Supporting Information for

**Dust pathway of the Songnen Plain, Northeast China in the last glacial period and their implication for ecological security**

Yan Jiaoa,1, Yuanyun Xiea,b,1,\*, Yunping Chia,b,\*, Lei Suna,b, Peng Wua, Zhenyu Weia, Haijin Liua, Yehui Wanga, Ruonan Liua

a College of Geographic Science, Harbin Normal University, Harbin 150025, China

b Heilongjiang Province Key Laboratory of Geographical Environment Monitoring and Spatial Information Service in Cold Regions, Harbin Normal University, Harbin 150025, China

\* Corresponding author.

E-mail: xyy0451@163.com (Y. Xie), 1982cyp@163.com (Y. Chi).

1 These authors contributed equally to this work.

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**Introduction**

This document contains details on (1) Acid dissolution method four-step procedure (Text S1), (2) The standard linear multivariate mixing framework in the frequentist model (Text S2), (3) The concentration and ratio of geochemical elements in the Harbin loess and its potential source area input by Frequentist model (Table S1), (4) Concentrations of major elements, trace elements and REE for the <10 μm fraction in the Northeast Sandy Lands (Table S2), (5) Concentrations of major elements, trace elements and REE for the <10 μm fraction in the Harbin loess (Table S3).

**Text S1 Acid dissolution method four-step procedure**

1. A mixture of 1 ml HF and 0.3 ml (1:1) HNO3 was added to samples in capped Teflon bombs, and were shaken for 15 min with an ultra-sonic device. The sample was then heated for 24 h on an electrical hot plate (150 °C) in order to break down silicates, and afterwards uncapped and heated until near dryness.
2. Samples were then re-dissolved in 1 ml HF, 0.3 ml (1:1) HNO3 and 0.5 ml HClO4 and placed on a hot plate in capped TEFLON for 7 days in order to further break down silicates, fluorides and zircons. The sample was then evaporated near to dryness when the cap was opened.
3. 2 ml (1:1) HNO3 was then added and dried on a hot plate in order to further break down the fluorides.
4. Samples were then treated with 2 ml (1:1) HNO3. At this stage, no remaining residue was detectable in the samples.

**Text S2 The standard linear multivariate mixing framework in the frequentist model**

The relative contribution of each potential sediment source is determined using a standard linear multivariate mixing model:

which satisfies:

where bi is the tracer property i (i = 1 t o n) of the sediment mixture, ai, j represents the tracer property i in the source type j (j = 1 t o m), ωj is the unknown relative contribution of the source type j, m represents the number of potential sediment sources and n is the number of tracer properties selected.

This system of equations is mathematically determined if the number of tracers is greater than or equal to the number of potential sources minus one (n ≥ m − 1). The procedure tries to find the source proportions that conserve the mass balance for all tracers from the complete exploration of the parameter space. All possible combinations of each source contribution (0–100%) are examined in small increments, using Latin hypercube sampling (LHS). The quality of each candidate is measured using the following function or goodness of fit (GOF), based on the sum of squares of the relative error:

whereΔi is the range of the tracer property i, used as a normalisation factor. The combinations that reproduce the observed sediment mixture with the maximum GOF are selected as the solution.

