



Geochemistry and Geochronology of Southern Norilsk Intrusions, SW Siberian Traps

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Table S1. Bulk compositions of igneous rocks within the Turumakit area.

| № | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------------------------------|----------|--------|----------|---------|---------|-----------|---------|
| № Sample | BT1-38.5 | BT1-70 | BT1-85.6 | BT1-111 | BT1-114 | BT1-187.3 | BT1-191 |
| SiO ₂ | 51.09 | 50.97 | 50.96 | 52.41 | 50.90 | 47.05 | 50.38 |
| TiO ₂ | 3.45 | 3.42 | 3.43 | 2.50 | 2.60 | 4.51 | 3.16 |
| Al ₂ O ₃ | 13.76 | 13.57 | 13.46 | 14.42 | 14.48 | 13.10 | 13.38 |
| FeO | 13.59 | 14.35 | 14.27 | 13.54 | 13.63 | 16.72 | 15.47 |
| MnO | 0.22 | 0.23 | 0.22 | 0.24 | 0.25 | 0.26 | 0.24 |
| MgO | 3.84 | 3.67 | 3.54 | 2.93 | 4.04 | 4.81 | 4.03 |
| CaO | 7.61 | 6.93 | 7.53 | 7.41 | 8.65 | 8.21 | 7.49 |
| Na ₂ O | 3.11 | 3.29 | 3.31 | 3.29 | 3.27 | 3.15 | 3.62 |
| K ₂ O | 2.37 | 2.54 | 2.06 | 2.36 | 1.56 | 1.63 | 1.87 |
| P ₂ O ₅ | 0.73 | 0.67 | 0.66 | 0.83 | 0.69 | 0.64 | 0.69 |
| LOI | 1.03 | 0.97 | 1.25 | 0.87 | 0.73 | 0.89 | 0.56 |
| Total | 99.75 | 99.65 | 99.43 | 99.92 | 100.08 | 100.09 | 100.34 |
| Sc | 31.4 | 29.8 | 33.9 | 29.8 | 31.8 | 36.7 | 30.7 |
| V | 249 | 226 | 242 | 164 | 215 | 266 | 225 |
| Co | 30.9 | 29.8 | 29.8 | 26.3 | 32.2 | 44.4 | 33.2 |
| Cu | 50.4 | 24.1 | 43.0 | 83.0 | 108.9 | 25.3 | 15.4 |
| Ni | 17.6 | 17.8 | 15.8 | 14.7 | 29.2 | 25.3 | 28.6 |
| Zn | 56.9 | 64.5 | 25.2 | 207 | 193 | 300 | 164 |
| Rb | 54.3 | 62.7 | 50.5 | 55.5 | 36.5 | 66.5 | 45.4 |
| Y | 44.1 | 44.3 | 50.2 | 52.2 | 40.4 | 45.2 | 45.5 |
| Zr | 334 | 307 | 375 | 275 | 241 | 584 | 175 |
| Nb | 22.2 | 24.1 | 24.5 | 24.8 | 20.6 | 36.7 | 21.8 |
| Ba | 666 | 721 | 744 | 786 | 596 | 1159 | 622 |
| La | 41.8 | 44.9 | 48.6 | 48.2 | 38.0 | 35.5 | 40.2 |
| Ce | 81.4 | 87.0 | 92.6 | 96.5 | 76.8 | 71.1 | 85.8 |
| Pr | 10.1 | 10.8 | 11.6 | 12.0 | 9.5 | 9.1 | 10.9 |
| Nd | 47.5 | 50.3 | 54.6 | 57.4 | 44.9 | 41.1 | 47.4 |
| Sr | 1290 | 604 | 595 | 565 | 455 | 541 | 379 |
| Sm | 10.3 | 10.8 | 12.3 | 12.5 | 9.7 | 9.0 | 10.5 |
| Zr | 334 | 307 | 375 | 275 | 241 | 584 | 175 |
| Eu | 2.83 | 3.11 | 3.29 | 3.50 | 2.82 | 3.48 | 2.91 |
| Gd | 9.73 | 9.86 | 11.8 | 11.8 | 9.2 | 9.2 | 10.4 |
| Tb | 1.38 | 1.39 | 1.62 | 1.69 | 1.31 | 1.38 | 1.50 |
| Dy | 9.34 | 9.18 | 10.7 | 11.1 | 8.79 | 8.53 | 8.97 |
| Ho | 1.76 | 1.73 | 2.03 | 2.16 | 1.66 | 1.66 | 1.67 |
| Er | 4.87 | 4.80 | 5.73 | 5.88 | 4.61 | 4.68 | 4.50 |
| Tm | 0.64 | 0.63 | 0.77 | 0.78 | 0.61 | 0.68 | 0.59 |
| Yb | 4.29 | 4.22 | 5.11 | 4.99 | 4.00 | 4.67 | 4.00 |
| Lu | 0.62 | 0.62 | 0.72 | 0.69 | 0.57 | 0.72 | 0.54 |
| Hf | 7.07 | 6.13 | 8.20 | 6.09 | 5.24 | 12.27 | 3.54 |
| Ta | 1.40 | 1.40 | 1.64 | 1.52 | 1.29 | 2.16 | 1.27 |
| Pb | 2.86 | 9.17 | 1.04 | 4.82 | 6.97 | 20.56 | 7.56 |
| Th | 5.08 | 5.58 | 5.76 | 5.12 | 3.28 | 4.62 | 2.47 |
| U | 1.04 | 1.07 | 0.99 | 0.92 | 0.76 | 1.22 | 0.55 |

Table S1. Cont.

| № | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-----------------|---------------|---------------|---------------|----------------|------------------|----------------|----------------|
| № Sample | BT6-78 | BT6-82 | BT6-93 | BT6-102 | BT6-102.6 | BT6-106 | BT6-107 |
| SiO2 | 50.41 | 50.51 | 50.50 | 51.86 | 50.51 | 51.41 | 50.45 |
| TiO2 | 3.27 | 3.48 | 3.24 | 3.31 | 4.47 | 3.46 | 3.48 |
| Al2O3 | 13.56 | 13.75 | 14.06 | 13.56 | 13.08 | 13.59 | 13.61 |
| FeO | 14.41 | 14.72 | 14.01 | 13.25 | 15.09 | 14.05 | 14.00 |
| MnO | 0.24 | 0.24 | 0.18 | 0.18 | 0.24 | 0.21 | 0.24 |
| MgO | 3.75 | 3.80 | 3.88 | 3.11 | 3.68 | 3.41 | 3.58 |
| CaO | 7.47 | 7.68 | 7.41 | 8.03 | 7.67 | 7.71 | 7.81 |
| Na2O | 3.34 | 3.10 | 3.51 | 3.19 | 3.05 | 3.08 | 3.19 |
| K2O | 2.08 | 1.98 | 2.13 | 2.43 | 2.01 | 2.14 | 2.12 |
| P2O5 | 0.75 | 0.65 | 0.76 | 0.77 | 0.67 | 0.64 | 0.75 |
| LOI | 1.21 | 1.22 | 1.02 | 1.76 | 0.68 | 1.06 | 1.04 |
| Total | 99.28 | 99.92 | 99.69 | 99.70 | 100.47 | 99.70 | 99.23 |
| Sc | 30.1 | 33.0 | 32.3 | 29.8 | 34.4 | 33.9 | 33.9 |
| V | 243 | 246 | 234 | 212 | 293 | 242 | 272 |
| Co | 34.2 | 34.7 | 34.0 | 23.8 | 33.1 | 31.0 | 32.4 |
| Cu | 152 | 39.6 | 61.3 | 11.8 | 74.7 | 27.6 | 31.6 |
| Ni | 20.1 | 17.5 | 19.7 | 14.7 | 18.2 | 14.3 | 17.4 |
| Zn | 232 | 110 | 100 | 9.0 | 119 | 117 | 208 |
| Rb | 53.8 | 53.9 | 51.9 | 37.8 | 50.5 | 51.6 | 55.5 |
| Y | 42.7 | 46.7 | 44.8 | 56.8 | 41.9 | 49.0 | 47.1 |
| Zr | 325 | 430 | 341 | 420 | 320 | 386 | 359 |
| Nb | 24.5 | 24.6 | 22.4 | 28.2 | 24.5 | 25.2 | 26.9 |
| Ba | 728 | 716 | 652 | 816 | 703 | 710 | 704 |
| La | 44.8 | 45.9 | 50.2 | 57.2 | 41.2 | 47.0 | 45.7 |
| Ce | 88.1 | 87.7 | 94.5 | 109 | 84.1 | 90.5 | 89.8 |
| Pr | 11.0 | 11.0 | 11.5 | 13.4 | 10.1 | 11.3 | 11.3 |
| Nd | 50.5 | 51.3 | 52.0 | 64.1 | 47.8 | 52.8 | 53.3 |
| Sr | 636 | 569 | 612 | 676 | 462 | 445 | 450 |
| Sm | 10.7 | 11.3 | 11.0 | 14.2 | 10.2 | 11.3 | 11.4 |
| Zr | 325 | 430 | 341 | 420 | 320 | 386 | 359 |
| Eu | 3.07 | 3.21 | 3.06 | 3.74 | 3.06 | 3.23 | 3.21 |
| Gd | 9.7 | 10.4 | 10.0 | 13.0 | 9.6 | 11.0 | 10.4 |
| Tb | 1.37 | 1.48 | 1.44 | 1.81 | 1.35 | 1.58 | 1.48 |
| Dy | 8.99 | 9.74 | 9.46 | 12.1 | 9.00 | 10.3 | 9.84 |
| Ho | 1.67 | 1.91 | 1.76 | 2.33 | 1.70 | 1.97 | 1.86 |
| Er | 4.63 | 5.08 | 4.93 | 6.31 | 4.68 | 5.35 | 5.07 |
| Tm | 0.60 | 0.68 | 0.64 | 0.81 | 0.62 | 0.75 | 0.68 |
| Yb | 4.12 | 4.69 | 4.33 | 5.65 | 4.31 | 4.90 | 4.53 |
| Lu | 0.58 | 0.67 | 0.62 | 0.78 | 0.59 | 0.71 | 0.65 |
| Hf | 6.57 | 8.90 | 6.77 | 8.81 | 6.58 | 8.20 | 7.23 |
| Ta | 1.43 | 1.56 | 1.30 | 1.77 | 1.53 | 1.61 | 1.58 |
| Pb | 18.87 | 8.62 | 4.55 | 0.24 | 5.81 | 6.38 | 9.76 |
| Th | 4.87 | 5.36 | 4.93 | 7.35 | 4.84 | 5.13 | 5.70 |
| U | 1.11 | 1.20 | 1.15 | 1.12 | 1.05 | 1.07 | 1.37 |

Table S1. Cont.

| № | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|--------------------------------|---------|---------|-----------|---------|---------|---------|-----------|
| № Sample | BT9-110 | BT6-114 | BT6-114.6 | BT6-116 | BT6-117 | BT6-120 | BT6-122.5 |
| SiO ₂ | 45.71 | 49.65 | 51.56 | 50.60 | 52.18 | 49.02 | 50.56 |
| TiO ₂ | 2.18 | 3.54 | 3.17 | 3.13 | 2.61 | 3.93 | 2.86 |
| Al ₂ O ₃ | 11.10 | 13.40 | 13.42 | 12.65 | 13.05 | 13.17 | 13.02 |
| FeO | 16.74 | 14.76 | 13.85 | 14.33 | 15.14 | 15.12 | 14.29 |
| MnO | 0.28 | 0.24 | 0.21 | 0.20 | 0.27 | 0.25 | 0.19 |
| MgO | 13.06 | 3.73 | 2.76 | 2.46 | 2.63 | 4.12 | 2.69 |
| CaO | 8.37 | 7.97 | 8.33 | 9.47 | 6.75 | 8.28 | 9.15 |
| Na ₂ O | 1.92 | 3.22 | 3.18 | 2.99 | 2.86 | 3.14 | 2.99 |
| K ₂ O | 0.51 | 1.98 | 2.84 | 2.59 | 3.21 | 1.75 | 2.63 |
| P ₂ O ₅ | 0.14 | 0.79 | 0.64 | 1.35 | 0.94 | 0.62 | 0.87 |
| LOI | 0.42 | 1.28 | 1.21 | 1.32 | 1.04 | 1.03 | 0.87 |
| Total | 100.00 | 99.27 | 99.98 | 99.77 | 99.63 | 99.41 | 99.23 |
| Sc | 41.1 | 35.6 | 30.1 | 23.6 | 28.9 | 36.3 | 34.3 |
| V | 298 | 281 | 222 | 186 | 181 | 333 | 128 |
| Co | 75.8 | 32.2 | 25.5 | 21.4 | 26.7 | 37.8 | 22.2 |
| Cu | 202 | 26.5 | 40.9 | 80.5 | 60.5 | 42.4 | 46.8 |
| Ni | 413 | 14.3 | 13.2 | 12.1 | 8.3 | 22.6 | 11.5 |
| Zn | 94.1 | 53.9 | 48.0 | 62.9 | 260 | 77.6 | 28.1 |
| Rb | 15.0 | 42.0 | 44.2 | 40.5 | 68.5 | 41.1 | 40.6 |
| Y | 32.4 | 52.5 | 52.9 | 59.8 | 59.0 | 41.2 | 60.7 |
| Zr | 117 | 390 | 455 | 401 | 530 | 316 | 489 |
| Nb | 6.9 | 27.4 | 29.8 | 35.4 | 26.1 | 24.4 | 31.7 |
| Ba | 156 | 830 | 929 | 865 | 1040 | 701 | 956 |
| La | 9.6 | 46.3 | 50.1 | 60.4 | 64.9 | 39.7 | 54.7 |
| Ce | 19.5 | 89.4 | 100.1 | 124 | 122 | 80.6 | 107 |
| Pr | 2.8 | 10.6 | 12.8 | 15.9 | 14.6 | 10.1 | 14.2 |
| Nd | 15.3 | 52.4 | 60.8 | 75.3 | 67.9 | 47.7 | 68.5 |
| Sr | 213 | 655 | 854 | 877 | 723 | 545 | 856 |
| Sm | 4.5 | 12.0 | 13.2 | 15.9 | 14.4 | 10.4 | 14.8 |
| Zr | 117 | 390 | 455 | 401 | 530 | 316 | 489 |
| Eu | 1.26 | 3.50 | 3.71 | 4.01 | 3.78 | 3.18 | 4.33 |
| Gd | 5.3 | 11.3 | 12.4 | 14.1 | 13.4 | 9.6 | 13.7 |
| Tb | 0.88 | 1.60 | 1.76 | 1.95 | 1.87 | 1.36 | 1.92 |
| Dy | 6.31 | 10.9 | 11.3 | 12.6 | 12.4 | 9.06 | 12.6 |
| Ho | 1.33 | 2.08 | 2.12 | 2.34 | 2.37 | 1.71 | 2.34 |
| Er | 3.85 | 5.36 | 5.87 | 6.43 | 6.60 | 4.66 | 6.55 |
| Tm | 0.52 | 0.74 | 0.78 | 0.82 | 0.88 | 0.63 | 0.85 |
| Yb | 3.65 | 5.27 | 5.15 | 5.56 | 5.68 | 4.21 | 5.61 |
| Lu | 0.54 | 0.73 | 0.74 | 0.77 | 0.79 | 0.59 | 0.79 |
| Hf | 2.86 | 7.83 | 9.44 | 8.32 | 10.99 | 6.78 | 9.78 |
| Ta | 0.46 | 1.59 | 1.72 | 1.91 | 1.64 | 1.48 | 1.65 |
| Pb | 1.06 | 1.11 | 5.60 | 3.42 | 18.85 | 1.81 | 1.04 |
| Th | 1.27 | 4.93 | 5.33 | 6.21 | 8.22 | 3.66 | 5.64 |
| U | 0.33 | 0.97 | 1.17 | 1.20 | 1.73 | 1.01 | 1.05 |

Table S1. Cont.

| № | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|----------|-----------|---------|---------|----------|----------|--------|-----------|
| № Sample | BT6-123.5 | BT6-126 | BT6-264 | BT8-61.5 | BT8-71.5 | BT8-84 | BT8-109.5 |
| SiO2 | 50.03 | 50.02 | 49.10 | 51.39 | 57.12 | 52.16 | 49.97 |
| TiO2 | 3.41 | 3.31 | 3.36 | 2.71 | 2.50 | 2.91 | 2.04 |
| Al2O3 | 13.46 | 14.46 | 13.42 | 13.69 | 13.49 | 13.19 | 13.48 |
| FeO | 14.51 | 14.17 | 13.48 | 14.48 | 13.38 | 15.79 | 14.27 |
| MnO | 0.26 | 0.22 | 0.15 | 0.27 | 0.19 | 0.24 | 0.19 |
| MgO | 3.85 | 3.58 | 4.33 | 2.94 | 2.04 | 2.53 | 4.61 |
| CaO | 7.90 | 7.91 | 10.52 | 7.59 | 5.85 | 7.28 | 11.25 |
| Na2O | 3.25 | 3.52 | 2.94 | 3.75 | 3.45 | 3.45 | 2.88 |
| K2O | 2.19 | 1.92 | 1.77 | 2.69 | 2.88 | 2.13 | 1.37 |
| P2O5 | 0.76 | 0.79 | 0.57 | 1.37 | 0.78 | 1.10 | 0.26 |
| LOI | 0.76 | 1.11 | 1.23 | 0.14 | 0.12 | nd | nd |
| Total | 99.61 | 99.90 | 99.63 | 100.87 | 101.66 | 100.79 | 100.32 |
| Sc | 33.9 | 32.1 | 30.4 | 31.9 | 26.2 | 33.4 | 44.0 |
| V | 281 | 237 | 255 | 223 | 90 | 127 | 368 |
| Co | 34.9 | 34.1 | 28.6 | 22.3 | 19.8 | 28.6 | 47.7 |
| Cu | 31.9 | 43.5 | 30.4 | 8.1 | 12.8 | 44.0 | 248.5 |
| Ni | 18.0 | 14.4 | 19.8 | 15.1 | 11.2 | 18.4 | 61.1 |
| Zn | 165 | 167.1 | 38.6 | 70.4 | 47.3 | 81.5 | 44.4 |
| Rb | 52.9 | 46.6 | 32.7 | 64.0 | 57.6 | 55.6 | 23.5 |
| Y | 47.4 | 42.7 | 44.5 | 60.7 | 71.0 | 76.0 | 38.5 |
| Zr | 511 | 215 | 473 | 368 | 514 | 458 | 129 |
| Nb | 25.4 | 24.0 | 21.1 | 22.7 | 32.3 | 31.9 | 6.89 |
| Ba | 798 | 779 | 557 | 652 | 977 | 836 | 433 |
| La | 48.3 | 44.1 | 41.7 | 58.5 | 66.1 | 84.8 | 13.3 |
| Ce | 93.8 | 87.3 | 89.0 | 117 | 125 | 151 | 27.9 |
| Pr | 12.0 | 10.6 | 11.0 | 15.4 | 16.4 | 20.1 | 3.96 |
| Nd | 56.2 | 50.4 | 52.4 | 67.0 | 72.3 | 87.3 | 18.9 |
| Sr | 725 | 650 | 1182 | 743 | 594 | 497 | 615 |
| Sm | 11.9 | 11.1 | 11.1 | 14.2 | 15.7 | 17.7 | 5.24 |
| Zr | 511 | 215 | 473 | 368 | 514 | 458 | 129 |
| Eu | 3.49 | 3.67 | 3.26 | 3.63 | 4.21 | 4.48 | 1.84 |
| Gd | 11.0 | 10.1 | 10.3 | 14.1 | 15.7 | 17.9 | 6.41 |
| Tb | 1.54 | 1.41 | 1.44 | 1.97 | 2.27 | 2.50 | 1.04 |
| Dy | 10.2 | 9.21 | 9.60 | 11.9 | 14.0 | 15.0 | 6.98 |
| Ho | 1.92 | 1.73 | 1.90 | 2.26 | 2.65 | 2.80 | 1.40 |
| Er | 5.32 | 4.67 | 5.26 | 6.08 | 7.18 | 7.70 | 4.14 |
| Tm | 0.70 | 0.61 | 0.72 | 0.79 | 0.99 | 1.01 | 0.56 |
| Yb | 4.62 | 3.92 | 4.84 | 5.22 | 6.44 | 6.64 | 3.92 |
| Lu | 0.68 | 0.57 | 0.69 | 0.75 | 0.93 | 0.94 | 0.59 |
| Hf | 10.00 | 4.71 | 9.47 | 8.02 | 11.28 | 9.96 | 3.33 |
| Ta | 1.50 | 1.34 | 1.27 | 1.34 | 1.94 | 1.96 | 0.42 |
| Pb | 9.07 | 8.32 | 0.75 | 5.23 | 4.50 | 1.82 | 1.34 |
| Th | 4.73 | 4.11 | 4.24 | 6.71 | 8.00 | 7.54 | 1.39 |
| U | 1.14 | 0.74 | 1.46 | 1.39 | 1.55 | 1.31 | 0.47 |

Table S1. Cont.

