|  |
| --- |
| **Table 1** |
| Geochemical composition of the Permian-Triassic sedimentary rocks from the Ailaoshan suture zone | | | | | | | |  |  |  |
| **Samples** | **13YZ15D** | **13YZ15E** | **13YZ15F** | **13YZ17B** | **13YZ17C** | **13YZ17F** | **13YZ25A** | **13YZ25B** | **13YZ25C** | **13YZ27B** |
| **Age** | **Late Permian** | **Late Permian** | **Late Permian** | **Early Permian** | **Early Permian** | **Early**  **Permian** | **Late Permian** | **Late Permian** | **Late Permian** | **Late Permian** |
| **Formation** | **Longtan** | **Longtan** | **Longtan** | **Maokou** | **Maokou** | **Maokou** | **Longtan** | **Longtan** | **Longtan** | **Longtan** |
| **Lithology** | **Siltstone** | **Sandstone** | **Sandstone** | **Arkose** | **Siltstone** | **Siltstone** | **Greywacke** | **Greywacke** | **Greywacke** | **Arkose** |
| SiO2 | 62.06 | 70.52 | 71.90 | 73.83 | 73.92 | 60.63 | 67.95 | 62.96 | 67.67 | 71.77 |
| TiO2 | 0.70 | 0.46 | 0.46 | 0.55 | 0.49 | 0.86 | 0.42 | 0.58 | 0.43 | 0.70 |
| Al2O3 | 17.16 | 12.24 | 12.09 | 11.95 | 11.82 | 18.98 | 12.82 | 15.36 | 13.09 | 12.41 |
| Fe2O3T | 6.56 | 4.72 | 4.55 | 3.34 | 3.44 | 6.70 | 4.58 | 5.96 | 4.72 | 5.31 |
| MnO | 0.03 | 0.03 | 0.04 | 0.02 | 0.02 | 0.02 | 0.11 | 0.10 | 0.11 | 0.08 |
| MgO | 2.43 | 1.47 | 1.65 | 1.41 | 1.59 | 2.03 | 1.97 | 2.96 | 2.02 | 0.74 |
| CaO | 0.01 | 0.09 | 0.11 | 0.03 | 0.11 | 0.16 | 1.22 | 1.36 | 1.15 | 0.02 |
| Na2O | 5.34 | 6.40 | 5.26 | 4.86 | 4.79 | 2.37 | 6.17 | 4.88 | 6.43 | 2.88 |
| K2O | 2.09 | 1.20 | 1.12 | 1.01 | 0.90 | 2.66 | 2.05 | 2.94 | 2.08 | 1.44 |
| P2O5 | 0.08 | 0.13 | 0.14 | 0.06 | 0.06 | 0.12 | 0.07 | 0.09 | 0.07 | 0.06 |
| L.O.I | 3.27 | 2.22 | 2.09 | 2.26 | 2.36 | 5.02 | 2.24 | 2.86 | 2.17 | 4.63 |
| Total | 99.73 | 99.48 | 99.41 | 99.31 | 99.48 | 99.54 | 99.60 | 100.05 | 99.94 | 100.04 |
| Sc | 14.16 | 10.70 | 10.19 | 9.39 | 8.78 | 20.25 | 16.41 | 21.75 | 16.52 | 7.11 |
| Ti | 4212 | 2715 | 2555 | 3235 | 2824 | 5274 | 2270 | 3454 | 2582 | 1055 |
| V | 99.82 | 46.59 | 44.27 | 62.26 | 63.86 | 133.80 | 39.96 | 67.05 | 39.31 | 47.16 |
| Cr | 67.29 | 35.00 | 31.49 | 46.23 | 32.69 | 91.12 | 5.24 | 6.64 | 5.55 | 43.72 |
| Mn | 231 | 225 | 304 | 98 | 98 | 145 | 776 | 760 | 782 | 540 |
| Co | 8.48 | 7.27 | 5.91 | 7.42 | 7.86 | 8.07 | 4.32 | 6.95 | 4.35 | 15.03 |
| Ni | 29.32 | 15.21 | 12.60 | 17.32 | 16.79 | 41.10 | 2.69 | 3.82 | 2.78 | 17.82 |