Supplementary Table 1 The concentration and ratio of geochemical elements in the Harbin loess and its potential source area input by Frequentist model.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | Be | Sc | V | Cr | Co | Ni | Cu | Zn | Ga | Rb | Sr | Y | Nb | Mo | Cd | Cs | Ba | La | Ce | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | Ta | Pb | Th | U | Zr | Hf |
| HL1 | 2.23 | 9.68 | 58.3 | 50 | 7.3 | 14.1 | 20.9 | 50.3 | 15.9 | 101 | 270 | 31.8 | 19 | 0.795 | 0.203 | 4.86 | 693 | 48.8 | 90.7 | 11.4 | 43.4 | 7.54 | 1.41 | 6.81 | 1.14 | 5.49 | 1.09 | 3.31 | 0.572 | 3.93 | 0.572 | 1.62 | 20.3 | 13.7 | 2.65 | 334 | 9.69 |
| HL2 | 2.56 | 8.77 | 52.4 | 44.2 | 5.52 | 10.2 | 16.8 | 45.6 | 15.3 | 99.2 | 273 | 29.5 | 18.8 | 0.831 | 0.293 | 3.91 | 667 | 42.2 | 83.6 | 9.53 | 35 | 6.39 | 1.21 | 5.42 | 0.986 | 5 | 1.08 | 3.18 | 0.569 | 4.23 | 0.581 | 1.69 | 18.9 | 11.5 | 2.72 | 410 | 12 |
| HL3 | 2.38 | 8.79 | 55.3 | 49.6 | 7.12 | 11.6 | 20.7 | 48 | 15.1 | 96 | 282 | 31.2 | 20.3 | 0.149 | 0.331 | 4.09 | 663 | 41.8 | 79.8 | 9.42 | 35.8 | 6.38 | 1.29 | 5.63 | 1.03 | 5.34 | 1.12 | 3 | 0.557 | 3.97 | 0.481 | 1.67 | 20.1 | 12.6 | 3.01 | 396 | 10.8 |
| HL4 | 2.1 | 17.3 | 130 | 125 | 13.9 | 25.9 | 36.7 | 105 | 20.4 | 88.5 | 363 | 69.2 | 41.4 | 2.02 | 1.12 | 6.49 | 728 | 108 | 213 | 25 | 97.2 | 17 | 1.96 | 14.7 | 2.51 | 12 | 2.43 | 6.98 | 1.26 | 9.45 | 1.36 | 3.64 | 23.7 | 45.7 | 9.54 | 1317 | 36.2 |
| HL5 | 2.16 | 7.81 | 49.5 | 39.3 | 6.84 | 11.2 | 23.3 | 40.6 | 14.2 | 97.6 | 289 | 23.7 | 15.7 | 0.66 | 0.283 | 3.8 | 715 | 34.2 | 72 | 7.74 | 29.6 | 5.28 | 1.21 | 4.76 | 0.866 | 4.12 | 0.827 | 2.37 | 0.365 | 2.8 | 0.434 | 1.18 | 19.5 | 9.72 | 2.12 | 221 | 6.18 |
| HQ-OD1 | 1.98 | 10.1 | 76.1 | 54.9 | 7.4 | 15.1 | 32.9 | 54.4 | 13.6 | 92.3 | 215 | 35.4 | 22.3 | 0.328 | 0.058 | 4.22 | 549 | 61.2 | 119 | 14.7 | 57.5 | 10.7 | 1.46 | 8.68 | 1.35 | 7.09 | 1.34 | 3.81 | 0.66 | 4.29 | 0.623 | 0.909 | 19.2 | 21.2 | 3.93 | 224 | 7.08 |
| HQ-OD2 | 2.09 | 8.53 | 60.7 | 43.9 | 5.83 | 12 | 26.4 | 43.3 | 12.7 | 94.3 | 201 | 26.7 | 16.8 | 0.309 | 0.055 | 3.78 | 579 | 33.6 | 67.6 | 8.17 | 31.1 | 6.06 | 1.07 | 5.05 | 0.871 | 4.81 | 0.938 | 2.74 | 0.505 | 3.38 | 0.479 | 1.15 | 17.4 | 13.1 | 2.6 | 180 | 5.81 |
| HQ-OD3 | 1.9 | 12.6 | 107 | 98.8 | 10.2 | 18.2 | 41.9 | 96.4 | 16.1 | 87.4 | 252 | 51.6 | 35.9 | 0.543 | 0.085 | 3.56 | 622 | 104 | 165 | 24.5 | 92.3 | 16.6 | 1.91 | 13.5 | 2.05 | 10.2 | 1.91 | 5.33 | 0.911 | 6.32 | 0.92 | 0.68 | 24.5 | 42.9 | 6.48 | 348 | 13.3 |
| HQ-OD4 | 1.77 | 14.7 | 175 | 155 | 12 | 19.6 | 42.6 | 112 | 15.9 | 78.8 | 233 | 71.5 | 40.9 | 0.945 | 0.1 | 3.09 | 507 | 160 | 248 | 38.3 | 145 | 25.8 | 2.37 | 20.7 | 3.07 | 14.4 | 2.63 | 7.49 | 1.32 | 8.78 | 1.28 | 1.1 | 24.3 | 68.2 | 9.33 | 532 | 20.6 |
| HQ-OD5 | 2.06 | 8.33 | 61.5 | 42.1 | 6.14 | 15 | 24.1 | 47.8 | 13.9 | 103 | 206 | 22.5 | 13.1 | 0.437 | 0.05 | 4.62 | 620 | 29.6 | 60.3 | 6.96 | 26.5 | 5.15 | 0.985 | 4.28 | 0.738 | 4.19 | 0.833 | 2.34 | 0.422 | 2.69 | 0.363 | 0.96 | 21.6 | 10.5 | 2.59 | 97.5 | 3.18 |
| HQ-OD6 | 1.85 | 10.5 | 90.8 | 62.3 | 8.65 | 16.5 | 24.6 | 62.5 | 14.5 | 90.8 | 222 | 36.8 | 22 | 0.551 | 0.061 | 3.72 | 589 | 64.5 | 126 | 15.3 | 57.8 | 10.5 | 1.52 | 8.49 | 1.37 | 6.91 | 1.33 | 3.83 | 0.658 | 4.49 | 0.637 | 1.59 | 21.7 | 22.4 | 3.86 | 173 | 5.41 |
| HQ-OD7 | 1.67 | 12.7 | 98.4 | 68.4 | 8.25 | 15.1 | 31.4 | 70.2 | 14.4 | 87.4 | 210 | 43.8 | 29.9 | 0.592 | 0.089 | 3.67 | 556 | 83.1 | 163 | 19.3 | 71.8 | 13.3 | 1.55 | 10.7 | 1.72 | 8.59 | 1.58 | 4.59 | 0.776 | 5.39 | 0.764 | 2.18 | 22 | 31.8 | 4.99 | 252 | 8.08 |
| HQ-OD8 | 1.63 | 8.48 | 63 | 42.7 | 5.98 | 12 | 20.6 | 45.5 | 12.1 | 83 | 188 | 27.6 | 16.2 | 0.381 | 0.038 | 3.3 | 553 | 37.5 | 74.6 | 9.11 | 35 | 6.65 | 1.14 | 5.46 | 0.889 | 4.89 | 0.978 | 2.76 | 0.505 | 3.3 | 0.46 | 1.16 | 17.7 | 14.5 | 2.53 | 129 | 3.99 |
| HQ-OD9 | 1.87 | 8.43 | 59 | 42.4 | 6.24 | 13.6 | 22.5 | 44.7 | 13 | 95 | 197 | 24.7 | 15.5 | 0.319 | 0.063 | 3.9 | 579 | 40.3 | 77.4 | 9.15 | 34.8 | 6.68 | 1.13 | 5.34 | 0.899 | 4.64 | 0.891 | 2.51 | 0.436 | 2.94 | 0.398 | 1.13 | 18.6 | 13.6 | 2.29 | 114 | 3.66 |
| HQ-OD10 | 1.67 | 9.22 | 67 | 47.3 | 7.12 | 15.7 | 20.4 | 51.8 | 13.5 | 94.2 | 200 | 28.3 | 17.3 | 0.44 | 0.064 | 4.05 | 566 | 42.7 | 83.9 | 10.2 | 38.2 | 7.21 | 1.15 | 5.82 | 0.992 | 5.24 | 1.03 | 2.98 | 0.51 | 3.48 | 0.502 | 1.27 | 19.4 | 14.4 | 2.86 | 146 | 4.88 |
| HQ-OD11 | 1.91 | 9.99 | 67.2 | 46.7 | 7 | 14 | 21.6 | 54.3 | 13.9 | 97 | 206 | 30 | 18.9 | 0.437 | 0.067 | 4.28 | 591 | 43.8 | 86.2 | 10.6 | 40 | 7.56 | 1.26 | 6.18 | 1.04 | 5.55 | 1.07 | 3.06 | 0.521 | 3.6 | 0.514 | 1.32 | 21 | 16.4 | 2.99 | 152 | 4.86 |
| HQ-OD12 | 1.78 | 9.42 | 63.6 | 48.1 | 5.66 | 10.8 | 24.7 | 49.7 | 13.6 | 96.8 | 203 | 32.5 | 22.6 | 0.391 | 0.053 | 3.67 | 588 | 51 | 101 | 12.2 | 46.8 | 8.63 | 1.28 | 7.19 | 1.19 | 6.16 | 1.18 | 3.45 | 0.606 | 4.05 | 0.575 | 1.62 | 18.8 | 21.1 | 3.32 | 194 | 6.28 |
| HQ-OD13 | 1.66 | 11.5 | 51.6 | 31.4 | 5.23 | 11.1 | 16.7 | 40.2 | 11.9 | 87.9 | 180 | 23.4 | 13.7 | 0.327 | 0.047 | 3.73 | 552 | 37.8 | 72 | 8.71 | 32.8 | 6.02 | 1 | 5.04 | 0.818 | 4.31 | 0.853 | 2.45 | 0.433 | 2.78 | 0.385 | 0.97 | 16.4 | 12.2 | 2.32 | 115 | 3.66 |
| HQ-OD14 | 1.81 | 11.4 | 57.1 | 42.9 | 5.73 | 12.2 | 18 | 44.5 | 13.4 | 97.7 | 195 | 25.2 | 15.4 | 0.381 | 0.06 | 4.22 | 615 | 35.1 | 68 | 8.51 | 32.3 | 6.1 | 1.11 | 5.04 | 0.862 | 4.63 | 0.912 | 2.67 | 0.46 | 3.03 | 0.439 | 1.09 | 19.2 | 11.5 | 2.71 | 130 | 4.14 |
| HQ-OD15 | 1.89 | 12.3 | 77.5 | 59.9 | 7.62 | 15.8 | 24.3 | 62.1 | 14.9 | 94.5 | 224 | 35.5 | 24.6 | 0.4 | 0.047 | 4.35 | 561 | 56.6 | 111 | 13.6 | 51.6 | 9.52 | 1.41 | 7.65 | 1.3 | 6.83 | 1.3 | 3.71 | 0.65 | 4.42 | 0.627 | 1.75 | 21 | 21.5 | 3.59 | 225 | 7.13 |
| HQ-OD16 | 2.09 | 10.3 | 79.7 | 53.5 | 8.98 | 22.1 | 28.2 | 61.5 | 14.8 | 104 | 194 | 27.9 | 18.3 | 0.42 | 0.092 | 5.5 | 561 | 39.3 | 76.4 | 9.41 | 36.6 | 7.03 | 1.27 | 5.81 | 0.985 | 5.23 | 1.03 | 2.91 | 0.503 | 3.35 | 0.471 | 1.5 | 20.2 | 12.3 | 2.49 | 138 | 4.36 |
| HQ-OD17 | 2.19 | 11.1 | 71.2 | 52.1 | 6.47 | 11.9 | 27 | 58 | 13.9 | 93.2 | 232 | 44.8 | 27.7 | 0.382 | 0.074 | 3.42 | 629 | 79.6 | 159 | 19.2 | 72.4 | 13.3 | 1.59 | 10.5 | 1.71 | 8.56 | 1.61 | 4.65 | 0.8 | 5.33 | 0.756 | 2.07 | 20.5 | 29.5 | 4.43 | 246 | 8.01 |
| HQ-OD18 | 1.71 | 8.64 | 65.7 | 45.9 | 5.39 | 9.96 | 47 | 51.6 | 13.8 | 102 | 215 | 33.6 | 22.5 | 0.436 | 0.057 | 3.46 | 622 | 52 | 104 | 12.6 | 48.5 | 9.32 | 1.31 | 7.36 | 1.23 | 6.25 | 1.21 | 3.46 | 0.586 | 4.06 | 0.584 | 1.57 | 19.9 | 18.2 | 3.25 | 190 | 6.11 |
| HQ-OD19 | 1.74 | 9.94 | 92.8 | 75.8 | 8.66 | 17.6 | 34.2 | 68.9 | 13.9 | 92.7 | 202 | 34.6 | 24.8 | 0.634 | 0.197 | 4.2 | 590 | 56.1 | 111 | 13.6 | 52.3 | 9.9 | 1.34 | 8.07 | 1.32 | 6.8 | 1.26 | 3.69 | 0.678 | 4.38 | 0.622 | 1.84 | 25.9 | 24.3 | 4.31 | 284 | 9.15 |
| HQ-OD20 | 1.54 | 8.43 | 80.8 | 62.1 | 6.5 | 12.7 | 29.5 | 54.1 | 12.6 | 82.2 | 193 | 29.8 | 21.1 | 0.518 | 0.071 | 3.34 | 593 | 52.8 | 104 | 12.6 | 49 | 8.95 | 1.28 | 7.34 | 1.18 | 5.79 | 1.11 | 3.26 | 0.563 | 3.69 | 0.517 | 1.56 | 17.9 | 19.1 | 3.27 | 198 | 6.39 |
| HQ-OD21 | 1.6 | 9.58 | 93.8 | 75.3 | 7.97 | 15.7 | 29 | 61.5 | 13.1 | 80 | 187 | 35.7 | 25.3 | 0.616 | 0.067 | 4.68 | 554 | 72.7 | 140 | 16.8 | 64.2 | 11.3 | 1.3 | 9.25 | 1.44 | 7.06 | 1.33 | 3.82 | 0.675 | 4.49 | 0.642 | 1.94 | 19.7 | 31.3 | 4.85 | 306 | 9.84 |
| HQ-OD22 | 1.66 | 8.57 | 76.8 | 43 | 9.67 | 15.6 | 38.7 | 55.3 | 13.2 | 82.6 | 229 | 25.1 | 18 | 0.473 | 0.07 | 3.65 | 573 | 51.2 | 106 | 11.8 | 45.7 | 8.18 | 1.18 | 6.8 | 1.1 | 5.27 | 0.997 | 3.66 | 0.518 | 3.36 | 0.499 | 1.5 | 18.5 | 18.1 | 3 | 233 | 6.78 |
| HQ-OD23 | 2.02 | 10.9 | 91.8 | 61 | 11.5 | 26.3 | 33.8 | 65.2 | 16.6 | 101 | 203 | 26.8 | 14.2 | 0.676 | 0.143 | 6.72 | 531 | 39 | 74.9 | 8.95 | 35.7 | 6.79 | 1.23 | 5.83 | 0.981 | 5.15 | 0.996 | 2.8 | 0.517 | 3.11 | 0.434 | 1.03 | 21.5 | 13.2 | 2.63 | 128 | 4.16 |
| HQ-OD24 | 1.81 | 11 | 104 | 83.3 | 10.6 | 19.7 | 34.1 | 69.2 | 14.8 | 92.2 | 218 | 35 | 25.3 | 0.536 | 0.07 | 4.51 | 602 | 70.2 | 137 | 16.4 | 63.3 | 11.4 | 1.44 | 9.29 | 1.49 | 7.23 | 1.33 | 3.8 | 0.664 | 4.32 | 0.617 | 2.3 | 21.5 | 28.5 | 4.51 | 265 | 8.94 |
| HQ-OD25 | 1.74 | 8.37 | 68.1 | 50.4 | 7.58 | 15.6 | 27 | 46.3 | 12.9 | 92.6 | 193 | 25 | 16.6 | 0.395 | 0.121 | 4.13 | 686 | 38.7 | 77.6 | 9.05 | 34.5 | 6.3 | 1.09 | 5.47 | 0.92 | 4.75 | 0.929 | 2.76 | 0.498 | 3.18 | 0.449 | 1.28 | 21.8 | 13.1 | 2.7 | 178 | 5.77 |