| N ^o | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
|--------------------------------|---------|-----------|---------|---------|---------|---------|---------|
| N ^o Sample | BT1-117 | BT1-147.5 | BT1-154 | BT1-161 | BT1-169 | BT1-176 | BT1-183 |
| SiO ₂ | 49.39 | 48.54 | 46.64 | 46.99 | 48.91 | 46.96 | 48.48 |
| TiO ₂ | 1.94 | 0.74 | 0.78 | 0.80 | 0.92 | 1.02 | 1.42 |
| Al ₂ O ₃ | 14.58 | 17.23 | 15.46 | 16.27 | 15.61 | 12.32 | 15.23 |
| FeO | 13.90 | 10.21 | 11.97 | 11.31 | 11.30 | 13.34 | 13.49 |
| MnO | 0.25 | 0.20 | 0.19 | 0.17 | 0.16 | 0.22 | 0.19 |
| MgO | 6.12 | 8.90 | 12.13 | 11.70 | 10.46 | 14.01 | 7.60 |
| CaO | 8.88 | 11.21 | 10.27 | 10.43 | 11.18 | 9.19 | 10.57 |
| Na ₂ O | 2.83 | 2.05 | 1.87 | 1.96 | 2.08 | 1.97 | 2.45 |
| K ₂ O | 1.29 | 0.39 | 0.32 | 0.29 | 0.36 | 0.32 | 0.65 |
| P ₂ O ₅ | 0.44 | 0.09 | 0.11 | 0.07 | 0.13 | 0.12 | 0.21 |
| LOI | nd | nd | nd | nd | nd | nd | nd |
| Total | 99.61 | 99.54 | 99.74 | 100.01 | 101.11 | 99.48 | 100.29 |
| Sc | 31.6 | 33.0 | 28.2 | 26.5 | 33.5 | 31.9 | 36.5 |
| V | 192 | 224 | 177 | 174 | 220 | 221 | 273 |
| Co | 49.5 | 61.5 | 70.8 | 68.4 | 62.8 | 83.3 | 64.3 |
| Cu | 53 | 107 | 116 | 100 | 116 | 139 | 877 |
| Ni | 61.8 | 255.0 | 353.8 | 361.5 | 299.2 | 516.0 | 368.7 |
| Zn | 151 | 104 | 49.2 | 50.3 | 92.3 | 113.3 | 121 |
| Rb | 24.2 | 8.7 | 8.4 | 7.8 | 9.5 | 8.1 | 14.1 |
| Y | 28.3 | 16.8 | 13.9 | 14.9 | 22.0 | 19.4 | 24.6 |
| Zr | 209 | 39.4 | 51.1 | 61.5 | 63.6 | 48.5 | 73.6 |
| Nb | 9.00 | 2.74 | 2.63 | 3.03 | 3.32 | 3.34 | 7.00 |
| Ba | 378 | 109 | 93 | 92 | 115 | 103 | 167 |
| La | 16.4 | 4.69 | 4.72 | 5.16 | 5.75 | 5.85 | 7.26 |
| Ce | 35.3 | 10.1 | 10.4 | 11.2 | 12.6 | 12.8 | 15.7 |
| Pr | 4.72 | 1.51 | 1.44 | 1.57 | 1.88 | 1.88 | 2.34 |
| Nd | 21.3 | 7.51 | 7.34 | 8.07 | 9.46 | 9.10 | 11.4 |
| Sr | 425 | 262 | 201 | 218 | 217 | 177 | 324 |
| Sm | 5.14 | 2.15 | 2.11 | 2.29 | 2.81 | 2.63 | 3.19 |
| Zr | 209 | 39.4 | 51.1 | 61.5 | 63.6 | 48.5 | 73.6 |
| Eu | 1.88 | 0.87 | 0.78 | 0.84 | 1.03 | 0.93 | 1.16 |
| Gd | 5.63 | 2.76 | 2.29 | 2.58 | 3.35 | 3.15 | 3.93 |
| Tb | 0.84 | 0.45 | 0.39 | 0.42 | 0.58 | 0.51 | 0.65 |
| Dy | 5.40 | 3.08 | 2.77 | 3.19 | 3.97 | 3.48 | 4.44 |
| Ho | 1.04 | 0.62 | 0.57 | 0.65 | 0.83 | 0.71 | 0.90 |
| Er | 3.04 | 1.76 | 1.68 | 1.82 | 2.40 | 2.17 | 2.64 |
| Tm | 0.42 | 0.24 | 0.24 | 0.26 | 0.34 | 0.29 | 0.37 |
| Yb | 2.83 | 1.71 | 1.65 | 1.81 | 2.39 | 2.03 | 2.63 |
| Lu | 0.39 | 0.26 | 0.24 | 0.25 | 0.34 | 0.30 | 0.38 |
| Hf | 4.00 | 1.17 | 1.29 | 1.52 | 1.64 | 1.43 | 2.13 |
| Ta | 0.56 | 0.17 | 0.18 | 0.19 | 0.21 | 0.21 | 0.44 |
| Pb | 19.07 | 3.93 | 1.35 | 1.39 | 1.66 | 1.65 | 4.59 |
| Th | 2.62 | 0.37 | 0.72 | 0.81 | 0.92 | 0.65 | 1.00 |
| U | 0.68 | 0.10 | 0.21 | 0.23 | 0.31 | 0.16 | 0.27 |

Table S1. Cont.

| № | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
|--------------------------------|----------|--------|----------|--------|----------|-----------|---------|
| № Sample | BT6-20.5 | BT6-27 | BT6-31.1 | BT6-42 | BT6-63.8 | BT6-129.7 | BT6-132 |
| SiO ₂ | 48.83 | 49.13 | 50.38 | 50.15 | 48.19 | 49.84 | 48.34 |
| TiO ₂ | 0.97 | 0.96 | 0.95 | 0.88 | 1.31 | 1.18 | 0.84 |
| Al ₂ O ₃ | 16.49 | 15.94 | 16.84 | 16.72 | 15.15 | 15.55 | 15.30 |
| FeO | 9.47 | 9.98 | 9.19 | 9.05 | 12.51 | 10.82 | 10.90 |
| MnO | 0.16 | 0.17 | 0.16 | 0.15 | 0.15 | 0.17 | 0.20 |
| MgO | 7.51 | 8.00 | 7.65 | 7.67 | 7.15 | 7.61 | 9.69 |
| CaO | 13.03 | 13.01 | 10.41 | 11.08 | 10.67 | 11.75 | 11.71 |
| Na ₂ O | 2.36 | 2.15 | 3.35 | 3.50 | 2.75 | 2.55 | 2.17 |
| K ₂ O | 0.43 | 0.31 | 0.94 | 0.76 | 1.37 | 0.38 | 0.29 |
| P ₂ O ₅ | 0.14 | 0.11 | 0.07 | 0.10 | 0.13 | 0.13 | 0.13 |
| LOI | nd | nd | nd | nd | nd | nd | nd |
| Total | 99.40 | 99.77 | 99.94 | 100.07 | 99.38 | 99.98 | 99.56 |
| Sc | 41.6 | 45.1 | 41.1 | 44.4 | 43.5 | 43.0 | 42.9 |
| V | 228 | 276 | 242 | 228 | 298 | 284 | 234 |
| Co | 44.2 | 49.6 | 41.4 | 43.1 | 49.9 | 49.2 | 53.8 |
| Cu | 124 | 139 | 136 | 101 | 286 | 184 | 92 |
| Ni | 116.2 | 129.3 | 114.8 | 130.0 | 119.2 | 131.4 | 188.1 |
| Zn | 91.4 | 82.0 | 73.6 | 54.3 | 72.5 | 63.5 | 80.4 |
| Rb | 11.1 | 7.5 | 27.2 | 35.7 | 30.1 | 9.7 | 6.9 |
| Y | 17.3 | 17.4 | 16.1 | 17.4 | 26.0 | 23.5 | 17.6 |
| Zr | 60.5 | 76.6 | 52.7 | 79.8 | 95.8 | 88.6 | 71.9 |
| Nb | 3.56 | 3.13 | 2.76 | 3.07 | 4.35 | 4.21 | 2.86 |
| Ba | 136 | 97 | 156 | 129 | 219 | 126 | 89 |
| La | 6.12 | 5.51 | 4.89 | 5.52 | 7.68 | 7.67 | 5.30 |
| Ce | 13.5 | 11.9 | 11.0 | 11.8 | 16.1 | 16.5 | 11.0 |
| Pr | 1.90 | 1.67 | 1.52 | 1.70 | 2.25 | 2.31 | 1.55 |
| Nd | 9.85 | 8.73 | 8.02 | 8.83 | 12.1 | 12.2 | 8.31 |
| Sr | 339 | 254 | 642 | 652 | 1234 | 264 | 204 |
| Sm | 2.71 | 2.51 | 2.31 | 2.58 | 3.58 | 3.46 | 2.40 |
| Zr | 60.5 | 76.6 | 52.7 | 79.8 | 95.8 | 88.6 | 71.9 |
| Eu | 0.92 | 0.89 | 0.84 | 0.86 | 1.23 | 1.25 | 0.88 |
| Gd | 2.91 | 2.89 | 2.64 | 2.95 | 4.19 | 3.97 | 2.81 |
| Tb | 0.49 | 0.47 | 0.45 | 0.49 | 0.71 | 0.64 | 0.48 |
| Dy | 3.59 | 3.49 | 3.27 | 3.57 | 5.18 | 4.77 | 3.45 |
| Ho | 0.70 | 0.71 | 0.65 | 0.72 | 1.07 | 0.97 | 0.70 |
| Er | 2.05 | 2.07 | 1.90 | 2.01 | 3.09 | 2.78 | 2.11 |
| Tm | 0.28 | 0.29 | 0.27 | 0.29 | 0.44 | 0.40 | 0.30 |
| Yb | 1.93 | 2.04 | 1.82 | 2.01 | 3.05 | 2.69 | 1.95 |
| Lu | 0.27 | 0.29 | 0.26 | 0.28 | 0.46 | 0.39 | 0.30 |
| Hf | 1.52 | 1.83 | 1.29 | 1.91 | 2.36 | 2.19 | 1.88 |
| Ta | 0.21 | 0.20 | 0.17 | 0.20 | 0.29 | 0.29 | 0.20 |
| Pb | 2.37 | 2.38 | 1.79 | 1.36 | 2.62 | 1.87 | 1.60 |
| Th | 0.76 | 0.80 | 0.75 | 0.84 | 1.13 | 1.05 | 0.74 |
| U | 0.24 | 0.30 | 0.25 | 0.23 | 0.56 | 0.29 | 0.20 |