| **Table 1** *(Table continued)* | | | | | | | | | | |
| **Samples** | **13YZ15D** | **13YZ15E** | **13YZ15F** | **13YZ17B** | **13YZ17C** | **13YZ17F** | **13YZ25A** | **13YZ25B** | **13YZ25C** | **13YZ27B** |
| **Age** | **Late Permian** | **Late Permian** | **Late Permian** | **Early Permian** | **Early Permian** | **Early**  **Permian** | **Late Permian** | **Late Permian** | **Late Permian** | **Late Permian** |
| **Formation** | **Longtan** | **Longtan** | **Longtan** | **Maokou** | **Maokou** | **Maokou** | **Longtan** | **Longtan** | **Longtan** | **Longtan** |
| **Lithology** | **Siltstone** | **Sandstone** | **Sandstone** | **Arkose** | **Siltstone** | **Siltstone** | **Greywacke** | **Greywacke** | **Greywacke** | **Arkose** |
| Cu | 7.36 | 12.79 | 11.26 | 2.71 | 2.53 | 50.38 | 8.28 | 11.10 | 5.59 | 13.72 |
| Zn | 47.28 | 49.55 | 38.18 | 47.54 | 50.51 | 84.29 | 86.49 | 104.00 | 85.53 | 184.50 |
| Ga | 24.79 | 15.47 | 14.99 | 13.89 | 13.92 | 25.13 | 16.14 | 20.42 | 16.55 | 14.07 |
| Ge | 2.85 | 2.03 | 2.01 | 2.05 | 1.93 | 3.14 | 1.60 | 2.51 | 1.66 | 1.57 |
| Rb | 91.12 | 51.90 | 46.92 | 61.42 | 55.07 | 162.80 | 28.94 | 46.12 | 29.64 | 31.86 |
| Sr | 48.78 | 44.40 | 42.03 | 90.26 | 82.94 | 129.00 | 51.13 | 182.50 | 51.97 | 34.79 |
| Y | 33.51 | 40.68 | 45.01 | 19.36 | 11.47 | 35.37 | 43.23 | 47.70 | 42.81 | 6.69 |
| Zr | 294.80 | 222.10 | 223.60 | 186.50 | 41.70 | 149.30 | 156.90 | 141.40 | 157.80 | 166.30 |
| Nb | 21.10 | 10.92 | 10.43 | 8.65 | 7.79 | 15.92 | 4.21 | 3.93 | 4.35 | 1.16 |
| Cs | 3.69 | 2.71 | 2.31 | 11.92 | 9.66 | 28.79 | 0.72 | 1.63 | 0.76 | 3.59 |
| Ba | 304 | 191 | 178 | 204 | 188 | 411 | 257 | 359 | 245 | 255 |
| La | 48.60 | 26.67 | 26.20 | 26.41 | 25.50 | 44.84 | 10.47 | 12.51 | 11.05 | 12.78 |
| Ce | 104.00 | 54.47 | 52.75 | 50.96 | 49.78 | 87.56 | 21.55 | 25.14 | 23.60 | 24.09 |
| Pr | 11.43 | 6.62 | 6.57 | 5.71 | 5.53 | 10.35 | 3.59 | 3.83 | 3.89 | 2.89 |
| Nd | 41.89 | 26.53 | 25.99 | 21.02 | 19.77 | 38.40 | 16.69 | 17.65 | 17.45 | 10.71 |
| Sm | 8.53 | 6.14 | 6.11 | 3.76 | 3.39 | 7.95 | 4.95 | 5.23 | 5.25 | 2.00 |
| Eu | 1.36 | 1.14 | 1.15 | 0.71 | 0.58 | 1.39 | 1.14 | 1.70 | 1.25 | 0.43 |
| Gd | 7.21 | 6.06 | 6.20 | 3.40 | 2.36 | 6.92 | 5.58 | 5.90 | 6.07 | 1.49 |
| Tb | 0.99 | 1.08 | 1.13 | 0.50 | 0.31 | 1.05 | 1.10 | 1.14 | 1.24 | 0.20 |
| Dy | 5.92 | 7.16 | 7.57 | 3.10 | 1.90 | 6.44 | 7.78 | 7.69 | 8.41 | 1.18 |