| HQ-OD26 | 1.58 | 7.11 | 52.2 | 42.1 | 5.32 | 12.2 | 31.8 | 41.3 | 11.7 | 82 | 175 | 18.8 | 13.7 | 0.432 | 0.059 | 4.19 | 605 | 27.9 | 56.2 | 6.36 | 24 | 4.59 | 0.896 | 3.78 | 0.665 | 3.48 | 0.697 | 2.06 | 0.373 | 2.34 | 0.344 | 1.08 | 16.4 | 9.84 | 2.27 | 118 | 3.79 |
| HQ-OD27 | 1.56 | 8.81 | 86 | 58.1 | 9.95 | 22 | 35.9 | 54.8 | 12.8 | 84.5 | 186 | 24 | 14.7 | 0.622 | 0.101 | 4.54 | 587 | 41.9 | 82 | 9.66 | 36.8 | 7.13 | 1.12 | 5.84 | 0.945 | 4.86 | 0.915 | 2.64 | 0.451 | 3.05 | 0.425 | 1.09 | 21.7 | 15.2 | 2.87 | 146 | 4.8 |
| HQ-OD28 | 1.51 | 8.3 | 63.4 | 47.3 | 7.86 | 17.8 | 32.4 | 50.1 | 11.9 | 78.9 | 183 | 20.6 | 11.8 | 0.454 | 0.083 | 4.77 | 548 | 28 | 53.3 | 6.41 | 25.1 | 4.8 | 0.968 | 4.18 | 0.703 | 3.94 | 0.759 | 2.15 | 0.387 | 2.44 | 0.348 | 0.924 | 17.5 | 8.52 | 2.23 | 103 | 3.41 |
| HQ-OD29 | 1.85 | 9.83 | 94.1 | 60.7 | 10.2 | 20.5 | 40.7 | 60.3 | 13.9 | 85.4 | 189 | 29.2 | 16.8 | 0.702 | 0.101 | 4.97 | 565 | 46.4 | 89.1 | 10.7 | 41 | 7.9 | 1.21 | 6.29 | 1.01 | 5.44 | 1.02 | 2.91 | 0.519 | 3.26 | 0.475 | 1.4 | 20.4 | 15.1 | 2.81 | 171 | 5.19 |
| HQ-OD30 | 1.3 | 6.19 | 63.1 | 36.2 | 12 | 28.4 | 38.1 | 35.5 | 8.54 | 57 | 541 | 24.5 | 9.01 | 0.448 | 0.159 | 3.81 | 789 | 31.7 | 55.6 | 7.33 | 29.1 | 5.67 | 1.09 | 4.83 | 0.81 | 4.39 | 0.856 | 2.37 | 0.401 | 2.43 | 0.349 | 0.676 | 23.4 | 9.25 | 2.19 | 95.8 | 2.9 |
| HQ-OD31 | 1.57 | 7.88 | 69.1 | 52.6 | 8.85 | 18.3 | 35.5 | 48.3 | 12.1 | 80.3 | 332 | 24.5 | 13.3 | 0.599 | 0.099 | 4.67 | 583 | 32 | 59.3 | 7.5 | 28.8 | 5.67 | 1.06 | 4.66 | 0.816 | 4.6 | 0.862 | 2.48 | 0.431 | 2.79 | 0.384 | 0.917 | 18.4 | 9.9 | 2.46 | 130 | 4.01 |
| HQ-OD32 | 1.44 | 7.4 | 75 | 50.1 | 12.3 | 24.5 | 37.9 | 46.7 | 11 | 70.2 | 388 | 48 | 12.3 | 0.753 | 0.261 | 4.17 | 615 | 55.5 | 75.5 | 13.4 | 53.5 | 10.7 | 2 | 9.12 | 1.57 | 8.26 | 1.64 | 4.2 | 0.675 | 4.16 | 0.579 | 0.804 | 24 | 14 | 2.74 | 144 | 4.35 |
| SNNW1 | 2.25 | 10.2 | 77.8 | 56.7 | 12.1 | 24.4 | 27.8 | 60.3 | 16.8 | 100 | 335 | 34.7 | 15.3 | 0.426 | 0.204 | 5.9 | 617 | 46.7 | 90.1 | 11.1 | 41.6 | 8.56 | 1.49 | 6.59 | 1.27 | 6.47 | 1.23 | 3.6 | 0.628 | 3.94 | 0.495 | 1.21 | 21.4 | 14.9 | 2.66 | 367 | 9.7 |
| SNNW2 | 2 | 10.3 | 72.1 | 52.4 | 11.4 | 19.7 | 20.6 | 51.1 | 16.4 | 98.5 | 265 | 34.2 | 17.5 | 0.296 | 0.155 | 4.85 | 654 | 39.5 | 79.3 | 9.15 | 35.5 | 6.84 | 1.36 | 5.56 | 1.08 | 5.81 | 1.11 | 3.35 | 0.621 | 4.07 | 0.507 | 1.39 | 24.3 | 12.5 | 2.6 | 514 | 13.8 |
| SNNW3 | 2.24 | 11.3 | 96 | 63 | 15.8 | 19.1 | 31.3 | 57 | 16.5 | 89.3 | 310 | 38.1 | 19.1 | 0.411 | 0.131 | 4.1 | 658 | 54.5 | 117 | 12.7 | 47.8 | 8.55 | 1.61 | 7.48 | 1.41 | 7.06 | 1.29 | 4.04 | 0.698 | 4.63 | 0.641 | 1.7 | 23.7 | 16 | 3.54 | 616 | 17.8 |
| SNNW4 | 2.51 | 10.9 | 92.8 | 130 | 15.4 | 25.4 | 54.8 | 90 | 18.3 | 99 | 300 | 41.8 | 24.1 | 4.07 | 0.162 | 4.63 | 695 | 63.4 | 129 | 14.5 | 54.6 | 9.87 | 1.49 | 8.44 | 1.43 | 7.24 | 1.46 | 4.27 | 0.761 | 4.81 | 0.655 | 1.86 | 28.8 | 20.1 | 4.58 | 649 | 16.7 |
| SNNW5 | 2.16 | 9.41 | 75.8 | 58 | 13.8 | 14.1 | 28.1 | 52.2 | 16.4 | 98.4 | 312 | 32.3 | 20.3 | 0.458 | 0.092 | 3.89 | 731 | 45 | 91.7 | 10.5 | 39.6 | 6.61 | 1.4 | 5.91 | 1.11 | 5.79 | 1.05 | 3.62 | 0.547 | 3.83 | 0.512 | 1.57 | 23 | 13.6 | 3.61 | 614 | 15.3 |
| SNNW6 | 2.07 | 9.94 | 87.1 | 67 | 23 | 18.4 | 35.4 | 55.5 | 16.8 | 92.2 | 294 | 35.2 | 23.6 | 0.611 | 0.145 | 4.01 | 675 | 50.2 | 116 | 11.6 | 43.1 | 7.95 | 1.4 | 6.74 | 1.2 | 6.17 | 1.19 | 3.8 | 0.685 | 4.36 | 0.65 | 1.82 | 20.5 | 14.8 | 3.63 | 625 | 16.3 |
| SNNW7 | 2.55 | 11.6 | 86.4 | 71.2 | 18.2 | 21.7 | 24.5 | 69.4 | 19.2 | 106 | 284 | 38.6 | 20.4 | 0.601 | 0.165 | 5.44 | 705 | 51 | 107 | 11.6 | 43.7 | 8.16 | 1.58 | 7.3 | 1.29 | 6.85 | 1.28 | 3.87 | 0.643 | 4.44 | 0.659 | 1.55 | 26.7 | 14.8 | 3.17 | 565 | 14.8 |
| SNNW8 | 2.08 | 8.15 | 66.8 | 43.3 | 11.6 | 12.6 | 20.8 | 40.6 | 14.9 | 87.8 | 284 | 28.1 | 16.3 | 0.347 | 0.132 | 3.17 | 645 | 38.6 | 86.3 | 8.95 | 33.9 | 5.89 | 1.16 | 5.18 | 0.952 | 4.88 | 0.874 | 2.87 | 0.487 | 3.55 | 0.485 | 1.18 | 19 | 14.7 | 2.75 | 416 | 11 |
| SNNW9 | 1.8 | 10.2 | 83 | 63.4 | 17 | 18.1 | 26 | 57 | 17.4 | 93.1 | 301 | 37.8 | 21.9 | 0.436 | 0.3 | 4.09 | 672 | 52 | 110 | 11.8 | 44.5 | 7.42 | 1.38 | 7.47 | 1.26 | 6.55 | 1.31 | 3.91 | 0.694 | 4.85 | 0.724 | 1.57 | 26 | 18 | 3.78 | 783 | 20.6 |
| SNNW10 | 2.37 | 11.1 | 85.3 | 68 | 12.9 | 28.3 | 23.8 | 63.6 | 18.3 | 100 | 292 | 35.3 | 21.6 | 0.482 | 0.145 | 4.54 | 638 | 47 | 97.1 | 10.9 | 39 | 7.84 | 1.44 | 7.07 | 1.09 | 6.57 | 1.32 | 3.87 | 0.616 | 4.15 | 0.743 | 1.68 | 21.5 | 16.9 | 3.43 | 483 | 12.3 |
| SNNW11 | 1.86 | 11.2 | 105 | 86.7 | 9.67 | 13 | 34.9 | 78.4 | 17.5 | 96.2 | 273 | 54.4 | 32.2 | 0.757 | 0.111 | 4.25 | 584 | 79.6 | 163 | 18.9 | 71.2 | 12.6 | 1.71 | 11.1 | 1.85 | 10.1 | 1.93 | 6.04 | 1.04 | 7.54 | 1.15 | 2.94 | 21.9 | 31.2 | 6.86 | 1543 | 41 |
| SNNW12 | 2.32 | 8.31 | 82.6 | 47.7 | 10.1 | 18.6 | 22.4 | 50 | 14.4 | 94.2 | 319 | 33 | 16.9 | 0.438 | 0.145 | 4.43 | 619 | 40.4 | 77.9 | 9.92 | 39.1 | 7 | 1.44 | 6.18 | 1.09 | 5.69 | 1.17 | 3.52 | 0.564 | 4.02 | 0.622 | 1.31 | 18.8 | 13.7 | 2.94 | 454 | 11.9 |
| SNNW13 | 2.28 | 12.7 | 98.9 | 71.4 | 15.2 | 28.4 | 30.2 | 83.2 | 19 | 111 | 248 | 40.2 | 18.6 | 0.517 | 0.262 | 7.31 | 625 | 49.4 | 95.9 | 11.5 | 41.4 | 8.1 | 1.5 | 7.78 | 1.28 | 7.27 | 1.38 | 4.34 | 0.652 | 4.48 | 0.698 | 1.41 | 26.4 | 16.7 | 3.26 | 473 | 11.7 |
| SNNW14 | 1.7 | 10.1 | 72.1 | 64.8 | 8.07 | 14.2 | 46.3 | 48.5 | 15.3 | 87.5 | 263 | 42.3 | 22.7 | 0.409 | 0.107 | 3.44 | 588 | 53.8 | 106 | 13.1 | 49.9 | 9.33 | 1.56 | 8.06 | 1.41 | 7.95 | 1.47 | 4.59 | 0.818 | 5.32 | 0.877 | 1.92 | 18.1 | 21.5 | 4.31 | 800 | 20.6 |
| SNSW1 | 1.47 | 11.2 | 82.4 | 60.8 | 10.1 | 22.4 | 28.8 | 62.6 | 15.9 | 85.1 | 357 | 32.9 | 19.2 | 0.73 | 0.289 | 5.49 | 556 | 46.3 | 92.5 | 11.4 | 44.6 | 8.24 | 1.32 | 7.21 | 1.1 | 6.16 | 1.18 | 3.31 | 0.532 | 4.15 | 0.537 | 1.55 | 19.8 | 17.3 | 3.06 | 350 | 10.1 |
| SNSW2 | 2.38 | 10.8 | 91.7 | 65.4 | 12.8 | 31.4 | 34.8 | 61.1 | 15.5 | 88.8 | 564 | 31.4 | 16 | 0.572 | 0.319 | 5.98 | 588 | 42.1 | 84.1 | 9.14 | 37.2 | 6.6 | 1.22 | 5.75 | 1.02 | 5.54 | 1.13 | 3.22 | 0.499 | 3.67 | 0.521 | 1.27 | 20.7 | 13.5 | 2.73 | 297 | 8.65 |
| SNSW3 | 2.39 | 12.1 | 79.9 | 65.2 | 13 | 24.8 | 29.1 | 77.8 | 19.2 | 112 | 258 | 31.2 | 19 | 1.07 | 0.162 | 7.75 | 628 | 41.8 | 81.6 | 9.78 | 38.3 | 7 | 1.41 | 6.31 | 1.09 | 5.99 | 1.15 | 3.13 | 0.572 | 4.02 | 0.515 | 1.5 | 25.6 | 14.2 | 2.51 | 235 | 7.49 |
| SNSW4 | 2.31 | 12.9 | 89.4 | 77.4 | 17.1 | 27.4 | 45 | 83 | 20.7 | 113 | 254 | 36.2 | 25.4 | 0.797 | 0.334 | 8 | 636 | 54.2 | 108 | 12.8 | 49.8 | 9.2 | 1.5 | 7.72 | 1.3 | 6.33 | 1.33 | 3.57 | 0.643 | 4.41 | 0.655 | 2.75 | 27.5 | 19.3 | 3.38 | 421 | 12.2 |
| SNSW5 | 2.28 | 12.3 | 83.1 | 66.1 | 12.9 | 23.4 | 27.5 | 75 | 18.7 | 107 | 246 | 32.4 | 18.6 | 0.782 | 0.25 | 7.4 | 602 | 43.2 | 85.3 | 9.98 | 39 | 7.19 | 1.36 | 6.43 | 1.11 | 5.53 | 1.21 | 3.11 | 0.57 | 3.69 | 0.54 | 1.47 | 30.2 | 16.2 | 2.49 | 280 | 7.93 |
| SNSW6 | 2.19 | 11.5 | 79.1 | 57.5 | 10.6 | 19.3 | 24.1 | 68.1 | 17.8 | 102 | 272 | 31.7 | 20.9 | 0.664 | 0.344 | 6.48 | 629 | 44.1 | 86.2 | 10.4 | 40.2 | 7.28 | 1.33 | 6.73 | 1.04 | 5.63 | 1.12 | 3.18 | 0.53 | 3.5 | 0.54 | 1.53 | 23.9 | 15.3 | 2.8 | 284 | 7.83 |
| SNSW7 | 2.29 | 9.53 | 58.7 | 52.9 | 8.63 | 16.9 | 22.9 | 62.7 | 15.9 | 92.2 | 216 | 24.9 | 17.8 | 0.393 | 0.115 | 5.64 | 542 | 34 | 67.7 | 8.12 | 31.8 | 5.93 | 1.1 | 4.75 | 0.854 | 4.8 | 0.961 | 2.75 | 0.451 | 2.97 | 0.47 | 1.4 | 19.7 | 11.3 | 2.34 | 306 | 9.06 |
| SNSW8 | 2.5 | 13.1 | 81.8 | 66.8 | 13.2 | 27.5 | 31.8 | 87.9 | 19.6 | 110 | 206 | 30 | 19.4 | 0.685 | 0.148 | 8.5 | 599 | 43.7 | 87.9 | 9.97 | 39.9 | 7.67 | 1.33 | 6.17 | 1.11 | 6.07 | 1.14 | 3.4 | 0.54 | 3.44 | 0.541 | 1.53 | 25.2 | 14.3 | 2.57 | 285 | 8.48 |
| SNSW9 | 2.24 | 11.5 | 87.7 | 77.5 | 9.27 | 20.8 | 26.6 | 74.8 | 16.4 | 89.7 | 249 | 33.9 | 24.6 | 0.686 | 0.177 | 5.17 | 573 | 53 | 101 | 12.4 | 48.8 | 9.6 | 1.57 | 7.5 | 1.25 | 6.82 | 1.3 | 3.84 | 0.611 | 4 | 0.633 | 2 | 22.9 | 15.8 | 3.55 | 510 | 15.2 |
| SNSW10 | 2.98 | 12 | 84.9 | 65 | 14.7 | 21.8 | 21.3 | 92.8 | 20.9 | 104 | 218 | 33.5 | 40.7 | 0.851 | 0.375 | 5.08 | 565 | 43.3 | 104 | 9.87 | 38.6 | 7.07 | 1.1 | 6.81 | 1.06 | 6.11 | 1.25 | 3.3 | 0.589 | 4.26 | 0.618 | 2.88 | 26.8 | 14.8 | 2.25 | 486 | 12.8 |