Table S1. *Cont.*

| № | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
|--------------------------------|---------|-----------|---------|---------|---------|---------|---------|
| № Sample | BT6-136 | BT6-143.6 | BT6-151 | BT6-179 | BT6-192 | BT6-200 | BT6-206 |
| SiO ₂ | 46.20 | 46.95 | 47.63 | 46.19 | 46.69 | 44.66 | 45.78 |
| TiO ₂ | 0.79 | 0.87 | 0.90 | 0.65 | 0.60 | 0.58 | 0.61 |
| Al ₂ O ₃ | 13.88 | 15.03 | 16.62 | 16.08 | 17.93 | 12.92 | 15.27 |
| FeO | 13.74 | 12.69 | 11.25 | 11.74 | 9.70 | 13.06 | 11.66 |
| MnO | 0.19 | 0.20 | 0.17 | 0.17 | 0.17 | 0.24 | 0.17 |
| MgO | 13.89 | 11.30 | 9.74 | 13.29 | 11.82 | 17.90 | 14.48 |
| CaO | 9.01 | 10.46 | 11.01 | 9.85 | 10.84 | 8.40 | 9.74 |
| Na ₂ O | 1.93 | 1.96 | 2.25 | 1.75 | 2.03 | 1.51 | 1.75 |
| K ₂ O | 0.25 | 0.28 | 0.33 | 0.24 | 0.22 | 0.19 | 0.21 |
| P ₂ O ₅ | 0.08 | 0.10 | 0.09 | 0.09 | 0.10 | 0.13 | 0.07 |
| LOI | nd | nd | nd | nd | nd | nd | nd |
| Total | 99.95 | 99.85 | 100.00 | 100.04 | 100.10 | 99.58 | 99.72 |
| Sc | 27.7 | 33.4 | 33.0 | 22.5 | 22.3 | 23.0 | 22.9 |
| V | 170 | 194 | 207 | 142 | 140 | 128 | 135 |
| Co | 89.8 | 71.9 | 59.3 | 76.9 | 66.3 | 103.0 | 82.3 |
| Cu | 109 | 117 | 96 | 91.0 | 91.1 | 78.5 | 78.2 |
| Ni | 364.8 | 271.9 | 233.8 | 395.7 | 365.9 | 596.7 | 469.6 |
| Zn | 93.3 | 83.4 | 58.3 | 61.5 | 70.3 | 112 | 64.5 |
| Rb | 6.8 | 7.1 | 8.6 | 5.5 | 4.9 | 5.1 | 4.8 |
| Y | 15.4 | 16.2 | 21.0 | 10.7 | 10.9 | 11.0 | 10.6 |
| Zr | 83.5 | 61.1 | 82.6 | 41.5 | 43.6 | 45.1 | 39.2 |
| Nb | 2.95 | 2.90 | 4.04 | 2.10 | 2.16 | 2.24 | 1.96 |
| Ba | 84 | 86 | 106 | 76 | 70 | 64 | 65 |
| La | 4.82 | 5.03 | 6.04 | 3.79 | 3.77 | 3.69 | 3.39 |
| Ce | 10.5 | 10.5 | 12.9 | 8.53 | 8.11 | 8.06 | 7.37 |
| Pr | 1.47 | 1.49 | 1.86 | 1.17 | 1.12 | 1.09 | 1.05 |
| Nd | 7.56 | 7.73 | 10.2 | 5.98 | 5.78 | 5.76 | 5.45 |
| Sr | 171 | 183 | 204 | 228 | 219 | 155 | 193 |
| Sm | 2.20 | 2.26 | 3.00 | 1.69 | 1.66 | 1.56 | 1.57 |
| Zr | 83.5 | 61.1 | 82.6 | 41.5 | 43.6 | 45.1 | 39.2 |
| Eu | 0.79 | 0.84 | 0.98 | 0.70 | 0.68 | 0.59 | 0.64 |
| Gd | 2.52 | 2.61 | 3.44 | 1.89 | 1.86 | 1.81 | 1.79 |
| Tb | 0.41 | 0.43 | 0.58 | 0.30 | 0.31 | 0.30 | 0.30 |
| Dy | 2.98 | 3.13 | 4.30 | 2.33 | 2.24 | 2.23 | 2.17 |
| Ho | 0.63 | 0.64 | 0.88 | 0.46 | 0.46 | 0.45 | 0.45 |
| Er | 1.84 | 1.88 | 2.64 | 1.34 | 1.34 | 1.38 | 1.37 |
| Tm | 0.26 | 0.26 | 0.37 | 0.19 | 0.19 | 0.19 | 0.19 |
| Yb | 1.79 | 1.80 | 2.57 | 1.29 | 1.25 | 1.27 | 1.30 |
| Lu | 0.26 | 0.28 | 0.38 | 0.19 | 0.19 | 0.19 | 0.19 |
| Hf | 1.92 | 1.44 | 2.07 | 1.03 | 1.11 | 1.09 | 1.01 |
| Ta | 0.19 | 0.19 | 0.28 | 0.14 | 0.14 | 0.13 | 0.16 |
| Pb | 0.89 | 0.81 | 1.14 | 1.07 | 1.83 | 1.28 | 0.71 |
| Th | 0.69 | 0.79 | 1.49 | 0.49 | 0.49 | 0.52 | 0.51 |
| U | 0.29 | 0.21 | 0.41 | 0.15 | 0.14 | 0.16 | 0.16 |

Table S1. Cont.