| **Table 1** *(Table continued)* | | | | | | | | | | |
| **Samples** | **13YZ15D** | **13YZ15E** | **13YZ15F** | **13YZ17B** | **13YZ17C** | **13YZ17F** | **13YZ25A** | **13YZ25B** | **13YZ25C** | **13YZ27B** |
| **Age** | **Late Permian** | **Late Permian** | **Late Permian** | **Early Permian** | **Early Permian** | **Early**  **Permian** | **Late Permian** | **Late Permian** | **Late Permian** | **Late Permian** |
| **Formation** | **Longtan** | **Longtan** | **Longtan** | **Maokou** | **Maokou** | **Maokou** | **Longtan** | **Longtan** | **Longtan** | **Longtan** |
| **Lithology** | **Siltstone** | **Sandstone** | **Sandstone** | **Arkose** | **Siltstone** | **Siltstone** | **Greywacke** | **Greywacke** | **Greywacke** | **Arkose** |
| Ho | 1.29 | 1.65 | 1.70 | 0.71 | 0.42 | 1.35 | 1.79 | 1.80 | 1.86 | 0.25 |
| Er | 3.81 | 4.77 | 4.91 | 2.07 | 1.23 | 3.75 | 5.08 | 5.13 | 5.80 | 0.71 |
| Tm | 0.63 | 0.76 | 0.75 | 0.34 | 0.19 | 0.58 | 0.80 | 0.81 | 0.88 | 0.11 |
| Yb | 4.28 | 4.94 | 4.92 | 2.16 | 1.31 | 3.73 | 5.38 | 5.38 | 6.01 | 0.76 |
| Lu | 0.72 | 0.78 | 0.77 | 0.36 | 0.21 | 0.60 | 0.88 | 0.88 | 0.95 | 0.12 |
| Hf | 8.03 | 6.63 | 6.44 | 5.34 | 1.39 | 4.49 | 5.04 | 4.25 | 5.39 | 4.69 |
| Ta | 1.82 | 0.95 | 0.91 | 0.80 | 0.73 | 1.38 | 0.31 | 0.27 | 0.33 | 0.07 |
| Pb | 1.82 | 4.08 | 3.14 | 4.91 | 4.34 | 23.50 | 1.78 | 2.89 | 1.76 | 9.07 |
| Th | 22.83 | 15.38 | 14.38 | 12.69 | 9.78 | 19.79 | 2.77 | 2.12 | 2.95 | 2.60 |
| U | 4.41 | 3.37 | 3.17 | 2.71 | 1.84 | 3.30 | 1.38 | 1.19 | 1.54 | 1.84 |
| CIA | 61 | 51 | 55 | 57 | 57 | 73 | 47 | 53 | 47 | 66 |
| ICV | 1.00 | 1.17 | 1.09 | 0.94 | 0.96 | 0.78 | 1.28 | 1.22 | 1.29 | 0.89 |
| WIP | 76 | 75 | 64 | 59 | 58 | 53 | 85 | 84 | 87 | 43 |
| (La/Yb)N | 8.14 | 3.87 | 3.82 | 8.77 | 13.98 | 8.62 | 1.40 | 1.67 | 1.32 | 12.00 |
| Eu/Eu\* | 0.53 | 0.57 | 0.57 | 0.60 | 0.63 | 0.57 | 0.66 | 0.93 | 0.68 | 0.76 |
| **Samples** | **13YZ27C** | **AW12** | **13YZ06B** | **13YZ06C** | **AW14** | **AW15** | **AW16** | **AW17** | **AW18** | **AW19** |
| **Age** | **Late**  **Permian** | **Late**  **Permian** | **Middle Middle**  **Triassic Triassic** | | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** |
| **Formation** | **Longtan** | **Undivided** | **Undivided Undivided** | | **Undivided** | **Undivided** | **Undivided** | **Undivided** | **Undivided** | **Undivided** |