| SNSW11 | 2.41 | 12.6 | 78 | 77.3 | 11 | 20.3 | 22.4 | 89.6 | 20.6 | 105 | 242 | 32.8 | 35.3 | 0.452 | 0.396 | 4.88 | 545 | 47 | 93.4 | 10.7 | 41.2 | 7.58 | 1.17 | 7.07 | 1.07 | 5.85 | 1.19 | 3.61 | 0.551 | 4.39 | 0.569 | 3.12 | 21.4 | 15.3 | 2.54 | 552 | 14.3 |
| SNSW12 | 2.43 | 11.8 | 77.2 | 61.4 | 11.8 | 20.1 | 20.2 | 81.6 | 18.4 | 106 | 230 | 30 | 31.6 | 0.734 | 0.253 | 5.21 | 582 | 41.1 | 90.5 | 9.44 | 37.1 | 6.83 | 1.12 | 6.55 | 1.08 | 5.71 | 1.12 | 3.04 | 0.489 | 3.71 | 0.513 | 2.42 | 23 | 15.2 | 2.21 | 391 | 10.8 |
| SNSW13 | 2.93 | 12.9 | 76.4 | 61.5 | 14.4 | 22 | 21.8 | 86.8 | 20.4 | 99.8 | 226 | 31.3 | 35.7 | 0.753 | 0.274 | 4.86 | 575 | 47.7 | 107 | 10.7 | 40.5 | 7.4 | 1.2 | 6.77 | 1.15 | 5.7 | 1.15 | 3.04 | 0.489 | 3.87 | 0.555 | 2.8 | 24.9 | 14.6 | 2.31 | 442 | 11.8 |
| HS1 | 2.48 | 12.4 | 91.5 | 62.6 | 11.2 | 26.8 | 36.5 | 83.5 | 18.7 | 122 | 193 | 32.3 | 19.2 | 0.579 | 0.085 | 8.43 | 557 | 41.7 | 77.4 | 9.64 | 37.6 | 7.24 | 1.3 | 6.09 | 1.07 | 5.78 | 1.14 | 3.18 | 0.545 | 3.6 | 0.517 | 1.35 | 24.3 | 14.2 | 2.64 | 161 | 5.1 |
| HS2 | 2.73 | 13.7 | 90 | 66.9 | 12.4 | 27.6 | 38.4 | 86.1 | 20.1 | 129 | 209 | 32.9 | 21.7 | 0.472 | 0.09 | 8.81 | 607 | 44.5 | 81.8 | 10.5 | 40.8 | 7.65 | 1.38 | 6.53 | 1.12 | 6.05 | 1.17 | 3.29 | 0.576 | 3.72 | 0.531 | 1.47 | 25.7 | 14.7 | 2.53 | 155 | 4.87 |
| HS3 | 2.74 | 13.3 | 101 | 67.1 | 11.5 | 31.2 | 40.3 | 86.2 | 19.6 | 117 | 200 | 33.3 | 18.4 | 0.598 | 0.095 | 8.58 | 560 | 45.6 | 87.3 | 10.8 | 41.6 | 7.89 | 1.41 | 6.81 | 1.14 | 6.1 | 1.19 | 3.28 | 0.583 | 3.67 | 0.509 | 1.24 | 25.3 | 15.6 | 2.57 | 154 | 4.79 |
| HS4 | 3.52 | 5.94 | 114.6 | 96.66 | 13.27 | 46 | 37.53 | 58.52 | 20.46 | 6.74 | 82.79 | 19.14 | 19.64 | 0.932 | 2.292 | 2.40 | 303.5 | 13.6 | 32.96 | 4.14 | 16.25 | 3.64 | 0.77 | 3.58 | 0.57 | 3.39 | 0.76 | 2.22 | 0.359 | 2.35 | 0.367 | 1.35 | 16.75 | 6.79 | 1.44 | 429.8 | 11.7 |
| HS5 | 3.31 | 4.19 | 110.5 | 90.21 | 15.13 | 42.57 | 35.22 | 58.97 | 19.15 | 10.75 | 84.91 | 16.73 | 19.41 | 0.715 | 2.223 | 2.46 | 311.5 | 13.39 | 30.97 | 3.89 | 14.97 | 3.24 | 0.70 | 3.06 | 0.45 | 2.9 | 0.61 | 1.87 | 0.308 | 2.01 | 0.319 | 1.26 | 16.14 | 6.18 | 1.36 | 434.8 | 11.13 |
| HS6 | 3.34 | 4.66 | 123.4 | 93.14 | 14.6 | 52.26 | 38.06 | 64.28 | 18.3 | 14.52 | 86.46 | 21.65 | 19.38 | 0.999 | 1.979 | 3.01 | 236.3 | 16.05 | 36.6 | 4.59 | 17.69 | 3.92 | 0.83 | 3.78 | 0.59 | 3.44 | 0.73 | 2.16 | 0.343 | 2.27 | 0.349 | 1.19 | 16.36 | 6.82 | 1.49 | 379.9 | 9.638 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | LREE/HREE | Ce/Ce\* | Eu/Eu\* | (La/Yb)N | (La/Lu)N | (Ce/Yb)N | (La/Sm)N | (Gd/Yb)N | La/Nb | Th/Nb | Y/Nb | Zr/Nb | Hf/Nb | U/Nb | La/Ta | Th/Ta | Y/Ta | Zr/Ta | Hf/Ta | U/Ta | (LREE/HREE)N |
| HL1 | 8.87 | 0.90 | 0.60 | 8.39 | 8.86 | 5.98 | 4.07 | 1.40 | 2.57 | 0.72 | 1.67 | 17.58 | 0.51 | 0.14 | 30.12 | 8.46 | 19.63 | 206.17 | 5.98 | 1.64 | 6.18 |
| HL2 | 8.45 | 0.98 | 0.63 | 6.74 | 7.54 | 5.12 | 4.16 | 1.04 | 2.24 | 0.61 | 1.57 | 21.81 | 0.64 | 0.14 | 24.97 | 6.80 | 17.46 | 242.60 | 7.10 | 1.61 | 5.26 |
| HL3 | 8.26 | 0.94 | 0.66 | 7.11 | 9.02 | 5.21 | 4.12 | 1.15 | 2.06 | 0.62 | 1.54 | 19.51 | 0.53 | 0.15 | 25.03 | 7.54 | 18.68 | 237.13 | 6.47 | 1.80 | 5.62 |
| HL4 | 9.12 | 0.96 | 0.38 | 7.72 | 8.24 | 5.84 | 4.00 | 1.26 | 2.61 | 1.10 | 1.67 | 31.81 | 0.87 | 0.23 | 29.67 | 12.55 | 19.01 | 361.81 | 9.95 | 2.62 | 6.09 |
| HL5 | 9.07 | 1.04 | 0.74 | 8.25 | 8.18 | 6.66 | 4.08 | 1.38 | 2.18 | 0.62 | 1.51 | 14.08 | 0.39 | 0.14 | 28.98 | 8.24 | 20.08 | 187.29 | 5.24 | 1.80 | 6.28 |
| HQ-OD1 | 9.50 | 0.93 | 0.46 | 9.64 | 10.20 | 7.19 | 3.60 | 1.64 | 2.74 | 0.95 | 1.59 | 10.04 | 0.32 | 0.18 | 67.33 | 23.32 | 38.94 | 246.42 | 7.79 | 4.32 | 7.10 |
| HQ-OD2 | 7.86 | 0.96 | 0.59 | 6.72 | 7.28 | 5.18 | 3.49 | 1.21 | 2.00 | 0.78 | 1.59 | 10.71 | 0.35 | 0.15 | 29.22 | 11.39 | 23.22 | 156.52 | 5.05 | 2.26 | 5.17 |
| HQ-OD3 | 9.83 | 0.77 | 0.39 | 11.12 | 11.74 | 6.77 | 3.94 | 1.73 | 2.90 | 1.19 | 1.44 | 9.69 | 0.37 | 0.18 | 152.94 | 63.09 | 75.88 | 511.76 | 19.56 | 9.53 | 7.91 |
| HQ-OD4 | 10.38 | 0.74 | 0.31 | 12.31 | 12.98 | 7.32 | 3.90 | 1.91 | 3.91 | 1.67 | 1.75 | 13.01 | 0.50 | 0.23 | 145.45 | 62.00 | 65.00 | 483.64 | 18.73 | 8.48 | 8.66 |
| HQ-OD5 | 8.17 | 0.98 | 0.64 | 7.44 | 8.47 | 5.81 | 3.62 | 1.29 | 2.26 | 0.80 | 1.72 | 7.44 | 0.24 | 0.20 | 30.83 | 10.94 | 23.44 | 101.56 | 3.31 | 2.70 | 5.57 |
| HQ-OD6 | 9.94 | 0.94 | 0.49 | 9.71 | 10.51 | 7.27 | 3.87 | 1.53 | 2.93 | 1.02 | 1.67 | 7.86 | 0.25 | 0.18 | 40.57 | 14.09 | 23.14 | 108.81 | 3.40 | 2.43 | 7.28 |
| HQ-OD7 | 10.32 | 0.95 | 0.40 | 10.42 | 11.29 | 7.84 | 3.93 | 1.61 | 2.78 | 1.06 | 1.46 | 8.43 | 0.27 | 0.17 | 38.12 | 14.59 | 20.09 | 115.60 | 3.71 | 2.29 | 7.79 |
| HQ-OD8 | 8.52 | 0.95 | 0.58 | 7.68 | 8.46 | 5.86 | 3.55 | 1.34 | 2.31 | 0.90 | 1.70 | 7.96 | 0.25 | 0.16 | 32.33 | 12.50 | 23.79 | 111.21 | 3.44 | 2.18 | 5.84 |
| HQ-OD9 | 9.39 | 0.94 | 0.58 | 9.26 | 10.51 | 6.82 | 3.80 | 1.47 | 2.60 | 0.88 | 1.59 | 7.35 | 0.24 | 0.15 | 35.66 | 12.04 | 21.86 | 100.88 | 3.24 | 2.03 | 6.87 |
| HQ-OD10 | 8.92 | 0.94 | 0.54 | 8.29 | 8.83 | 6.25 | 3.73 | 1.36 | 2.47 | 0.83 | 1.64 | 8.44 | 0.28 | 0.17 | 33.62 | 11.34 | 22.28 | 114.96 | 3.84 | 2.25 | 6.21 |
| HQ-OD11 | 8.80 | 0.94 | 0.56 | 8.22 | 8.85 | 6.21 | 3.65 | 1.39 | 2.32 | 0.87 | 1.59 | 8.04 | 0.26 | 0.16 | 33.18 | 12.42 | 22.73 | 115.15 | 3.68 | 2.27 | 6.25 |
| HQ-OD12 | 9.05 | 0.95 | 0.50 | 8.51 | 9.21 | 6.46 | 3.72 | 1.44 | 2.26 | 0.93 | 1.44 | 8.58 | 0.28 | 0.15 | 31.48 | 13.02 | 20.06 | 119.75 | 3.88 | 2.05 | 6.41 |
| HQ-OD13 | 9.28 | 0.93 | 0.55 | 9.19 | 10.19 | 6.71 | 3.95 | 1.47 | 2.76 | 0.89 | 1.71 | 8.39 | 0.27 | 0.17 | 38.97 | 12.58 | 24.12 | 118.56 | 3.77 | 2.39 | 6.65 |
| HQ-OD14 | 8.38 | 0.92 | 0.61 | 7.83 | 8.30 | 5.82 | 3.62 | 1.35 | 2.28 | 0.75 | 1.64 | 8.44 | 0.27 | 0.18 | 32.20 | 10.55 | 23.12 | 119.27 | 3.80 | 2.49 | 5.79 |
| HQ-OD15 | 9.20 | 0.94 | 0.50 | 8.65 | 9.37 | 6.51 | 3.74 | 1.40 | 2.30 | 0.87 | 1.44 | 9.15 | 0.29 | 0.15 | 32.34 | 12.29 | 20.29 | 128.57 | 4.07 | 2.05 | 6.56 |
| HQ-OD16 | 8.38 | 0.93 | 0.61 | 7.93 | 8.66 | 5.91 | 3.52 | 1.41 | 2.15 | 0.67 | 1.52 | 7.54 | 0.24 | 0.14 | 26.20 | 8.20 | 18.60 | 92.00 | 2.91 | 1.66 | 5.94 |
| HQ-OD17 | 10.17 | 0.95 | 0.41 | 10.09 | 10.93 | 7.73 | 3.77 | 1.60 | 2.87 | 1.06 | 1.62 | 8.88 | 0.29 | 0.16 | 38.45 | 14.25 | 21.64 | 118.84 | 3.87 | 2.14 | 7.58 |
| HQ-OD18 | 9.20 | 0.95 | 0.48 | 8.65 | 9.24 | 6.64 | 3.51 | 1.47 | 2.31 | 0.81 | 1.49 | 8.44 | 0.27 | 0.14 | 33.12 | 11.59 | 21.40 | 121.02 | 3.89 | 2.07 | 6.62 |
| HQ-OD19 | 9.11 | 0.94 | 0.46 | 8.66 | 9.36 | 6.57 | 3.57 | 1.49 | 2.26 | 0.98 | 1.40 | 11.45 | 0.37 | 0.17 | 30.49 | 13.21 | 18.80 | 154.35 | 4.97 | 2.34 | 6.51 |
| HQ-OD20 | 9.75 | 0.94 | 0.48 | 9.67 | 10.60 | 7.30 | 3.71 | 1.61 | 2.50 | 0.91 | 1.41 | 9.38 | 0.30 | 0.15 | 33.85 | 12.24 | 19.10 | 126.92 | 4.10 | 2.10 | 7.21 |
| HQ-OD21 | 10.67 | 0.94 | 0.39 | 10.94 | 11.76 | 8.08 | 4.05 | 1.67 | 2.87 | 1.24 | 1.41 | 12.09 | 0.39 | 0.19 | 37.47 | 16.13 | 18.40 | 157.73 | 5.07 | 2.50 | 8.05 |
| HQ-OD22 | 10.09 | 1.01 | 0.48 | 10.30 | 10.65 | 8.18 | 3.94 | 1.64 | 2.84 | 1.01 | 1.39 | 12.94 | 0.38 | 0.17 | 34.13 | 12.07 | 16.73 | 155.33 | 4.52 | 2.00 | 7.17 |
| HQ-OD23 | 8.40 | 0.94 | 0.60 | 8.47 | 9.33 | 6.24 | 3.62 | 1.52 | 2.75 | 0.93 | 1.89 | 9.01 | 0.29 | 0.19 | 37.86 | 12.82 | 26.02 | 124.27 | 4.04 | 2.55 | 6.04 |
| HQ-OD24 | 10.43 | 0.95 | 0.43 | 10.98 | 11.81 | 8.22 | 3.88 | 1.74 | 2.77 | 1.13 | 1.38 | 10.47 | 0.35 | 0.18 | 30.52 | 12.39 | 15.22 | 115.22 | 3.89 | 1.96 | 8.04 |
| HQ-OD25 | 8.82 | 0.97 | 0.57 | 8.22 | 8.95 | 6.32 | 3.87 | 1.39 | 2.33 | 0.79 | 1.51 | 10.72 | 0.35 | 0.16 | 30.23 | 10.23 | 19.53 | 139.06 | 4.51 | 2.11 | 6.06 |
| HQ-OD26 | 8.73 | 0.99 | 0.66 | 8.06 | 8.42 | 6.22 | 3.83 | 1.31 | 2.04 | 0.72 | 1.37 | 8.61 | 0.28 | 0.17 | 25.83 | 9.11 | 17.41 | 109.26 | 3.51 | 2.10 | 5.78 |
| HQ-OD27 | 9.34 | 0.95 | 0.53 | 9.28 | 10.23 | 6.97 | 3.70 | 1.55 | 2.85 | 1.03 | 1.63 | 9.93 | 0.33 | 0.20 | 38.44 | 13.94 | 22.02 | 133.94 | 4.40 | 2.63 | 6.89 |
| HQ-OD28 | 7.95 | 0.93 | 0.66 | 7.75 | 8.35 | 5.66 | 3.67 | 1.39 | 2.37 | 0.72 | 1.75 | 8.73 | 0.29 | 0.19 | 30.30 | 9.22 | 22.29 | 111.47 | 3.69 | 2.41 | 5.56 |
| HQ-OD29 | 9.38 | 0.94 | 0.52 | 9.62 | 10.14 | 7.08 | 3.70 | 1.56 | 2.76 | 0.90 | 1.74 | 10.18 | 0.31 | 0.17 | 33.14 | 10.79 | 20.86 | 122.14 | 3.71 | 2.01 | 6.85 |
| HQ-OD30 | 7.94 | 0.85 | 0.64 | 8.82 | 9.43 | 5.93 | 3.52 | 1.61 | 3.52 | 1.03 | 2.72 | 10.63 | 0.32 | 0.24 | 46.89 | 13.68 | 36.24 | 141.72 | 4.29 | 3.24 | 6.01 |
