 | 0.67 | 2.01 | - | - | 3.54 | 10.10 | 10.40 | 12.40 | 13.70 | - | - |
| Co | 0.42 | 0.43 | 0.92 | 0.71 | 0.71 | 0.74 | 1.20 | 1.16 | 1.47 | 1.07 | 2.15 | 2.05 | 2.60 | 2.14 | 0.67 | 0.73 |
| Ni | 0.67 | 0.66 | 2.40 | 2.14 | 1.21 | 0.57 | 0.91 | 0.46 | 0.54 | 0.68 | 3.52 | 3.45 | 3.06 | 2.57 | 1.23 | 1.70 |
| Ga | 22.92 | 23.36 | 26.22 | 18.78 | 20.54 | 18.14 | 18.48 | 15.58 | 15.78 | 19.21 | 14.1 | 13.0 | 13.6 | 14.1 | 14.48 | 14.95 |
| Rb | 141 | 147 | 145 | 134 | 118 | 128 | 113 | 149 | 130 | 171 | 65.1 | 59.0 | 59.5 | 59.3 | 72 | 65 |
| Sr | 65 | 66 | 90 | 115 | 115 | 162 | 131 | 246 | 219 | 330 | 593 | 605 | 625 | 625 | 647 | 700 |
| Zr | 232 | 236 | 384 | 302 | 292 | 329 | 379 | 386 | 455 | 61 | 91.0 | 83.5 | 114 | 84.5 | 96 | 95 |
| Nb | 41.06 | 42.02 | 44.92 | 14.66 | 18.05 | 17.07 | 10.19 | 17.25 | 17.45 | 6.37 | 5.13 | 4.56 | 4.45 | 4.84 | 1.52 | 2.19 |
| Ba | 757 | 769 | 1020 | 1074 | 1106 | 1262 | 1606 | 2167 | 2010 | 1639 | 2159 | 2193 | 2527 | 2322 | 686 | 617 |
| Hf | 5.14 | 5.29 | 7.32 | 7.12 | 6.75 | 7.74 | 8.83 | 7.28 | 8.18 | 1.63 | 4.18 | 3.51 | 4.71 | 3.64 | 2.24 | 2.27 |
| Ta | 1.37 | 1.47 | 1.40 | 0.90 | 1.14 | 1.17 | 0.64 | 0.82 | 0.57 | 0.37 | 0.58 | 0.25 | 0.15 | 0.24 | 0.10 | 0.14 |
| Th | 19.14 | 19.80 | 14.16 | 10.60 | 11.23 | 9.64 | 6.46 | 23.71 | 19.46 | 5.47 | 2.00 | 1.09 | 0.95 | 0.78 | 0.14 | 0.14 |
| U | 2.64 | 2.72 | 2.58 | 1.40 | 1.03 | 1.00 | 0.67 | 3.70 | 3.04 | 1.36 | 0.64 | 0.51 | 0.29 | 0.32 | 0.42 | 0.44 |
| Sr/Y | 1.38 | 1.37 | 1.73 | 3.65 | 3.15 | 4.40 | 5.62 | 12.42 | 10.93 | 116.02 | 147.51 | 154.34 | 171.70 | 187.69 | 369.40 | 278.29 |
| Tzr (℃) | 819 | 821 | 863 | 840 | 829 | 838 | 864 | 879 | 896 | 705 | 737 | 725 | 751 | 731 | 750 | 746 |

**Major elements are reported in wt.%, trace and REE concentrations are reported in ppm. (La/Yb)N = (La/0.687)/(Yb/0.493). EuN/EuN\* = 2\*(Eu/0.168)/((Sm/0.444) + (Gd/0.596)); CeN/CeN\* = 2\*(Ce/1.775)/((La/0.687) + (Pr/0.276)).** **Tzr (℃) =12900/[2.95+0.85M+ln(496000/Zrmelt)]；M=(Na+K+2Ca)/(Al\*Si) cation ration**