| **Lithology** | **Greywacke** | **Siltstone** | **Arkose** | **Siltstone** | **Greywacke** | **Metasandstone** | **Metasandstone** | **Metasiltstone** | **Metasandstone** | **Siltstone** |
| SiO2 | 73.94 | 70.24 | 72.86 | 85.53 | 81.55 | 78.56 | 65.97 | 72.48 | 70.52 | 63.47 |
| TiO2 | 0.72 | 0.64 | 0.67 | 0.43 | 0.56 | 0.70 | 0.83 | 0.51 | 0.59 | 0.84 |
| Al2O3 | 12.63 | 12.75 | 12.57 | 6.14 | 8.15 | 9.26 | 14.81 | 13.19 | 12.56 | 19.23 |
| Fe2O3T | 3.34 | 6.13 | 5.08 | 3.17 | 3.73 | 3.82 | 6.51 | 3.60 | 3.80 | 5.04 |
| MnO | 0.04 | 0.06 | 0.07 | 0.06 | 0.04 | 0.04 | 0.10 | 0.03 | 0.04 | 0.05 |
| MgO | 0.55 | 2.50 | 0.73 | 0.42 | 1.19 | 1.49 | 2.38 | 0.64 | 1.02 | 1.59 |
| CaO | 0.01 | 0.01 | 0.06 | 0.01 | 0.01 | 0.01 | 0.24 | 0.05 | 0.86 | 0.06 |
| Na2O | 2.81 | 0.88 | 0.57 | 1.20 | 0.13 | 1.12 | 3.39 | 1.92 | 2.30 | 0.30 |
| K2O | 1.48 | 2.77 | 3.63 | 1.01 | 1.20 | 1.75 | 2.11 | 5.26 | 5.72 | 4.77 |
| P2O5 | 0.07 | 0.10 | 0.15 | 0.06 | 0.05 | 0.07 | 0.16 | 0.12 | 0.14 | 0.14 |
| L.O.I | 3.77 | 3.34 | 3.24 | 1.94 | 3.42 | 2.77 | 3.12 | 2.12 | 2.03 | 4.16 |
| Total | 99.33 | 99.37 | 99.62 | 99.91 | 99.90 | 99.47 | 99.63 | 99.93 | 99.57 | 99.65 |
| Sc | 14.21 | 13.19 | 13.24 | 4.31 | 4.36 | 10.37 | 15.86 | 7.05 | 10.36 | 18.60 |
| Ti | 4165 | 2365 | 4139 | 2428 | 1455 | 4042 | 4803 | 1860 | 3619 | 5167 |
| V | 112.40 | 80.03 | 74.18 | 35.57 | 33.58 | 70.07 | 105.70 | 20.88 | 50.70 | 124.50 |
| Cr | 55.87 | 72.33 | 47.03 | 30.43 | 98.82 | 95.43 | 62.53 | 14.18 | 27.12 | 101.50 |
| Mn | 289 | 417 | 536 | 417 | 210 | 279 | 728 | 182 | 321 | 373 |
| Co | 10.23 | 17.82 | 8.86 | 6.66 | 4.36 | 12.71 | 11.83 | 3.57 | 7.00 | 16.08 |
| Ni | 12.07 | 47.33 | 27.99 | 20.23 | 73.49 | 42.07 | 32.41 | 6.42 | 11.83 | 46.39 |
| Cu | 13.72 | 44.60 | 12.88 | 10.38 | 10.98 | 18.08 | 23.68 | 18.67 | 7.14 | 44.90 |
| Zn | 100.60 | 125.40 | 57.33 | 40.27 | 33.91 | 72.83 | 54.35 | 43.21 | 66.72 | 75.52 |
| Ga | 14.97 | 17.28 | 15.81 | 6.02 | 5.15 | 11.26 | 18.25 | 20.37 | 16.64 | 25.77 |
| Ge | 2.37 | 2.58 | 2.78 | 1.72 | 1.68 | 2.11 | 2.57 | 2.18 | 2.23 | 2.76 |
| Rb | 63.87 | 124.00 | 280.80 | 67.03 | 36.84 | 80.46 | 115.70 | 253.60 | 269.10 | 280.30 |
| Sr | 82.51 | 13.02 | 47.88 | 25.76 | 34.50 | 13.92 | 62.31 | 47.74 | 84.39 | 32.91 |
| **Table 1** *(Table continued)* | | | | | | | | | | |
| **Samples** | **13YZ27C** | **AW12** | **13YZ06B** | **13YZ06C** | **AW14** | **AW15** | **AW16** | **AW17** | **AW18** | **AW19** |