| HQ-OD31 | 7.89 | 0.90 | 0.63 | 7.75 | 8.65 | 5.51 | 3.55 | 1.35 | 2.41 | 0.74 | 1.84 | 9.77 | 0.30 | 0.18 | 34.90 | 10.80 | 26.72 | 141.77 | 4.37 | 2.68 | 5.63 |
| HQ-OD32 | 6.97 | 0.65 | 0.62 | 9.02 | 9.95 | 4.70 | 3.26 | 1.78 | 4.51 | 1.14 | 3.90 | 11.71 | 0.35 | 0.22 | 69.03 | 17.41 | 59.70 | 179.10 | 5.41 | 3.41 | 5.95 |
| SNNW1 | 8.24 | 0.93 | 0.61 | 8.01 | 9.79 | 5.93 | 3.43 | 1.36 | 3.05 | 0.97 | 2.27 | 23.99 | 0.63 | 0.17 | 38.60 | 12.31 | 28.68 | 303.31 | 8.02 | 2.20 | 5.92 |
| SNNW2 | 7.76 | 0.98 | 0.67 | 6.56 | 8.09 | 5.05 | 3.63 | 1.11 | 2.26 | 0.71 | 1.95 | 29.37 | 0.79 | 0.15 | 28.42 | 8.99 | 24.60 | 369.78 | 9.93 | 1.87 | 5.07 |
| SNNW3 | 8.89 | 1.04 | 0.62 | 7.95 | 8.83 | 6.55 | 4.01 | 1.31 | 2.85 | 0.84 | 1.99 | 32.25 | 0.93 | 0.19 | 32.06 | 9.41 | 22.41 | 362.35 | 10.47 | 2.08 | 6.04 |
| SNNW4 | 9.39 | 1.00 | 0.50 | 8.91 | 10.05 | 6.95 | 4.04 | 1.42 | 2.63 | 0.83 | 1.73 | 26.93 | 0.69 | 0.19 | 34.09 | 10.81 | 22.47 | 348.92 | 8.98 | 2.46 | 6.53 |
| SNNW5 | 8.71 | 0.99 | 0.68 | 7.94 | 9.12 | 6.20 | 4.29 | 1.25 | 2.22 | 0.67 | 1.59 | 30.25 | 0.75 | 0.18 | 28.66 | 8.66 | 20.57 | 391.08 | 9.75 | 2.30 | 5.97 |
| SNNW6 | 9.29 | 1.13 | 0.58 | 7.78 | 8.02 | 6.89 | 3.97 | 1.25 | 2.13 | 0.63 | 1.49 | 26.48 | 0.69 | 0.15 | 27.58 | 8.13 | 19.34 | 343.41 | 8.96 | 1.99 | 5.83 |
| SNNW7 | 8.47 | 1.03 | 0.63 | 7.76 | 8.03 | 6.25 | 3.93 | 1.33 | 2.50 | 0.73 | 1.89 | 27.70 | 0.73 | 0.16 | 32.90 | 9.55 | 24.90 | 364.52 | 9.55 | 2.05 | 5.77 |
| SNNW8 | 9.07 | 1.09 | 0.64 | 7.35 | 8.26 | 6.30 | 4.12 | 1.18 | 2.37 | 0.90 | 1.72 | 25.52 | 0.67 | 0.17 | 32.71 | 12.46 | 23.81 | 352.54 | 9.32 | 2.33 | 5.90 |
| SNNW9 | 8.48 | 1.04 | 0.57 | 7.25 | 7.46 | 5.88 | 4.41 | 1.25 | 2.37 | 0.82 | 1.73 | 35.75 | 0.94 | 0.17 | 33.12 | 11.46 | 24.08 | 498.73 | 13.12 | 2.41 | 5.50 |
| SNNW10 | 7.99 | 1.01 | 0.59 | 7.65 | 6.57 | 6.06 | 3.77 | 1.38 | 2.18 | 0.78 | 1.63 | 22.36 | 0.57 | 0.16 | 27.98 | 10.06 | 21.01 | 287.50 | 7.32 | 2.04 | 5.27 |
| SNNW11 | 8.52 | 0.98 | 0.44 | 7.13 | 7.19 | 5.60 | 3.98 | 1.19 | 2.47 | 0.97 | 1.69 | 47.92 | 1.27 | 0.21 | 27.07 | 10.61 | 18.50 | 524.83 | 13.95 | 2.33 | 5.48 |
| SNNW12 | 7.69 | 0.91 | 0.67 | 6.79 | 6.74 | 5.02 | 3.63 | 1.25 | 2.39 | 0.81 | 1.95 | 26.86 | 0.70 | 0.17 | 30.84 | 10.46 | 25.19 | 346.56 | 9.08 | 2.24 | 5.10 |
| SNNW13 | 7.45 | 0.94 | 0.58 | 7.45 | 7.35 | 5.55 | 3.84 | 1.41 | 2.66 | 0.90 | 2.16 | 25.43 | 0.63 | 0.18 | 35.04 | 11.84 | 28.51 | 335.46 | 8.30 | 2.31 | 5.23 |
| SNNW14 | 7.66 | 0.94 | 0.55 | 6.83 | 6.37 | 5.16 | 3.63 | 1.23 | 2.37 | 0.95 | 1.86 | 35.24 | 0.91 | 0.19 | 28.02 | 11.20 | 22.03 | 416.67 | 10.73 | 2.24 | 4.93 |
| SNSW1 | 8.45 | 0.94 | 0.52 | 7.54 | 8.95 | 5.78 | 3.54 | 1.41 | 2.41 | 0.90 | 1.71 | 18.23 | 0.53 | 0.16 | 29.87 | 11.16 | 21.23 | 225.81 | 6.52 | 1.97 | 6.24 |
| SNSW2 | 8.45 | 1.00 | 0.61 | 7.75 | 8.39 | 5.94 | 4.01 | 1.27 | 2.63 | 0.84 | 1.96 | 18.56 | 0.54 | 0.17 | 33.15 | 10.63 | 24.72 | 233.86 | 6.81 | 2.15 | 5.80 |
| SNSW3 | 7.90 | 0.95 | 0.65 | 7.03 | 8.43 | 5.26 | 3.76 | 1.27 | 2.20 | 0.75 | 1.64 | 12.37 | 0.39 | 0.13 | 27.87 | 9.47 | 20.80 | 156.67 | 4.99 | 1.67 | 5.56 |
| SNSW4 | 9.07 | 0.96 | 0.54 | 8.31 | 8.59 | 6.35 | 3.71 | 1.42 | 2.13 | 0.76 | 1.43 | 16.57 | 0.48 | 0.13 | 19.71 | 7.02 | 13.16 | 153.09 | 4.44 | 1.23 | 6.29 |
| SNSW5 | 8.38 | 0.96 | 0.61 | 7.91 | 8.31 | 5.99 | 3.78 | 1.41 | 2.32 | 0.87 | 1.74 | 15.05 | 0.43 | 0.13 | 29.39 | 11.02 | 22.04 | 190.48 | 5.39 | 1.69 | 5.81 |
| SNSW6 | 8.51 | 0.94 | 0.58 | 8.51 | 8.48 | 6.38 | 3.81 | 1.56 | 2.11 | 0.73 | 1.52 | 13.59 | 0.37 | 0.13 | 28.82 | 10.00 | 20.72 | 185.62 | 5.12 | 1.83 | 6.13 |
| SNSW7 | 8.26 | 0.95 | 0.63 | 7.74 | 7.51 | 5.91 | 3.61 | 1.30 | 1.91 | 0.63 | 1.40 | 17.19 | 0.51 | 0.13 | 24.29 | 8.07 | 17.79 | 218.57 | 6.47 | 1.67 | 5.57 |
| SNSW8 | 8.50 | 0.99 | 0.59 | 8.58 | 8.39 | 6.62 | 3.59 | 1.45 | 2.25 | 0.74 | 1.55 | 14.69 | 0.44 | 0.13 | 28.56 | 9.35 | 19.61 | 186.27 | 5.54 | 1.68 | 5.97 |
| SNSW9 | 8.72 | 0.92 | 0.57 | 8.95 | 8.69 | 6.54 | 3.47 | 1.52 | 2.15 | 0.64 | 1.38 | 20.73 | 0.62 | 0.14 | 26.50 | 7.90 | 16.95 | 255.00 | 7.60 | 1.78 | 6.26 |
| SNSW10 | 8.50 | 1.18 | 0.48 | 6.87 | 7.27 | 6.33 | 3.85 | 1.30 | 1.06 | 0.36 | 0.82 | 11.94 | 0.31 | 0.06 | 15.03 | 5.14 | 11.63 | 168.75 | 4.44 | 0.78 | 5.59 |
| SNSW11 | 8.27 | 0.98 | 0.49 | 7.23 | 8.58 | 5.51 | 3.90 | 1.31 | 1.33 | 0.43 | 0.93 | 15.64 | 0.41 | 0.07 | 15.06 | 4.90 | 10.51 | 176.92 | 4.58 | 0.81 | 5.78 |
| SNSW12 | 8.38 | 1.08 | 0.51 | 7.49 | 8.32 | 6.32 | 3.79 | 1.43 | 1.30 | 0.48 | 0.95 | 12.37 | 0.34 | 0.07 | 16.98 | 6.28 | 12.40 | 161.57 | 4.46 | 0.91 | 6.03 |
| SNSW13 | 9.44 | 1.11 | 0.52 | 8.33 | 8.92 | 7.16 | 4.06 | 1.42 | 1.34 | 0.41 | 0.88 | 12.38 | 0.33 | 0.06 | 17.04 | 5.21 | 11.18 | 157.86 | 4.21 | 0.83 | 6.72 |
| HS1 | 7.98 | 0.90 | 0.60 | 7.83 | 8.37 | 5.57 | 3.63 | 1.37 | 2.17 | 0.74 | 1.68 | 8.39 | 0.27 | 0.14 | 30.89 | 10.52 | 23.93 | 119.26 | 3.78 | 1.96 | 5.66 |
| HS2 | 8.12 | 0.89 | 0.60 | 8.08 | 8.70 | 5.70 | 3.66 | 1.42 | 2.05 | 0.68 | 1.52 | 7.14 | 0.22 | 0.12 | 30.27 | 10.00 | 22.38 | 105.44 | 3.31 | 1.72 | 5.84 |
| HS3 | 8.36 | 0.92 | 0.59 | 8.40 | 9.30 | 6.16 | 3.64 | 1.50 | 2.48 | 0.85 | 1.81 | 8.37 | 0.26 | 0.14 | 36.77 | 12.58 | 26.85 | 124.19 | 3.86 | 2.07 | 6.11 |
| HS4 | 12.68 | 1.03 | 0.65 | 3.93 | 3.85 | 3.65 | 2.35 | 1.24 | 0.69 | 0.35 | 0.97 | 21.88 | 0.60 | 0.07 | 10.07 | 5.03 | 14.17 | 318.13 | 8.66 | 1.07 | 3.27 |
| HS5 | 14.03 | 1.01 | 0.68 | 4.51 | 4.36 | 3.99 | 2.60 | 1.23 | 0.69 | 0.32 | 0.86 | 22.40 | 0.57 | 0.07 | 10.64 | 4.91 | 13.30 | 345.63 | 8.85 | 1.08 | 3.62 |
| HS6 | 14.63 | 0.99 | 0.65 | 4.77 | 4.78 | 4.18 | 2.58 | 1.35 | 0.83 | 0.35 | 1.12 | 19.60 | 0.50 | 0.08 | 13.40 | 5.69 | 18.07 | 317.11 | 8.05 | 1.25 | 3.83 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | MREEN/MREEN\* | LREEN/HREEN | Nb/Ta | Th/Sc | Th/U | La/Th | La/Sc | Zr/Hf | Th/∑REE | Th/(LREE/HREE) | Co/Th | Cr/Th | Th/Co | Cr/V | Y/Ni | La/Co | Cr/Ni | Y/TbN | Y/LaN | Y/NdN |
| HL1 | 0.35 | 5.91 | 11.73 | 1.42 | 5.17 | 3.56 | 5.04 | 34.47 | 0.06 | 1.54 | 0.53 | 3.65 | 1.88 | 0.86 | 2.26 | 6.68 | 3.55 | 1.62 | 0.24 | 0.52 |
| HL2 | 0.34 | 4.84 | 11.12 | 1.31 | 4.23 | 3.67 | 4.81 | 34.17 | 0.06 | 1.36 | 0.48 | 3.84 | 2.08 | 0.84 | 2.89 | 7.64 | 4.33 | 1.74 | 0.26 | 0.60 |
| HL3 | 0.36 | 5.26 | 12.16 | 1.43 | 4.19 | 3.32 | 4.76 | 36.67 | 0.06 | 1.53 | 0.57 | 3.94 | 1.77 | 0.90 | 2.69 | 5.87 | 4.28 | 1.76 | 0.27 | 0.62 |
| HL4 | 0.34 | 5.62 | 11.37 | 2.64 | 4.79 | 2.36 | 6.24 | 36.38 | 0.09 | 5.01 | 0.30 | 2.74 | 3.29 | 0.96 | 2.67 | 7.77 | 4.83 | 1.60 | 0.24 | 0.51 |
| HL5 | 0.37 | 5.81 | 13.31 | 1.24 | 4.58 | 3.52 | 4.38 | 35.76 | 0.06 | 1.07 | 0.70 | 4.04 | 1.42 | 0.79 | 2.12 | 5.00 | 3.51 | 1.59 | 0.25 | 0.57 |
| HQ-OD1 | 0.35 | 6.80 | 24.53 | 2.10 | 5.39 | 2.89 | 6.06 | 31.64 | 0.07 | 2.23 | 0.35 | 2.59 | 2.86 | 0.72 | 2.34 | 8.27 | 3.64 | 1.52 | 0.21 | 0.44 |
| HQ-OD2 | 0.38 | 4.83 | 14.61 | 1.54 | 5.04 | 2.56 | 3.94 | 30.98 | 0.08 | 1.67 | 0.45 | 3.35 | 2.25 | 0.72 | 2.23 | 5.76 | 3.66 | 1.78 | 0.29 | 0.61 |
| HQ-OD3 | 0.32 | 7.87 | 52.79 | 3.40 | 6.62 | 2.42 | 8.25 | 26.17 | 0.10 | 4.37 | 0.24 | 2.30 | 4.21 | 0.92 | 2.84 | 10.20 | 5.43 | 1.46 | 0.18 | 0.40 |
| HQ-OD4 | 0.31 | 8.67 | 37.18 | 4.64 | 7.31 | 2.35 | 10.88 | 25.83 | 0.10 | 6.57 | 0.18 | 2.27 | 5.68 | 0.89 | 3.65 | 13.33 | 7.91 | 1.35 | 0.16 | 0.35 |
| HQ-OD5 | 0.38 | 5.24 | 13.65 | 1.26 | 4.05 | 2.82 | 3.55 | 30.66 | 0.07 | 1.29 | 0.58 | 4.01 | 1.71 | 0.68 | 1.50 | 4.82 | 2.81 | 1.77 | 0.28 | 0.60 |
| HQ-OD6 | 0.33 | 6.92 | 13.84 | 2.13 | 5.80 | 2.88 | 6.14 | 31.98 | 0.07 | 2.25 | 0.39 | 2.78 | 2.59 | 0.69 | 2.23 | 7.46 | 3.78 | 1.56 | 0.21 | 0.45 |
| HQ-OD7 | 0.33 | 7.36 | 13.72 | 2.50 | 6.37 | 2.61 | 6.54 | 31.19 | 0.08 | 3.08 | 0.26 | 2.15 | 3.85 | 0.70 | 2.90 | 10.07 | 4.53 | 1.48 | 0.19 | 0.43 |
| HQ-OD8 | 0.36 | 5.51 | 13.97 | 1.71 | 5.73 | 2.59 | 4.42 | 32.33 | 0.08 | 1.70 | 0.41 | 2.94 | 2.42 | 0.68 | 2.30 | 6.27 | 3.56 | 1.80 | 0.27 | 0.56 |
| HQ-OD9 | 0.35 | 6.53 | 13.72 | 1.61 | 5.94 | 2.96 | 4.78 | 31.15 | 0.07 | 1.45 | 0.46 | 3.12 | 2.18 | 0.72 | 1.82 | 6.46 | 3.12 | 1.59 | 0.22 | 0.50 |
| HQ-OD10 | 0.35 | 5.89 | 13.62 | 1.56 | 5.03 | 2.97 | 4.63 | 29.92 | 0.07 | 1.61 | 0.49 | 3.28 | 2.02 | 0.71 | 1.80 | 6.00 | 3.01 | 1.65 | 0.24 | 0.53 |
| HQ-OD11 | 0.36 | 5.93 | 14.32 | 1.64 | 5.48 | 2.67 | 4.38 | 31.28 | 0.08 | 1.86 | 0.43 | 2.85 | 2.34 | 0.69 | 2.14 | 6.26 | 3.34 | 1.67 | 0.25 | 0.53 |