| № | 50 | 51 | 52 | 53 | 54 | 55 | 56 |
|--------------------------------|---------|-----------|---------|---------|-----------|-----------|-----------|
| № Sample | BT6-215 | BT6-225.5 | BT6-249 | BT6-256 | BT8-115.5 | BT8-134.3 | BT8-147.3 |
| SiO ₂ | 47.44 | 46.21 | 47.04 | 46.10 | 49.28 | 47.67 | 47.61 |
| TiO ₂ | 0.87 | 0.74 | 0.97 | 0.94 | 0.71 | 0.87 | 0.92 |
| Al ₂ O ₃ | 17.31 | 15.19 | 13.52 | 11.96 | 13.64 | 15.05 | 16.52 |
| FeO | 10.07 | 12.10 | 12.60 | 13.71 | 12.55 | 12.19 | 10.70 |
| MnO | 0.18 | 0.20 | 0.17 | 0.19 | 0.17 | 0.21 | 0.17 |
| MgO | 11.21 | 13.47 | 14.07 | 15.46 | 9.93 | 11.88 | 11.57 |
| CaO | 10.58 | 9.69 | 9.07 | 8.34 | 11.44 | 9.84 | 10.77 |
| Na ₂ O | 2.23 | 1.90 | 1.98 | 1.96 | 2.11 | 1.89 | 2.01 |
| K ₂ O | 0.33 | 0.27 | 0.32 | 0.33 | 0.49 | 0.41 | 0.38 |
| P ₂ O ₅ | 0.10 | 0.08 | 0.13 | 0.18 | 0.11 | 0.15 | 0.10 |
| LOI | nd | nd | nd | nd | nd | nd | nd |
| Total | 100.31 | 99.85 | 99.90 | 99.17 | 100.43 | 100.16 | 100.74 |
| Sc | 24.9 | 26.2 | 28.8 | 30.7 | 49.7 | 33.1 | 30.3 |
| V | 171 | 155 | 199 | 194 | 289 | 232 | 201 |
| Co | 63.6 | 77.6 | 83.8 | 82.2 | 67.3 | 76.0 | 66.8 |
| Cu | 57.6 | 98.0 | 113 | 99.2 | 202 | 108 | 76.8 |
| Ni | 318.0 | 438.7 | 479.7 | 512.3 | 229.9 | 360.8 | 324.2 |
| Zn | 23.2 | 64.1 | 97.3 | 40.6 | 77.8 | 168 | 86.1 |
| Rb | 8.2 | 6.4 | 8.4 | 8.7 | 9.9 | 10.3 | 6.8 |
| Y | 14.2 | 14.6 | 17.4 | 19.0 | 21.8 | 21.0 | 16.7 |
| Zr | 61.7 | 59.3 | 69.3 | 89.2 | 76.7 | 71.6 | 51.9 |
| Nb | 3.26 | 2.54 | 3.72 | 3.79 | 1.90 | 3.33 | 2.56 |
| Ba | 99 | 83 | 100 | 105 | 109 | 129 | 92 |
| La | 5.37 | 4.73 | 5.91 | 6.25 | 3.96 | 6.52 | 5.29 |
| Ce | 11.57 | 9.67 | 13.2 | 13.5 | 9.41 | 14.8 | 11.7 |
| Pr | 1.56 | 1.36 | 1.81 | 1.88 | 1.44 | 2.13 | 1.70 |
| Nd | 8.03 | 7.20 | 9.52 | 9.92 | 7.51 | 10.7 | 8.32 |
| Sr | 218 | 206 | 197 | 165 | 436 | 238 | 205 |
| Sm | 2.24 | 2.11 | 2.65 | 2.79 | 2.50 | 2.92 | 2.33 |
| Zr | 61.7 | 59.3 | 69.3 | 89.2 | 76.7 | 71.6 | 51.9 |
| Eu | 0.86 | 0.78 | 0.92 | 0.97 | 0.84 | 0.92 | 0.83 |
| Gd | 2.53 | 2.36 | 2.97 | 3.21 | 3.32 | 3.51 | 2.73 |
| Tb | 0.41 | 0.39 | 0.48 | 0.53 | 0.57 | 0.58 | 0.45 |
| Dy | 2.96 | 2.89 | 3.49 | 3.86 | 4.09 | 3.89 | 3.16 |
| Ho | 0.60 | 0.60 | 0.72 | 0.82 | 0.84 | 0.78 | 0.61 |
| Er | 1.68 | 1.81 | 2.11 | 2.29 | 2.43 | 2.26 | 1.79 |
| Tm | 0.25 | 0.24 | 0.29 | 0.32 | 0.34 | 0.31 | 0.26 |
| Yb | 1.62 | 1.76 | 2.04 | 2.21 | 2.47 | 2.17 | 1.72 |
| Lu | 0.24 | 0.26 | 0.29 | 0.34 | 0.35 | 0.30 | 0.26 |
| Hf | 1.51 | 1.47 | 1.76 | 2.15 | 2.00 | 1.98 | 1.31 |
| Ta | 0.19 | 0.17 | 0.22 | 0.25 | 0.13 | 0.20 | 0.16 |
| Pb | 0.27 | 0.57 | 1.58 | 0.22 | 1.82 | 5.30 | 1.40 |
| Th | 0.65 | 0.78 | 0.92 | 0.93 | 2.03 | 2.10 | 0.57 |
| U | 0.24 | 0.22 | 0.25 | 0.27 | 0.69 | 0.19 | 0.16 |

Table S1. *Cont.*

| № | 57 | 58 | 59 |
|--------------------------------|---------|---------|---------|
| № Sample | BT8-153 | BT8-177 | BT8-199 |
| SiO ₂ | 47.54 | 46.72 | 46.98 |
| TiO ₂ | 0.84 | 0.69 | 1.15 |
| Al ₂ O ₃ | 17.25 | 15.99 | 17.45 |
| FeO | 10.40 | 11.71 | 10.61 |
| MnO | 0.16 | 0.16 | 0.20 |
| MgO | 11.07 | 13.24 | 9.86 |
| CaO | 10.65 | 9.65 | 10.43 |
| Na ₂ O | 1.86 | 1.85 | 2.29 |
| K ₂ O | 0.33 | 0.29 | 0.42 |
| P ₂ O ₅ | 0.09 | 0.10 | 0.13 |
| LOI | nd | nd | nd |
| Total | 100.18 | 100.39 | 99.52 |
| Sc | 23.3 | 22.4 | 34.3 |
| V | 177 | 159 | 202 |
| Co | 66.4 | 88.7 | 60.4 |
| Cu | 91.6 | 121 | 114 |
| Ni | 342.8 | 493.2 | 302.6 |
| Zn | 36.7 | 103 | 94.9 |
| Rb | 8.2 | 7.1 | 8.0 |
| Y | 15.6 | 13.8 | 19.0 |
| Zr | 63.1 | 40.8 | 61.4 |
| Nb | 3.10 | 2.69 | 2.22 |
| Ba | 104 | 87 | 104 |
| La | 5.36 | 4.87 | 6.53 |
| Ce | 11.9 | 10.9 | 13.5 |
| Pr | 1.70 | 1.52 | 1.9 |
| Nd | 8.08 | 7.22 | 9.48 |
| Sr | 239 | 212 | 249 |
| Sm | 2.21 | 1.92 | 2.36 |
| Zr | 63.1 | 40.8 | 61.4 |
| Eu | 0.83 | 0.75 | 0.89 |
| Gd | 2.58 | 2.24 | 3.06 |
| Tb | 0.42 | 0.36 | 0.50 |
| Dy | 2.86 | 2.45 | 3.41 |
| Ho | 0.59 | 0.49 | 0.67 |
| Er | 1.71 | 1.47 | 1.99 |
| Tm | 0.23 | 0.21 | 0.30 |
| Yb | 1.65 | 1.46 | 1.93 |
| Lu | 0.24 | 0.22 | 0.28 |
| Hf | 1.62 | 1.11 | 1.70 |
| Ta | 0.19 | 0.16 | 0.16 |
| Pb | 0.52 | 1.25 | 3.67 |
| Th | 0.63 | 0.49 | 0.57 |
| U | 0.19 | 0.13 | 0.17 |

Note. Major oxides are given in wt %, and trace elements in ppm. Samples 1–22, 24–27 and 23, 28–59 are from Ergalakh and Norilsk-type intrusions, respectively.