| **Age** | **Late**  **Permian** | **Late**  **Permian** | **Middle Middle**  **Triassic Triassic** | | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** |
| **Formation** | **Longtan** | **Undivided** | **Undivided Undivided** | | **Undivided** | **Undivided** | **Undivided** | **Undivided** | **Undivided** | **Undivided** |
| **Lithology** | **Greywacke** | **Siltstone** | **Arkose** | **Siltstone** | **Greywacke** | **Metasandstone** | **Metasandstone** | **Metasiltstone** | **Metasandstone** | **Siltstone** |
| Y | 19.51 | 25.98 | 33.73 | 17.73 | 14.00 | 21.05 | 35.86 | 38.19 | 37.93 | 41.83 |
| Zr | 170.80 | 151.50 | 183.70 | 261.50 | 163.60 | 323.10 | 201.00 | 173.10 | 194.10 | 210.50 |
| Nb | 8.08 | 7.97 | 12.55 | 8.49 | 5.05 | 12.83 | 11.74 | 8.26 | 14.16 | 18.69 |
| Cs | 3.96 | 6.07 | 53.64 | 15.26 | 1.56 | 4.10 | 3.90 | 5.79 | 6.93 | 13.20 |
| Ba | 293 | 589 | 259 | 159 | 108 | 431 | 274 | 623 | 846 | 854 |
| La | 27.83 | 35.87 | 35.01 | 27.67 | 16.42 | 31.84 | 29.47 | 44.08 | 44.73 | 57.11 |
| Ce | 53.51 | 75.05 | 70.62 | 57.36 | 27.89 | 51.91 | 51.23 | 78.45 | 89.81 | 111.00 |
| Pr | 6.63 | 8.42 | 8.67 | 6.93 | 3.91 | 7.54 | 7.38 | 10.96 | 10.19 | 13.00 |
| Nd | 24.80 | 31.23 | 33.50 | 26.33 | 14.98 | 25.70 | 28.05 | 41.14 | 37.13 | 47.64 |
| Sm | 4.89 | 6.21 | 7.10 | 4.94 | 3.12 | 5.26 | 6.31 | 8.96 | 7.62 | 9.46 |
| Eu | 1.08 | 1.19 | 1.29 | 0.83 | 0.67 | 0.95 | 1.04 | 0.98 | 1.10 | 1.49 |
| Gd | 4.10 | 5.77 | 6.69 | 4.34 | 2.97 | 4.73 | 6.01 | 8.09 | 6.80 | 8.13 |
| Tb | 0.60 | 0.81 | 0.98 | 0.61 | 0.43 | 0.66 | 0.98 | 1.21 | 1.10 | 1.23 |
| Dy | 3.66 | 4.93 | 5.92 | 3.37 | 2.56 | 4.04 | 6.31 | 7.31 | 6.72 | 7.57 |
| Ho | 0.76 | 1.01 | 1.25 | 0.65 | 0.54 | 0.87 | 1.35 | 1.55 | 1.42 | 1.59 |
| Er | 2.07 | 2.85 | 3.44 | 1.74 | 1.48 | 2.49 | 3.87 | 4.19 | 3.87 | 4.38 |
| Tm | 0.32 | 0.43 | 0.53 | 0.26 | 0.22 | 0.40 | 0.58 | 0.62 | 0.58 | 0.66 |
| Yb | 2.02 | 2.74 | 3.29 | 1.67 | 1.42 | 2.67 | 3.79 | 3.75 | 3.58 | 4.20 |
| Lu | 0.32 | 0.44 | 0.53 | 0.27 | 0.22 | 0.44 | 0.59 | 0.56 | 0.56 | 0.67 |
| Hf | 4.87 | 4.42 | 4.89 | 7.16 | 4.59 | 8.92 | 5.35 | 4.77 | 5.55 | 5.95 |
| **Table 1** *(Table continued)* | | | | | | | | | | |
| **Samples** | **13YZ27C** | **AW12** | **13YZ06B** | **13YZ06C** | **AW14** | **AW15** | **AW16** | **AW17** | **AW18** | **AW19** |
| **Age** | **Late**  **Permian** | **Late**  **Permian** | **Middle Middle**  **Triassic Triassic** | | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** | **Middle Triassic** |