| HQ-OD12 | 0.35 | 6.07 | 13.95 | 2.24 | 6.36 | 2.42 | 5.41 | 30.89 | 0.09 | 2.33 | 0.27 | 2.28 | 3.73 | 0.76 | 3.01 | 9.01 | 4.45 | 1.58 | 0.23 | 0.49 |
| HQ-OD13 | 0.34 | 6.35 | 14.12 | 1.06 | 5.26 | 3.10 | 3.29 | 31.42 | 0.07 | 1.32 | 0.43 | 2.57 | 2.33 | 0.61 | 2.11 | 7.23 | 2.83 | 1.66 | 0.23 | 0.51 |
| HQ-OD14 | 0.36 | 5.54 | 14.13 | 1.01 | 4.24 | 3.05 | 3.08 | 31.40 | 0.07 | 1.37 | 0.50 | 3.73 | 2.01 | 0.75 | 2.07 | 6.13 | 3.52 | 1.70 | 0.26 | 0.55 |
| HQ-OD15 | 0.35 | 6.21 | 14.06 | 1.75 | 5.99 | 2.63 | 4.60 | 31.56 | 0.08 | 2.34 | 0.35 | 2.79 | 2.82 | 0.77 | 2.25 | 7.43 | 3.79 | 1.58 | 0.23 | 0.49 |
| HQ-OD16 | 0.37 | 5.68 | 12.20 | 1.19 | 4.94 | 3.20 | 3.82 | 31.65 | 0.06 | 1.47 | 0.73 | 4.35 | 1.37 | 0.67 | 1.26 | 4.38 | 2.42 | 1.64 | 0.26 | 0.54 |
| HQ-OD17 | 0.33 | 7.19 | 13.38 | 2.66 | 6.66 | 2.70 | 7.17 | 30.71 | 0.08 | 2.90 | 0.22 | 1.77 | 4.56 | 0.73 | 3.76 | 12.30 | 4.38 | 1.52 | 0.21 | 0.44 |
| HQ-OD18 | 0.35 | 6.27 | 14.33 | 2.11 | 5.60 | 2.86 | 6.02 | 31.10 | 0.07 | 1.98 | 0.30 | 2.52 | 3.38 | 0.70 | 3.37 | 9.65 | 4.61 | 1.58 | 0.24 | 0.49 |
| HQ-OD19 | 0.35 | 6.14 | 13.48 | 2.44 | 5.64 | 2.31 | 5.64 | 31.04 | 0.09 | 2.67 | 0.36 | 3.12 | 2.81 | 0.82 | 1.97 | 6.48 | 4.31 | 1.52 | 0.23 | 0.47 |
| HQ-OD20 | 0.34 | 6.89 | 13.53 | 2.27 | 5.84 | 2.76 | 6.26 | 30.99 | 0.08 | 1.96 | 0.34 | 3.25 | 2.94 | 0.77 | 2.35 | 8.12 | 4.89 | 1.46 | 0.21 | 0.43 |
| HQ-OD21 | 0.32 | 7.62 | 13.04 | 3.27 | 6.45 | 2.32 | 7.59 | 31.10 | 0.09 | 2.93 | 0.25 | 2.41 | 3.93 | 0.80 | 2.27 | 9.12 | 4.80 | 1.44 | 0.18 | 0.40 |
| HQ-OD22 | 0.33 | 7.04 | 12.00 | 2.11 | 6.03 | 2.83 | 5.97 | 34.37 | 0.07 | 1.79 | 0.53 | 2.38 | 1.87 | 0.56 | 1.61 | 5.29 | 2.76 | 1.32 | 0.18 | 0.39 |
| HQ-OD23 | 0.38 | 5.77 | 13.79 | 1.21 | 5.02 | 2.95 | 3.58 | 30.77 | 0.07 | 1.57 | 0.87 | 4.62 | 1.15 | 0.66 | 1.02 | 3.39 | 2.32 | 1.58 | 0.25 | 0.53 |
| HQ-OD24 | 0.33 | 7.65 | 11.00 | 2.59 | 6.32 | 2.46 | 6.38 | 29.64 | 0.09 | 2.73 | 0.37 | 2.92 | 2.69 | 0.80 | 1.78 | 6.62 | 4.23 | 1.36 | 0.18 | 0.39 |
| HQ-OD25 | 0.36 | 5.70 | 12.97 | 1.57 | 4.85 | 2.95 | 4.62 | 30.85 | 0.07 | 1.48 | 0.58 | 3.85 | 1.73 | 0.74 | 1.60 | 5.11 | 3.23 | 1.58 | 0.24 | 0.52 |
| HQ-OD26 | 0.36 | 5.40 | 12.69 | 1.38 | 4.33 | 2.84 | 3.92 | 31.13 | 0.07 | 1.13 | 0.54 | 4.28 | 1.85 | 0.81 | 1.54 | 5.24 | 3.45 | 1.64 | 0.25 | 0.56 |
| HQ-OD27 | 0.35 | 6.55 | 13.49 | 1.73 | 5.30 | 2.76 | 4.76 | 30.42 | 0.08 | 1.63 | 0.65 | 3.82 | 1.53 | 0.68 | 1.09 | 4.21 | 2.64 | 1.47 | 0.21 | 0.46 |
| HQ-OD28 | 0.38 | 5.31 | 12.77 | 1.03 | 3.82 | 3.29 | 3.37 | 30.21 | 0.06 | 1.07 | 0.92 | 5.55 | 1.08 | 0.75 | 1.16 | 3.56 | 2.66 | 1.70 | 0.27 | 0.58 |
| HQ-OD29 | 0.35 | 6.52 | 12.00 | 1.54 | 5.37 | 3.07 | 4.72 | 32.95 | 0.07 | 1.61 | 0.68 | 4.02 | 1.48 | 0.65 | 1.42 | 4.55 | 2.96 | 1.68 | 0.23 | 0.51 |
| HQ-OD30 | 0.39 | 5.98 | 13.33 | 1.49 | 4.22 | 3.43 | 5.12 | 33.03 | 0.06 | 1.17 | 1.30 | 3.91 | 0.77 | 0.57 | 0.86 | 2.64 | 1.27 | 1.75 | 0.28 | 0.60 |
| HQ-OD31 | 0.38 | 5.46 | 14.50 | 1.26 | 4.02 | 3.23 | 4.06 | 32.42 | 0.07 | 1.25 | 0.89 | 5.31 | 1.12 | 0.76 | 1.34 | 3.62 | 2.87 | 1.74 | 0.28 | 0.60 |
| HQ-OD32 | 0.42 | 6.37 | 15.30 | 1.89 | 5.11 | 3.96 | 7.50 | 33.10 | 0.06 | 2.01 | 0.88 | 3.58 | 1.14 | 0.67 | 1.96 | 4.51 | 2.04 | 1.77 | 0.32 | 0.64 |
| SNNW1 | 0.39 | 5.73 | 12.64 | 1.46 | 5.60 | 3.13 | 4.58 | 37.84 | 0.07 | 1.81 | 0.81 | 3.81 | 1.23 | 0.73 | 1.42 | 3.86 | 2.32 | 1.58 | 0.27 | 0.59 |
| SNNW2 | 0.38 | 4.76 | 12.59 | 1.21 | 4.81 | 3.16 | 3.83 | 37.25 | 0.06 | 1.61 | 0.91 | 4.19 | 1.10 | 0.73 | 1.74 | 3.46 | 2.66 | 1.84 | 0.32 | 0.68 |
| SNNW3 | 0.37 | 5.60 | 11.24 | 1.42 | 4.52 | 3.41 | 4.82 | 34.61 | 0.06 | 1.80 | 0.99 | 3.94 | 1.01 | 0.66 | 1.99 | 3.45 | 3.30 | 1.57 | 0.26 | 0.57 |
| SNNW4 | 0.34 | 6.13 | 12.96 | 1.84 | 4.39 | 3.15 | 5.82 | 38.86 | 0.07 | 2.14 | 0.77 | 6.47 | 1.31 | 1.40 | 1.65 | 4.12 | 5.12 | 1.70 | 0.24 | 0.54 |
| SNNW5 | 0.36 | 5.76 | 12.93 | 1.45 | 3.77 | 3.31 | 4.78 | 40.13 | 0.06 | 1.56 | 1.01 | 4.26 | 0.99 | 0.77 | 2.29 | 3.26 | 4.11 | 1.69 | 0.26 | 0.58 |
| SNNW6 | 0.35 | 5.23 | 12.97 | 1.49 | 4.08 | 3.39 | 5.05 | 38.34 | 0.06 | 1.59 | 1.55 | 4.53 | 0.64 | 0.77 | 1.91 | 2.18 | 3.64 | 1.70 | 0.26 | 0.58 |
| SNNW7 | 0.38 | 5.35 | 13.16 | 1.28 | 4.67 | 3.45 | 4.40 | 38.18 | 0.06 | 1.75 | 1.23 | 4.81 | 0.81 | 0.82 | 1.78 | 2.80 | 3.28 | 1.74 | 0.28 | 0.63 |
| SNNW8 | 0.36 | 5.36 | 13.81 | 1.80 | 5.35 | 2.63 | 4.74 | 37.82 | 0.08 | 1.62 | 0.79 | 2.95 | 1.27 | 0.65 | 2.23 | 3.33 | 3.44 | 1.71 | 0.27 | 0.59 |
| SNNW9 | 0.36 | 5.00 | 13.95 | 1.76 | 4.76 | 2.89 | 5.10 | 38.01 | 0.07 | 2.12 | 0.94 | 3.52 | 1.06 | 0.76 | 2.09 | 3.06 | 3.50 | 1.74 | 0.27 | 0.60 |
| SNNW10 | 0.37 | 4.90 | 12.86 | 1.52 | 4.93 | 2.78 | 4.23 | 39.27 | 0.07 | 2.11 | 0.76 | 4.02 | 1.31 | 0.80 | 1.25 | 3.64 | 2.40 | 1.88 | 0.28 | 0.64 |
| SNNW11 | 0.35 | 5.07 | 10.95 | 2.79 | 4.55 | 2.55 | 7.11 | 37.63 | 0.08 | 3.66 | 0.31 | 2.78 | 3.23 | 0.83 | 4.18 | 8.23 | 6.67 | 1.71 | 0.25 | 0.54 |
| SNNW12 | 0.38 | 4.91 | 12.90 | 1.65 | 4.66 | 2.95 | 4.86 | 38.15 | 0.07 | 1.78 | 0.74 | 3.48 | 1.36 | 0.58 | 1.77 | 4.00 | 2.56 | 1.76 | 0.30 | 0.60 |
| SNNW13 | 0.40 | 5.06 | 13.19 | 1.31 | 5.12 | 2.96 | 3.89 | 40.43 | 0.07 | 2.24 | 0.91 | 4.28 | 1.10 | 0.72 | 1.42 | 3.25 | 2.51 | 1.82 | 0.30 | 0.69 |
| SNNW14 | 0.38 | 4.63 | 11.82 | 2.13 | 4.99 | 2.50 | 5.33 | 38.83 | 0.08 | 2.81 | 0.38 | 3.01 | 2.66 | 0.90 | 2.98 | 6.67 | 4.56 | 1.74 | 0.29 | 0.60 |
| SNSW1 | 0.37 | 5.94 | 12.39 | 1.54 | 5.65 | 2.68 | 4.13 | 34.65 | 0.08 | 2.05 | 0.58 | 3.51 | 1.71 | 0.74 | 1.47 | 4.58 | 2.71 | 1.73 | 0.26 | 0.52 |
| SNSW2 | 0.37 | 5.50 | 12.60 | 1.25 | 4.95 | 3.12 | 3.90 | 34.34 | 0.07 | 1.60 | 0.95 | 4.84 | 1.05 | 0.71 | 1.00 | 3.29 | 2.08 | 1.79 | 0.27 | 0.60 |
| SNSW3 | 0.39 | 5.22 | 12.67 | 1.17 | 5.66 | 2.94 | 3.45 | 31.38 | 0.07 | 1.80 | 0.92 | 4.59 | 1.09 | 0.82 | 1.26 | 3.22 | 2.63 | 1.66 | 0.27 | 0.58 |
| SNSW4 | 0.35 | 5.87 | 9.24 | 1.50 | 5.71 | 2.81 | 4.20 | 34.51 | 0.07 | 2.13 | 0.89 | 4.01 | 1.13 | 0.87 | 1.32 | 3.17 | 2.82 | 1.62 | 0.25 | 0.52 |
| SNSW5 | 0.38 | 5.45 | 12.65 | 1.32 | 6.51 | 2.67 | 3.51 | 35.31 | 0.08 | 1.93 | 0.80 | 4.08 | 1.26 | 0.80 | 1.38 | 3.35 | 2.82 | 1.69 | 0.28 | 0.59 |
| SNSW6 | 0.37 | 5.85 | 13.66 | 1.33 | 5.46 | 2.88 | 3.83 | 36.27 | 0.07 | 1.80 | 0.69 | 3.76 | 1.44 | 0.73 | 1.64 | 4.16 | 2.98 | 1.77 | 0.26 | 0.56 |
| SNSW7 | 0.37 | 5.32 | 12.71 | 1.19 | 4.83 | 3.01 | 3.57 | 33.77 | 0.07 | 1.37 | 0.76 | 4.68 | 1.31 | 0.90 | 1.47 | 3.94 | 3.13 | 1.69 | 0.27 | 0.56 |
| SNSW8 | 0.38 | 5.73 | 12.68 | 1.09 | 5.56 | 3.06 | 3.34 | 33.61 | 0.07 | 1.68 | 0.92 | 4.67 | 1.08 | 0.82 | 1.09 | 3.31 | 2.43 | 1.57 | 0.25 | 0.53 |
| SNSW9 | 0.36 | 6.08 | 12.30 | 1.37 | 4.45 | 3.35 | 4.61 | 33.55 | 0.06 | 1.81 | 0.59 | 4.91 | 1.70 | 0.88 | 1.63 | 5.72 | 3.73 | 1.57 | 0.23 | 0.49 |
| SNSW10 | 0.38 | 4.89 | 14.13 | 1.23 | 6.58 | 2.93 | 3.61 | 37.97 | 0.06 | 1.74 | 0.99 | 4.39 | 1.01 | 0.77 | 1.54 | 2.95 | 2.98 | 1.83 | 0.28 | 0.62 |
| SNSW11 | 0.36 | 5.49 | 11.31 | 1.21 | 6.02 | 3.07 | 3.73 | 38.60 | 0.07 | 1.85 | 0.72 | 5.05 | 1.39 | 0.99 | 1.62 | 4.27 | 3.81 | 1.78 | 0.26 | 0.57 |
| SNSW12 | 0.40 | 5.53 | 13.06 | 1.29 | 6.88 | 2.70 | 3.48 | 36.20 | 0.07 | 1.81 | 0.78 | 4.04 | 1.29 | 0.80 | 1.49 | 3.48 | 3.05 | 1.61 | 0.27 | 0.57 |
| SNSW13 | 0.37 | 6.04 | 12.75 | 1.13 | 6.32 | 3.27 | 3.70 | 37.46 | 0.06 | 1.55 | 0.99 | 4.21 | 1.01 | 0.80 | 1.42 | 3.31 | 2.80 | 1.58 | 0.24 | 0.55 |
| HS1 | 0.38 | 5.46 | 14.22 | 1.15 | 5.38 | 2.94 | 3.36 | 31.57 | 0.07 | 1.78 | 0.79 | 4.41 | 1.27 | 0.68 | 1.21 | 3.72 | 2.34 | 1.75 | 0.28 | 0.61 |
| HS2 | 0.38 | 5.66 | 14.76 | 1.07 | 5.81 | 3.03 | 3.25 | 31.83 | 0.07 | 1.81 | 0.84 | 4.55 | 1.19 | 0.74 | 1.19 | 3.59 | 2.42 | 1.70 | 0.27 | 0.57 |
| HS3 | 0.38 | 5.87 | 14.84 | 1.17 | 6.07 | 2.92 | 3.43 | 32.15 | 0.07 | 1.87 | 0.74 | 4.30 | 1.36 | 0.66 | 1.07 | 3.97 | 2.15 | 1.69 | 0.27 | 0.57 |
| HS4 | 0.51 | 3.09 | 14.53 | 1.14 | 4.71 | 2.00 | 2.29 | 36.73 | 0.08 | 1.29 | 1.95 | 14.22 | 0.51 | 0.84 | 0.42 | 1.02 | 2.10 | 1.93 | 0.52 | 0.84 |
| HS5 | 0.47 | 3.42 | 15.42 | 1.47 | 4.52 | 2.17 | 3.19 | 39.06 | 0.07 | 1.06 | 2.45 | 14.61 | 0.41 | 0.82 | 0.39 | 0.88 | 2.12 | 1.96 | 0.46 | 0.79 |
| HS6 | 0.49 | 3.65 | 16.17 | 1.47 | 4.57 | 2.35 | 3.46 | 39.42 | 0.07 | 1.17 | 2.14 | 13.66 | 0.47 | 0.75 | 0.41 | 1.10 | 1.78 | 2.12 | 0.50 | 0.87 |