| **Formation** | **Longtan** | **Undivided** | **Undivided Undivided** | | **Undivided** | **Undivided** | **Undivided** | **Undivided** | **Undivided** | **Undivided** |
| **Lithology** | **Greywacke** | **Siltstone** | **Arkose** | **Siltstone** | **Greywacke** | **Metasandstone** | **Metasandstone** | **Metasiltstone** | **Metasandstone** | **Siltstone** |
| Ta | 0.64 | 0.55 | 0.99 | 0.64 | 0.43 | 1.12 | 0.92 | 0.67 | 1.24 | 1.58 |
| Pb | 17.87 | 14.32 | 6.72 | 3.93 | 6.93 | 18.29 | 4.48 | 13.33 | 35.39 | 26.05 |
| Th | 8.82 | 14.11 | 13.64 | 9.87 | 6.46 | 27.93 | 11.51 | 22.50 | 25.72 | 25.68 |
| U | 2.47 | 2.82 | 3.12 | 2.88 | 1.53 | 4.60 | 2.57 | 4.53 | 5.50 | 5.63 |
| CIA | 67 | 74 | 72 | 67 | 84 | 71 | 64 | 60 | 52 | 77 |
| ICV | 0.70 | 1.01 | 0.85 | 1.02 | 0.84 | 0.96 | 1.04 | 0.91 | 1.14 | 0.66 |
| WIP | 42 | 40 | 39 | 21 | 15 | 30 | 58 | 65 | 76 | 50 |
| (La/Yb)N | 9.88 | 9.39 | 7.63 | 11.86 | 8.32 | 8.55 | 5.57 | 8.44 | 8.97 | 9.77 |
| Eu/Eu\* | 0.74 | 0.61 | 0.57 | 0.55 | 0.67 | 0.58 | 0.51 | 0.35 | 0.47 | 0.52 |
| **Samples** | **AW20** | **CLX40** | **CLX41** | **CLX51** | **CLX52** | **CLX53** | **CLX54** | **CLX60** | **CLX75** |  |
| **Age** | **Middle**  **Triassic** | **Late Late**  **Triassic Triassic** | | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** |  |
| **Formation** | **Undivided** | **Undivided Undivided** | | **Gaoshanzhai** | **Gaoshanzhai** | **Gaoshanzhai** | **Gaoshanzhai** | **Zhama** | **Luma** |  |
| **Lithology** | **Mudstone** | **Sandstone** | **Sandstone** | **Sandstone** | **Siltstone** | **Siltstone** | **Sandstone** | **Sandstone** | **Sandstone** |  |
| SiO2 | 78.67 | 72.27 | 77.65 | 82.81 | 72.36 | 75.24 | 83.20 | 90.29 | 81.00 |  |
| TiO2 | 0.31 | 0.78 | 0.80 | 0.29 | 0.78 | 0.63 | 0.40 | 0.26 | 0.27 |  |
| Al2O3 | 12.42 | 12.57 | 10.79 | 6.70 | 12.57 | 12.10 | 8.27 | 4.70 | 9.55 |  |
| Fe2O3T | 1.85 | 6.46 | 4.29 | 5.13 | 5.89 | 4.74 | 2.59 | 1.22 | 3.11 |  |
| MnO | 0.01 | 0.02 | 0.05 | 0.06 | 0.03 | 0.02 | 0.02 | 0.22 | 0.01 |  |
| MgO | 0.49 | 1.63 | 0.73 | 0.92 | 1.65 | 1.01 | 0.61 | 0.11 | 0.61 |  |
| **Table 1** *(Table continued)* | | | | | | | | | | |
| **Samples** | **AW20** | **CLX40** | **CLX41** | **CLX51** | **CLX52** | **CLX53** | **CLX54** | **CLX60** | **CLX75** |  |