Supplementary Table 2a Concentrations (wt %) of major elements for the <10 μm fraction in the Northeast Sandy Lands.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | SiO2 | Al2O3 | Fe2O3 | MgO | CaO | Na2O | K2O | MnO | TiO2 | P2O5 | LOI | FeO |
| HL1 | 70.41 | 13.26 | 3.1 | 0.981 | 1.7 | 3.15 | 3.1 | 0.07 | 0.893 | 0.075 | 3.09 | 0.95 |
| HL2 | 72.65 | 12.64 | 2.56 | 0.715 | 1.68 | 3.15 | 3.13 | 0.064 | 0.898 | 0.064 | 2.42 | 0.91 |
| HL3 | 72.51 | 12.73 | 2.67 | 0.781 | 1.79 | 3.23 | 3.09 | 0.076 | 0.927 | 0.072 | 2.08 | 0.88 |
| HL4 | 55.33 | 12.78 | 6.48 | 1.98 | 6.62 | 2.34 | 2.41 | 0.202 | 2.39 | 0.152 | 8.72 | 1.85 |
| HL5 | 72.34 | 12.72 | 2.6 | 0.747 | 1.82 | 3.46 | 3.36 | 0.068 | 0.872 | 0.058 | 1.85 | 0.94 |
| HQ1 | 69.33 | 11.7 | 3.22 | 1.03 | 3.4 | 2.51 | 2.59 | 0.095 | 1.42 | 0.092 | 4.59 | 1.35 |
| HQ2 | 73.69 | 11.99 | 2.85 | 0.791 | 1.7 | 2.84 | 2.78 | 0.067 | 1.03 | 0.067 | 2.18 | 1.07 |
| HQ3 | 69.03 | 12.29 | 4.71 | 1.21 | 2.56 | 2.94 | 2.52 | 0.147 | 2.43 | 0.173 | 1.98 | 2.16 |
| HQ4 | 67.93 | 10.86 | 6.88 | 1.1 | 3.01 | 2.53 | 2.22 | 0.181 | 3.01 | 0.166 | 2.07 | 2.98 |
| HQ5 | 73.43 | 12.15 | 3.14 | 0.833 | 1.56 | 2.81 | 2.66 | 0.055 | 0.828 | 0.069 | 2.42 | 1.25 |
| HQ6 | 71.87 | 11.27 | 4.11 | 0.981 | 2.42 | 2.62 | 2.4 | 0.092 | 1.47 | 0.119 | 2.6 | 1.21 |
| HQ7 | 71.86 | 11.34 | 4.33 | 0.94 | 2.12 | 2.6 | 2.44 | 0.114 | 1.83 | 0.117 | 2.27 | 1.69 |
| HQ8 | 73.83 | 11.47 | 3.28 | 0.837 | 1.82 | 2.75 | 2.58 | 0.078 | 1.21 | 0.095 | 2.02 | 1.22 |
| HQ9 | 73.8 | 11.72 | 2.79 | 0.814 | 1.65 | 2.77 | 2.67 | 0.066 | 0.931 | 0.076 | 2.69 | 1.52 |
| HQ10 | 73.13 | 11.72 | 3.19 | 0.888 | 1.77 | 2.7 | 2.57 | 0.073 | 1.11 | 0.095 | 2.7 | 1.66 |
| HQ11 | 73.22 | 11.87 | 3.24 | 0.855 | 1.66 | 2.75 | 2.65 | 0.071 | 1.06 | 0.084 | 2.54 | 0.96 |
| HQ12 | 74.17 | 11.51 | 2.92 | 0.69 | 1.72 | 2.78 | 2.7 | 0.077 | 1.24 | 0.067 | 2.12 | 1.13 |
| HQ13 | 73.54 | 11.83 | 2.85 | 0.775 | 1.6 | 2.8 | 2.67 | 0.059 | 0.91 | 0.074 | 2.85 | 1.28 |
| HQ14 | 73.47 | 11.8 | 2.71 | 0.762 | 1.6 | 2.79 | 2.59 | 0.057 | 0.89 | 0.079 | 3.23 | 1.32 |
| HQ15 | 70.94 | 11.94 | 3.35 | 1.06 | 2.74 | 2.57 | 2.49 | 0.074 | 1.41 | 0.096 | 3.32 | 1.14 |
| HQ16 | 67.79 | 12.02 | 3.59 | 1.24 | 4 | 2.36 | 2.53 | 0.064 | 0.908 | 0.091 | 5.39 | 1.05 |
| HQ17 | 73.61 | 11.47 | 3.15 | 0.787 | 2.11 | 2.89 | 2.53 | 0.103 | 1.8 | 0.087 | 1.42 | 1.05 |
| HQ18 | 74.88 | 11.41 | 2.7 | 0.654 | 1.68 | 2.81 | 2.79 | 0.076 | 1.2 | 0.064 | 1.71 | 1.37 |
| OD1 | 71.61 | 11.65 | 4.18 | 0.987 | 2.22 | 2.71 | 2.56 | 0.101 | 1.46 | 0.135 | 2.34 | 1.24 |
| OD2 | 72.93 | 11.63 | 3.71 | 0.765 | 1.72 | 2.81 | 2.57 | 0.087 | 1.37 | 0.086 | 2.31 | 1.35 |
| OD3 | 71.55 | 11.93 | 4.56 | 0.95 | 1.94 | 2.75 | 2.54 | 0.108 | 1.63 | 0.11 | 1.92 | 1.29 |
| OD4 | 72.99 | 11.89 | 3.53 | 0.934 | 1.65 | 2.79 | 2.67 | 0.091 | 1.18 | 0.13 | 2.12 | 0.84 |
| OD5 | 62.62 | 12.23 | 4.13 | 1.78 | 5.7 | 2.03 | 2.43 | 0.078 | 0.797 | 0.155 | 8.02 | 1.03 |
| OD6 | 69.18 | 11.8 | 4.57 | 1.22 | 3.03 | 2.65 | 2.46 | 0.103 | 1.49 | 0.144 | 3.31 | 1.52 |
| OD7 | 73.24 | 12.01 | 3.13 | 0.959 | 1.62 | 2.75 | 2.66 | 0.062 | 0.956 | 0.109 | 2.47 | 1.16 |
| OD8 | 74.66 | 11.55 | 2.75 | 0.761 | 1.19 | 2.64 | 2.33 | 0.042 | 0.726 | 0.072 | 3.24 | 0.87 |
| OD9 | 70.65 | 12.01 | 4.19 | 1.28 | 2.25 | 2.47 | 2.46 | 0.091 | 0.963 | 0.142 | 3.45 | 1.74 |
| OD10 | 71.73 | 12.11 | 3.46 | 1.21 | 1.51 | 2.55 | 2.34 | 0.062 | 0.727 | 0.135 | 4.1 | 1.68 |
| OD11 | 68.15 | 12.02 | 4.64 | 1.36 | 2.75 | 2.35 | 2.33 | 0.095 | 1.02 | 0.134 | 5.13 | 1.53 |
| OD12 | 41.92 | 7.54 | 2.65 | 1.4 | 22.48 | 1.53 | 1.44 | 0.136 | 0.522 | 0.093 | 20.2 | 1.23 |
| OD13 | 65.54 | 10.63 | 3.17 | 2.24 | 5.4 | 2.16 | 2.24 | 0.071 | 0.743 | 0.102 | 7.68 | 1.03 |
| OD14 | 55.66 | 9.87 | 3.44 | 1.39 | 12.22 | 2.03 | 1.97 | 0.117 | 0.778 | 0.1 | 12.39 | 0.97 |
| SNNW1 | 65.75 | 13.13 | 3.11 | 0.967 | 4.24 | 2.64 | 2.72 | 0.068 | 0.753 | 0.053 | 1 | 6.53 |
| SNNW2 | 71.17 | 13.18 | 2.9 | 0.798 | 1.35 | 2.63 | 2.7 | 0.092 | 0.74 | 0.061 | 0.53 | 4.36 |
| SNNW3 | 70.03 | 13.26 | 3.74 | 0.909 | 1.95 | 3.07 | 2.8 | 0.116 | 1.14 | 0.123 | 0.83 | 2.75 |
| SNNW4 | 68.13 | 13.12 | 4.37 | 0.823 | 1.75 | 2.9 | 2.9 | 0.129 | 1.04 | 0.136 | 1.1 | 4.68 |
| SNNW5 | 71.56 | 13.15 | 3 | 0.704 | 1.56 | 3.07 | 2.95 | 0.093 | 0.895 | 0.113 | 0.45 | 2.9 |
| SNNW6 | 71.62 | 13.14 | 3.18 | 0.819 | 1.72 | 2.95 | 2.91 | 0.102 | 0.964 | 0.118 | 0.65 | 2.47 |
| SNNW7 | 69.53 | 13.36 | 3.94 | 0.905 | 1.61 | 2.88 | 2.78 | 0.1 | 0.928 | 0.148 | 0.38 | 3.75 |
| SNNW8 | 72.78 | 12.95 | 2.52 | 0.695 | 1.53 | 3.04 | 2.84 | 0.081 | 0.752 | 0.075 | 0.48 | 2.67 |
| SNNW9 | 71.33 | 12.97 | 3.15 | 0.864 | 1.75 | 3.11 | 2.93 | 0.11 | 0.934 | 0.111 | 0.4 | 2.7 |
| SNNW10 | 69.93 | 13.5 | 3.65 | 1.06 | 1.85 | 3.06 | 2.88 | 0.082 | 1.03 | 0.09 | 0.45 | 2.85 |
| SNNW11 | 70.27 | 12.53 | 4.43 | 0.83 | 1.87 | 3.12 | 2.83 | 0.118 | 1.7 | 0.109 | 1.2 | 2.11 |
| SNNW12 | 67.77 | 12.07 | 2.91 | 0.912 | 4.44 | 2.84 | 2.75 | 0.08 | 0.899 | 0.067 | 1 | 5.17 |
| SNNW13 | 65.62 | 13.9 | 4.38 | 1.35 | 2.21 | 2.45 | 2.72 | 0.107 | 0.936 | 0.124 | 1.1 | 6.15 |
| SNSW1 | 60.9 | 12.53 | 4.11 | 1.49 | 6.62 | 2.34 | 2.43 | 0.096 | 1.1 | 0.103 | 1.03 | 8.2 |
| SNSW2 | 54.42 | 11.81 | 3.65 | 1.91 | 10.73 | 2.06 | 2.21 | 0.084 | 0.769 | 0.085 | 0.89 | 12.26 |
| SNSW3 | 64.9 | 14.45 | 4.69 | 1.61 | 2 | 2.37 | 2.77 | 0.11 | 0.84 | 0.124 | 0.78 | 6.07 |
| SNSW4 | 63.71 | 14.25 | 5.03 | 1.53 | 2.71 | 2.23 | 2.68 | 0.166 | 1.09 | 0.134 | 0.98 | 6.42 |
| SNSW5 | 64.63 | 14.45 | 4.87 | 1.5 | 2.19 | 2.29 | 2.75 | 0.093 | 0.898 | 0.137 | 0.95 | 6.17 |
| SNSW6 | 66.61 | 13.77 | 4.35 | 1.25 | 2.35 | 2.57 | 2.82 | 0.106 | 1.02 | 0.12 | 1.16 | 4.95 |
| SNSW7 | 69.31 | 13.64 | 3.9 | 1.2 | 1.56 | 2.61 | 2.77 | 0.054 | 0.843 | 0.104 | 0.7 | 3.96 |
| SNSW8 | 65.11 | 14.63 | 5.18 | 1.61 | 1.51 | 2.1 | 2.67 | 0.064 | 0.879 | 0.124 | 0.67 | 6.08 |
| SNSW9 | 68.76 | 13.51 | 4.53 | 1.16 | 1.8 | 2.61 | 2.56 | 0.068 | 1.2 | 0.117 | 0.83 | 3.68 |
| SNSW10 | 65.67 | 13.84 | 6.01 | 1.21 | 1.84 | 2.8 | 2.85 | 0.112 | 0.974 | 0.167 | 0.75 | 4.52 |
| SNSW11 | 67.01 | 13.63 | 5.36 | 1.15 | 1.86 | 2.82 | 2.77 | 0.078 | 1.04 | 0.137 | 1.45 | 4.1 |
| SNSW12 | 67.52 | 13.41 | 5.15 | 1.19 | 1.76 | 2.83 | 2.87 | 0.098 | 0.915 | 0.138 | 0.96 | 4.08 |
| SNSW13 | 66.39 | 13.81 | 5.49 | 1.14 | 1.88 | 2.88 | 2.84 | 0.096 | 1.03 | 0.144 | 1.07 | 4.28 |