| **Age** | **Middle**  **Triassic** | **Late Late**  **Triassic Triassic** | | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** |  |
| **Formation** | **Undivided** | **Undivided Undivided** | | **Gaoshanzhai** | **Gaoshanzhai** | **Gaoshanzhai** | **Gaoshanzhai** | **Zhama** | **Luma** |  |
| **Lithology** | **Mudstone** | **Sandstone** | **Sandstone** | **Sandstone** | **Siltstone** | **Siltstone** | **Sandstone** | **Sandstone** | **Sandstone** |  |
| CaO | 0.01 | 0.09 | 0.16 | 0.07 | 0.04 | 0.07 | 0.09 | 0.11 | 0.09 |  |
| Na2O | 0.21 | 0.18 | 0.39 | 0.10 | 0.57 | 0.11 | 0.25 | 0.33 | 0.31 |  |
| K2O | 3.33 | 2.75 | 2.20 | 0.97 | 2.56 | 2.23 | 1.85 | 0.40 | 1.36 |  |
| P2O5 | 0.09 | 0.05 | 0.12 | 0.04 | 0.11 | 0.02 | 0.06 | 0.03 | 0.04 |  |
| L.O.I | 2.39 | 2.55 | 2.33 | 2.44 | 2.81 | 3.49 | 2.01 | 1.84 | 3.27 |  |
| Total | 99.72 | 99.36 | 99.52 | 99.43 | 99.36 | 99.65 | 99.34 | 99.50 | 99.61 |  |
| Sc | 3.33 | 11.63 | 12.08 | 5.12 | 11.29 | 10.58 | 6.35 | 2.76 | 5.77 |  |
| Ti | 1206 | 4332 | 4872 | 1423 | 4192 | 3645 | 1961 | 1256 | 1560 |  |
| V | 5.37 | 100.80 | 85.89 | 70.69 | 77.96 | 74.32 | 45.45 | 32.42 | 39.61 |  |
| Cr | 2.07 | 187.90 | 169.00 | 69.16 | 78.59 | 73.62 | 26.76 | 22.05 | 30.54 |  |
| Mn | 49 | 193 | 437 | 437 | 223 | 109 | 166 | 1450 | 86 |  |
| Co | 1.27 | 15.16 | 13.89 | 9.06 | 8.78 | 4.18 | 4.87 | 4.43 | 7.80 |  |
| Ni | 4.55 | 111.60 | 73.13 | 24.26 | 31.15 | 56.04 | 10.45 | 14.31 | 21.11 |  |
| Cu | 4.81 | 2.04 | 5.15 | 68.17 | 10.60 | 12.50 | 0.76 | 13.12 | 0.56 |  |
| Zn | 44.09 | 67.45 | 67.06 | 51.16 | 67.82 | 95.02 | 25.73 | 12.29 | 39.43 |  |
| Ga | 12.46 | 16.69 | 13.92 | 8.05 | 16.83 | 15.37 | 8.84 | 4.69 | 11.36 |  |
| Ge | 1.28 | 1.78 | 1.72 | 1.64 | 1.75 | 1.74 | 1.29 | 1.25 | 1.41 |  |
| Rb | 152.70 | 148.40 | 122.40 | 57.87 | 124.40 | 113.60 | 87.69 | 17.34 | 49.51 |  |
| Sr | 15.43 | 35.46 | 78.32 | 8.25 | 27.33 | 11.92 | 11.12 | 55.53 | 29.68 |  |
| Y | 41.82 | 29.26 | 32.98 | 14.64 | 30.80 | 24.61 | 17.70 | 7.72 | 15.66 |  |
| **Table 1** *(Table continued)* | | | | | | | | | | |
| **Samples** | **AW20** | **CLX40** | **CLX41** | **CLX51** | **CLX52** | **CLX53** | **CLX54** | **CLX60** | **CLX75** |  |
| **Age** | **Middle**  **Triassic** | **Late Late**  **Triassic Triassic** | | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** | **Late**  **Triassic** |  |
| **Formation** | **Undivided** | **Undivided Undivided** | | **Gaoshanzhai** | **Gaoshanzhai** | **Gaoshanzhai** | **Gaoshanzhai** | **Zhama** | **Luma** |  |
| **Lithology** | **Mudstone** | **Sandstone** | **Sandstone** | **Sandstone** | **Siltstone** | **Siltstone** | **Sandstone** | **Sandstone** | **Sandstone** |  |
| Zr | 133.40 | 163.40 | 246.30 | 77.07 | 210.90 | 168.00 | 91.57 | 132.80 | 89.19 |  |
| Nb | 8.63 | 15.18 | 15.69 | 4.43 | 16.27 | 14.17 | 5.28 | 4.74 | 6.36 |  |
| Cs | 3.24 | 9.46 | 8.97 | 3.49 | 5.88 | 6.73 | 5.22 | 1.09 | 3.04 |  |
| Ba | 459 | 450 | 423 | 171 | 345 | 426 | 326 | 121 | 272 |  |
| La | 21.35 | 37.23 | 39.50 | 20.93 | 43.97 | 36.88 | 14.35 | 16.02 | 25.25 |  |
| Ce | 41.24 | 73.63 | 79.34 | 39.60 | 86.58 | 73.82 | 28.74 | 31.15 | 49.46 |  |
| Pr | 5.85 | 9.20 | 9.60 | 4.49 | 10.18 | 8.65 | 3.54 | 3.70 | 5.80 |  |
| Nd | 22.73 | 35.02 | 35.17 | 15.98 | 35.93 | 30.56 | 13.47 | 13.40 | 21.59 |  |
| Sm | 6.10 | 7.03 | 6.65 | 2.87 | 6.50 | 5.76 | 2.87 | 2.55 | 3.90 |  |
| Eu | 0.55 | 1.23 | 1.18 | 0.56 | 1.16 | 1.05 | 0.68 | 0.52 | 0.82 |  |
| Gd | 6.98 | 6.24 | 5.74 | 2.54 | 5.48 | 4.68 | 2.90 | 2.10 | 3.25 |  |
| Tb | 1.29 | 0.94 | 0.93 | 0.40 | 0.89 | 0.75 | 0.48 | 0.31 | 0.49 |  |
| Dy | 8.21 | 5.59 | 5.88 | 2.54 | 5.58 | 4.46 | 3.13 | 1.78 | 2.92 |  |
| Ho | 1.67 | 1.12 | 1.23 | 0.54 | 1.15 | 0.95 | 0.67 | 0.33 | 0.58 |  |
| Er | 4.50 | 2.93 | 3.25 | 1.52 | 3.13 | 2.53 | 1.77 | 0.88 | 1.53 |  |
| Tm | 0.63 | 0.42 | 0.49 | 0.23 | 0.47 | 0.38 | 0.27 | 0.13 | 0.22 |  |
| Yb | 3.81 | 2.85 | 3.35 | 1.61 | 3.19 | 2.53 | 1.78 | 0.90 | 1.54 |  |
| Lu | 0.53 | 0.43 | 0.49 | 0.24 | 0.48 | 0.37 | 0.27 | 0.14 | 0.22 |  |
| Hf | 4.32 | 4.54 | 6.90 | 2.04 | 5.83 | 4.70 | 2.57 | 3.72 | 2.53 |  |
| Ta | 0.86 | 1.28 | 1.27 | 0.40 | 1.41 | 1.18 | 0.44 | 0.40 | 0.47 |  |
| Pb | 12.76 | 9.84 | 10.00 | 1.49 | 7.38 | 13.16 | 1.35 | 9.28 | 18.42 |  |
| Th | 23.57 | 14.20 | 15.78 | 5.28 | 19.28 | 17.49 | 5.66 | 5.41 | 6.02 |  |
| U | 5.58 | 3.23 | 3.47 | 1.31 | 3.78 | 2.80 | 1.51 | 1.82 | 1.30 |  |
| CIA | 76 | 79 | 78 | 84 | 78 | 82 | 77 | 81 | 82 |  |
| ICV | 0.50 | 0.95 | 0.80 | 1.12 | 0.91 | 0.73 | 0.70 | 0.52 | 0.60 |  |
| WIP | 32 | 30 | 25 | 12 | 32 | 24 | 20 | 7 | 17 |  |
| (La/Yb)N | 4.02 | 9.38 | 8.45 | 9.35 | 9.90 | 10.44 | 5.80 | 12.82 | 11.74 |  |
| Eu/Eu\* | 0.26 | 0.57 | 0.58 | 0.63 | 0.60 | 0.62 | 0.72 | 0.68 | 0.70 |  |

Eu/Eu\* =2×EuN/(SmN+GdN). (La/Yb)N calculations were chondrite-normalized