Major elements without recalculation on a volatile-free basis.

Total iron as Fe2O3.

Note: The HL1 to HL5 samples are from the Hulun Buir Sandy Land; the HQ1 to HQ18 samples are from the Horqin Sandy Land; the OD1 to OD14 samples are from the Onqin Daga Sandy Land; the SNNW1 to SNNW13 are from the northwestern area of the Songnen Sandy Land; the SNSW1 to SNSW13 samples are from the southwestern area of the Songnen Sandy Land.

Supplementary Table 2b Concentrations (ppm) of trace elements and REE of the <10 μm fraction in the Northeast Sandy Lands.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | Sc | V | Cr | Co | Ni | Cu | Zn | Ga | Rb | Sr | Y | Nb | Cs | Ba | Ta | Pb | Th | U | Zr | Hf | La | Ce | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er | Yb | Lu | Li | Be |
| HL1 | 9.68 | 58.3 | 50 | 7.3 | 14.1 | 20.9 | 50.3 | 15.9 | 101 | 270 | 31.8 | 19 | 4.86 | 693 | 1.62 | 20.3 | 13.7 | 2.65 | 334 | 9.69 | 48.8 | 90.7 | 11.4 | 43.4 | 7.54 | 1.41 | 6.81 | 1.14 | 5.49 | 1.09 | 3.31 | 3.93 | 0.572 | 18.2 | 2.23 |
| HL2 | 8.77 | 52.4 | 44.2 | 5.52 | 10.2 | 16.8 | 45.6 | 15.3 | 99.2 | 273 | 29.5 | 18.8 | 3.91 | 667 | 1.69 | 18.9 | 11.5 | 2.72 | 410 | 12 | 42.2 | 83.6 | 9.53 | 35 | 6.39 | 1.21 | 5.42 | 0.986 | 5 | 1.08 | 3.18 | 4.23 | 0.581 | 15.8 | 2.56 |
| HL3 | 8.79 | 55.3 | 49.6 | 7.12 | 11.6 | 20.7 | 48 | 15.1 | 96 | 282 | 31.2 | 20.3 | 4.09 | 663 | 1.67 | 20.1 | 12.6 | 3.01 | 396 | 10.8 | 41.8 | 79.8 | 9.42 | 35.8 | 6.38 | 1.29 | 5.63 | 1.03 | 5.34 | 1.12 | 3 | 3.97 | 0.481 | 15.2 | 2.38 |
| HL4 | 17.3 | 130 | 125 | 13.9 | 25.9 | 36.7 | 105 | 20.4 | 88.5 | 363 | 69.2 | 41.4 | 6.49 | 728 | 3.64 | 23.7 | 45.7 | 9.54 | 1317 | 36.2 | 108 | 213 | 25 | 97.2 | 17 | 1.96 | 14.7 | 2.51 | 12 | 2.43 | 6.98 | 9.45 | 1.36 | 13.8 | 2.1 |
| HL5 | 7.81 | 49.5 | 39.3 | 6.84 | 11.2 | 23.3 | 40.6 | 14.2 | 97.6 | 289 | 23.7 | 15.7 | 3.8 | 715 | 1.18 | 19.5 | 9.72 | 2.12 | 221 | 6.18 | 34.2 | 72 | 7.74 | 29.6 | 5.28 | 1.21 | 4.76 | 0.866 | 4.12 | 0.827 | 2.37 | 2.8 | 0.434 | 12.5 | 2.16 |
| HQ1 | 10.1 | 76.1 | 54.9 | 7.4 | 15.1 | 32.9 | 54.4 | 13.6 | 92.3 | 215 | 35.4 | 22.3 | 4.22 | 549 | 0.909 | 19.2 | 21.2 | 3.93 | 224 | 7.08 | 61.2 | 119 | 14.7 | 57.5 | 10.7 | 1.46 | 8.68 | 1.35 | 7.09 | 1.34 | 3.81 | 4.29 | 0.623 | 18.1 | 1.98 |
| HQ2 | 8.53 | 60.7 | 43.9 | 5.83 | 12 | 26.4 | 43.3 | 12.7 | 94.3 | 201 | 26.7 | 16.8 | 3.78 | 579 | 1.15 | 17.4 | 13.1 | 2.6 | 180 | 5.81 | 33.6 | 67.6 | 8.17 | 31.1 | 6.06 | 1.07 | 5.05 | 0.871 | 4.81 | 0.938 | 2.74 | 3.38 | 0.479 | 15.2 | 2.09 |
| HQ3 | 12.6 | 107 | 98.8 | 10.2 | 18.2 | 41.9 | 96.4 | 16.1 | 87.4 | 252 | 51.6 | 35.9 | 3.56 | 622 | 0.68 | 24.5 | 42.9 | 6.48 | 348 | 13.3 | 104 | 165 | 24.5 | 92.3 | 16.6 | 1.91 | 13.5 | 2.05 | 10.2 | 1.91 | 5.33 | 6.32 | 0.92 | 17.9 | 1.9 |
| HQ4 | 14.7 | 175 | 155 | 12 | 19.6 | 42.6 | 112 | 15.9 | 78.8 | 233 | 71.5 | 40.9 | 3.09 | 507 | 1.1 | 24.3 | 68.2 | 9.33 | 532 | 20.6 | 160 | 248 | 38.3 | 145 | 25.8 | 2.37 | 20.7 | 3.07 | 14.4 | 2.63 | 7.49 | 8.78 | 1.28 | 15.5 | 1.77 |
| HQ5 | 8.33 | 61.5 | 42.1 | 6.14 | 15 | 24.1 | 47.8 | 13.9 | 103 | 206 | 22.5 | 13.1 | 4.62 | 620 | 0.96 | 21.6 | 10.5 | 2.59 | 97.5 | 3.18 | 29.6 | 60.3 | 6.96 | 26.5 | 5.15 | 0.985 | 4.28 | 0.738 | 4.19 | 0.833 | 2.34 | 2.69 | 0.363 | 16.6 | 2.06 |
| HQ6 | 10.5 | 90.8 | 62.3 | 8.65 | 16.5 | 24.6 | 62.5 | 14.5 | 90.8 | 222 | 36.8 | 22 | 3.72 | 589 | 1.59 | 21.7 | 22.4 | 3.86 | 173 | 5.41 | 64.5 | 126 | 15.3 | 57.8 | 10.5 | 1.52 | 8.49 | 1.37 | 6.91 | 1.33 | 3.83 | 4.49 | 0.637 | 17.1 | 1.85 |
| HQ7 | 12.7 | 98.4 | 68.4 | 8.25 | 15.1 | 31.4 | 70.2 | 14.4 | 87.4 | 210 | 43.8 | 29.9 | 3.67 | 556 | 2.18 | 22 | 31.8 | 4.99 | 252 | 8.08 | 83.1 | 163 | 19.3 | 71.8 | 13.3 | 1.55 | 10.7 | 1.72 | 8.59 | 1.58 | 4.59 | 5.39 | 0.764 | 16.4 | 1.67 |
| HQ8 | 8.48 | 63 | 42.7 | 5.98 | 12 | 20.6 | 45.5 | 12.1 | 83 | 188 | 27.6 | 16.2 | 3.3 | 553 | 1.16 | 17.7 | 14.5 | 2.53 | 129 | 3.99 | 37.5 | 74.6 | 9.11 | 35 | 6.65 | 1.14 | 5.46 | 0.889 | 4.89 | 0.978 | 2.76 | 3.3 | 0.46 | 13.6 | 1.63 |
| HQ9 | 8.43 | 59 | 42.4 | 6.24 | 13.6 | 22.5 | 44.7 | 13 | 95 | 197 | 24.7 | 15.5 | 3.9 | 579 | 1.13 | 18.6 | 13.6 | 2.29 | 114 | 3.66 | 40.3 | 77.4 | 9.15 | 34.8 | 6.68 | 1.13 | 5.34 | 0.899 | 4.64 | 0.891 | 2.51 | 2.94 | 0.398 | 16.9 | 1.87 |
| HQ10 | 9.22 | 67 | 47.3 | 7.12 | 15.7 | 20.4 | 51.8 | 13.5 | 94.2 | 200 | 28.3 | 17.3 | 4.05 | 566 | 1.27 | 19.4 | 14.4 | 2.86 | 146 | 4.88 | 42.7 | 83.9 | 10.2 | 38.2 | 7.21 | 1.15 | 5.82 | 0.992 | 5.24 | 1.03 | 2.98 | 3.48 | 0.502 | 17.6 | 1.67 |
| HQ11 | 9.99 | 67.2 | 46.7 | 7 | 14 | 21.6 | 54.3 | 13.9 | 97 | 206 | 30 | 18.9 | 4.28 | 591 | 1.32 | 21 | 16.4 | 2.99 | 152 | 4.86 | 43.8 | 86.2 | 10.6 | 40 | 7.56 | 1.26 | 6.18 | 1.04 | 5.55 | 1.07 | 3.06 | 3.6 | 0.514 | 18.1 | 1.91 |
| HQ12 | 9.42 | 63.6 | 48.1 | 5.66 | 10.8 | 24.7 | 49.7 | 13.6 | 96.8 | 203 | 32.5 | 22.6 | 3.67 | 588 | 1.62 | 18.8 | 21.1 | 3.32 | 194 | 6.28 | 51 | 101 | 12.2 | 46.8 | 8.63 | 1.28 | 7.19 | 1.19 | 6.16 | 1.18 | 3.45 | 4.05 | 0.575 | 15.5 | 1.78 |
| HQ13 | 11.5 | 51.6 | 31.4 | 5.23 | 11.1 | 16.7 | 40.2 | 11.9 | 87.9 | 180 | 23.4 | 13.7 | 3.73 | 552 | 0.97 | 16.4 | 12.2 | 2.32 | 115 | 3.66 | 37.8 | 72 | 8.71 | 32.8 | 6.02 | 1 | 5.04 | 0.818 | 4.31 | 0.853 | 2.45 | 2.78 | 0.385 | 16.2 | 1.66 |
| HQ14 | 11.4 | 57.1 | 42.9 | 5.73 | 12.2 | 18 | 44.5 | 13.4 | 97.7 | 195 | 25.2 | 15.4 | 4.22 | 615 | 1.09 | 19.2 | 11.5 | 2.71 | 130 | 4.14 | 35.1 | 68 | 8.51 | 32.3 | 6.1 | 1.11 | 5.04 | 0.862 | 4.63 | 0.912 | 2.67 | 3.03 | 0.439 | 16.3 | 1.81 |
| HQ15 | 12.3 | 77.5 | 59.9 | 7.62 | 15.8 | 24.3 | 62.1 | 14.9 | 94.5 | 224 | 35.5 | 24.6 | 4.35 | 561 | 1.75 | 21 | 21.5 | 3.59 | 225 | 7.13 | 56.6 | 111 | 13.6 | 51.6 | 9.52 | 1.41 | 7.65 | 1.3 | 6.83 | 1.3 | 3.71 | 4.42 | 0.627 | 20.3 | 1.89 |
| HQ16 | 10.3 | 79.7 | 53.5 | 8.98 | 22.1 | 28.2 | 61.5 | 14.8 | 104 | 194 | 27.9 | 18.3 | 5.5 | 561 | 1.5 | 20.2 | 12.3 | 2.49 | 138 | 4.36 | 39.3 | 76.4 | 9.41 | 36.6 | 7.03 | 1.27 | 5.81 | 0.985 | 5.23 | 1.03 | 2.91 | 3.35 | 0.471 | 23.4 | 2.09 |
| HQ17 | 11.1 | 71.2 | 52.1 | 6.47 | 11.9 | 27 | 58 | 13.9 | 93.2 | 232 | 44.8 | 27.7 | 3.42 | 629 | 2.07 | 20.5 | 29.5 | 4.43 | 246 | 8.01 | 79.6 | 159 | 19.2 | 72.4 | 13.3 | 1.59 | 10.5 | 1.71 | 8.56 | 1.61 | 4.65 | 5.33 | 0.756 | 14.1 | 2.19 |
| HQ18 | 8.64 | 65.7 | 45.9 | 5.39 | 9.96 | 47 | 51.6 | 13.8 | 102 | 215 | 33.6 | 22.5 | 3.46 | 622 | 1.57 | 19.9 | 18.2 | 3.25 | 190 | 6.11 | 52 | 104 | 12.6 | 48.5 | 9.32 | 1.31 | 7.36 | 1.23 | 6.25 | 1.21 | 3.46 | 4.06 | 0.584 | 13.4 | 1.71 |
| OD1 | 9.94 | 92.8 | 75.8 | 8.66 | 17.6 | 34.2 | 68.9 | 13.9 | 92.7 | 202 | 34.6 | 24.8 | 4.2 | 590 | 1.84 | 25.9 | 24.3 | 4.31 | 284 | 9.15 | 56.1 | 111 | 13.6 | 52.3 | 9.9 | 1.34 | 8.07 | 1.32 | 6.8 | 1.26 | 3.69 | 4.38 | 0.622 | 17.3 | 1.74 |
| OD2 | 8.43 | 80.8 | 62.1 | 6.5 | 12.7 | 29.5 | 54.1 | 12.6 | 82.2 | 193 | 29.8 | 21.1 | 3.34 | 593 | 1.56 | 17.9 | 19.1 | 3.27 | 198 | 6.39 | 52.8 | 104 | 12.6 | 49 | 8.95 | 1.28 | 7.34 | 1.18 | 5.79 | 1.11 | 3.26 | 3.69 | 0.517 | 14 | 1.54 |
| OD3 | 9.58 | 93.8 | 75.3 | 7.97 | 15.7 | 29 | 61.5 | 13.1 | 80 | 187 | 35.7 | 25.3 | 4.68 | 554 | 1.94 | 19.7 | 31.3 | 4.85 | 306 | 9.84 | 72.7 | 140 | 16.8 | 64.2 | 11.3 | 1.3 | 9.25 | 1.44 | 7.06 | 1.33 | 3.82 | 4.49 | 0.642 | 19.3 | 1.6 |
| OD4 | 8.57 | 76.8 | 43 | 9.67 | 15.6 | 38.7 | 55.3 | 13.2 | 82.6 | 229 | 25.1 | 18 | 3.65 | 573 | 1.5 | 18.5 | 18.1 | 3 | 233 | 6.78 | 51.2 | 106 | 11.8 | 45.7 | 8.18 | 1.18 | 6.8 | 1.1 | 5.27 | 0.997 | 3.66 | 3.36 | 0.499 | 16 | 1.66 |
| OD5 | 10.9 | 91.8 | 61 | 11.5 | 26.3 | 33.8 | 65.2 | 16.6 | 101 | 203 | 26.8 | 14.2 | 6.72 | 531 | 1.03 | 21.5 | 13.2 | 2.63 | 128 | 4.16 | 39 | 74.9 | 8.95 | 35.7 | 6.79 | 1.23 | 5.83 | 0.981 | 5.15 | 0.996 | 2.8 | 3.11 | 0.434 | 29 | 2.02 |
| OD6 | 11 | 104 | 83.3 | 10.6 | 19.7 | 34.1 | 69.2 | 14.8 | 92.2 | 218 | 35 | 25.3 | 4.51 | 602 | 2.3 | 21.5 | 28.5 | 4.51 | 265 | 8.94 | 70.2 | 137 | 16.4 | 63.3 | 11.4 | 1.44 | 9.29 | 1.49 | 7.23 | 1.33 | 3.8 | 4.32 | 0.617 | 20.1 | 1.81 |
| OD7 | 8.37 | 68.1 | 50.4 | 7.58 | 15.6 | 27 | 46.3 | 12.9 | 92.6 | 193 | 25 | 16.6 | 4.13 | 686 | 1.28 | 21.8 | 13.1 | 2.7 | 178 | 5.77 | 38.7 | 77.6 | 9.05 | 34.5 | 6.3 | 1.09 | 5.47 | 0.92 | 4.75 | 0.929 | 2.76 | 3.18 | 0.449 | 16.8 | 1.74 |
| OD8 | 7.11 | 52.2 | 42.1 | 5.32 | 12.2 | 31.8 | 41.3 | 11.7 | 82 | 175 | 18.8 | 13.7 | 4.19 | 605 | 1.08 | 16.4 | 9.84 | 2.27 | 118 | 3.79 | 27.9 | 56.2 | 6.36 | 24 | 4.59 | 0.896 | 3.78 | 0.665 | 3.48 | 0.697 | 2.06 | 2.34 | 0.344 | 17.1 | 1.58 |
| OD9 | 8.81 | 86 | 58.1 | 9.95 | 22 | 35.9 | 54.8 | 12.8 | 84.5 | 186 | 24 | 14.7 | 4.54 | 587 | 1.09 | 21.7 | 15.2 | 2.87 | 146 | 4.8 | 41.9 | 82 | 9.66 | 36.8 | 7.13 | 1.12 | 5.84 | 0.945 | 4.86 | 0.915 | 2.64 | 3.05 | 0.425 | 20.1 | 1.56 |
| OD10 | 8.3 | 63.4 | 47.3 | 7.86 | 17.8 | 32.4 | 50.1 | 11.9 | 78.9 | 183 | 20.6 | 11.8 | 4.77 | 548 | 0.924 | 17.5 | 8.52 | 2.23 | 103 | 3.41 | 28 | 53.3 | 6.41 | 25.1 | 4.8 | 0.968 | 4.18 | 0.703 | 3.94 | 0.759 | 2.15 | 2.44 | 0.348 | 19.1 | 1.51 |
| OD11 | 9.83 | 94.1 | 60.7 | 10.2 | 20.5 | 40.7 | 60.3 | 13.9 | 85.4 | 189 | 29.2 | 16.8 | 4.97 | 565 | 1.4 | 20.4 | 15.1 | 2.81 | 171 | 5.19 | 46.4 | 89.1 | 10.7 | 41 | 7.9 | 1.21 | 6.29 | 1.01 | 5.44 | 1.02 | 2.91 | 3.26 | 0.475 | 23.1 | 1.85 |
| OD12 | 6.19 | 63.1 | 36.2 | 12 | 28.4 | 38.1 | 35.5 | 8.54 | 57 | 541 | 24.5 | 9.01 | 3.81 | 789 | 0.676 | 23.4 | 9.25 | 2.19 | 95.8 | 2.9 | 31.7 | 55.6 | 7.33 | 29.1 | 5.67 | 1.09 | 4.83 | 0.81 | 4.39 | 0.856 | 2.37 | 2.43 | 0.349 | 17.9 | 1.3 |
| OD13 | 7.88 | 69.1 | 52.6 | 8.85 | 18.3 | 35.5 | 48.3 | 12.1 | 80.3 | 332 | 24.5 | 13.3 | 4.67 | 583 | 0.917 | 18.4 | 9.9 | 2.46 | 130 | 4.01 | 32 | 59.3 | 7.5 | 28.8 | 5.67 | 1.06 | 4.66 | 0.816 | 4.6 | 0.862 | 2.48 | 2.79 | 0.384 | 30.5 | 1.57 |
| OD14 | 7.4 | 75 | 50.1 | 12.3 | 24.5 | 37.9 | 46.7 | 11 | 70.2 | 388 | 48 | 12.3 | 4.17 | 615 | 0.804 | 24 | 14 | 2.74 | 144 | 4.35 | 55.5 | 75.5 | 13.4 | 53.5 | 10.7 | 2 | 9.12 | 1.57 | 8.26 | 1.64 | 4.2 | 4.16 | 0.579 | 19.1 | 1.44 |
| SNNW1 | 10.2 | 77.8 | 56.7 | 12.1 | 24.4 | 27.8 | 60.3 | 16.8 | 100 | 335 | 34.7 | 15.3 | 5.9 | 617 | 1.21 | 21.4 | 14.9 | 2.66 | 367 | 9.7 | 46.7 | 90.1 | 11.1 | 41.6 | 8.56 | 1.49 | 6.59 | 1.27 | 6.47 | 1.23 | 3.6 | 3.94 | 0.495 | 27.4 | 2.25 |
| SNNW2 | 10.3 | 72.1 | 52.4 | 11.4 | 19.7 | 20.6 | 51.1 | 16.4 | 98.5 | 265 | 34.2 | 17.5 | 4.85 | 654 | 1.39 | 24.3 | 12.5 | 2.6 | 514 | 13.8 | 39.5 | 79.3 | 9.15 | 35.5 | 6.84 | 1.36 | 5.56 | 1.08 | 5.81 | 1.11 | 3.35 | 4.07 | 0.507 | 25.4 | 2 |
| SNNW3 | 11.3 | 96 | 63 | 15.8 | 19.1 | 31.3 | 57 | 16.5 | 89.3 | 310 | 38.1 | 19.1 | 4.1 | 658 | 1.7 | 23.7 | 16 | 3.54 | 616 | 17.8 | 54.5 | 117 | 12.7 | 47.8 | 8.55 | 1.61 | 7.48 | 1.41 | 7.06 | 1.29 | 4.04 | 4.63 | 0.641 | 21.2 | 2.24 |
| SNNW4 | 10.9 | 92.8 | 130 | 15.4 | 25.4 | 54.8 | 90 | 18.3 | 99 | 300 | 41.8 | 24.1 | 4.63 | 695 | 1.86 | 28.8 | 20.1 | 4.58 | 649 | 16.7 | 63.4 | 129 | 14.5 | 54.6 | 9.87 | 1.49 | 8.44 | 1.43 | 7.24 | 1.46 | 4.27 | 4.81 | 0.655 | 26.8 | 2.51 |
| SNNW5 | 9.41 | 75.8 | 58 | 13.8 | 14.1 | 28.1 | 52.2 | 16.4 | 98.4 | 312 | 32.3 | 20.3 | 3.89 | 731 | 1.57 | 23 | 13.6 | 3.61 | 614 | 15.3 | 45 | 91.7 | 10.5 | 39.6 | 6.61 | 1.4 | 5.91 | 1.11 | 5.79 | 1.05 | 3.62 | 3.83 | 0.512 | 21.8 | 2.16 |
| SNNW6 | 9.94 | 87.1 | 67 | 23 | 18.4 | 35.4 | 55.5 | 16.8 | 92.2 | 294 | 35.2 | 23.6 | 4.01 | 675 | 1.82 | 20.5 | 14.8 | 3.63 | 625 | 16.3 | 50.2 | 116 | 11.6 | 43.1 | 7.95 | 1.4 | 6.74 | 1.2 | 6.17 | 1.19 | 3.8 | 4.36 | 0.65 | 19.5 | 2.07 |
| SNNW7 | 11.6 | 86.4 | 71.2 | 18.2 | 21.7 | 24.5 | 69.4 | 19.2 | 106 | 284 | 38.6 | 20.4 | 5.44 | 705 | 1.55 | 26.7 | 14.8 | 3.17 | 565 | 14.8 | 51 | 107 | 11.6 | 43.7 | 8.16 | 1.58 | 7.3 | 1.29 | 6.85 | 1.28 | 3.87 | 4.44 | 0.659 | 25.6 | 2.55 |
| SNNW8 | 8.15 | 66.8 | 43.3 | 11.6 | 12.6 | 20.8 | 40.6 | 14.9 | 87.8 | 284 | 28.1 | 16.3 | 3.17 | 645 | 1.18 | 19 | 14.7 | 2.75 | 416 | 11 | 38.6 | 86.3 | 8.95 | 33.9 | 5.89 | 1.16 | 5.18 | 0.952 | 4.88 | 0.874 | 2.87 | 3.55 | 0.485 | 17.1 | 2.08 |
| SNNW9 | 10.2 | 83 | 63.4 | 17 | 18.1 | 26 | 57 | 17.4 | 93.1 | 301 | 37.8 | 21.9 | 4.09 | 672 | 1.57 | 26 | 18 | 3.78 | 783 | 20.6 | 52 | 110 | 11.8 | 44.5 | 7.42 | 1.38 | 7.47 | 1.26 | 6.55 | 1.31 | 3.91 | 4.85 | 0.724 | 19.1 | 1.8 |
| SNNW10 | 11.1 | 85.3 | 68 | 12.9 | 28.3 | 23.8 | 63.6 | 18.3 | 100 | 292 | 35.3 | 21.6 | 4.54 | 638 | 1.68 | 21.5 | 16.9 | 3.43 | 483 | 12.3 | 47 | 97.1 | 10.9 | 39 | 7.84 | 1.44 | 7.07 | 1.09 | 6.57 | 1.32 | 3.87 | 4.15 | 0.743 | 20.5 | 2.37 |
| SNNW11 | 11.2 | 105 | 86.7 | 9.67 | 13 | 34.9 | 78.4 | 17.5 | 96.2 | 273 | 54.4 | 32.2 | 4.25 | 584 | 2.94 | 21.9 | 31.2 | 6.86 | 1543 | 41 | 79.6 | 163 | 18.9 | 71.2 | 12.6 | 1.71 | 11.1 | 1.85 | 10.1 | 1.93 | 6.04 | 7.54 | 1.15 | 21.3 | 1.86 |
| SNNW12 | 8.31 | 82.6 | 47.7 | 10.1 | 18.6 | 22.4 | 50 | 14.4 | 94.2 | 319 | 33 | 16.9 | 4.43 | 619 | 1.31 | 18.8 | 13.7 | 2.94 | 454 | 11.9 | 40.4 | 77.9 | 9.92 | 39.1 | 7 | 1.44 | 6.18 | 1.09 | 5.69 | 1.17 | 3.52 | 4.02 | 0.622 | 21.9 | 2.32 |
| SNNW13 | 12.7 | 98.9 | 71.4 | 15.2 | 28.4 | 30.2 | 83.2 | 19 | 111 | 248 | 40.2 | 18.6 | 7.31 | 625 | 1.41 | 26.4 | 16.7 | 3.26 | 473 | 11.7 | 49.4 | 95.9 | 11.5 | 41.4 | 8.1 | 1.5 | 7.78 | 1.28 | 7.27 | 1.38 | 4.34 | 4.48 | 0.698 | 33 | 2.28 |
| SNNW14 | 10.1 | 72.1 | 64.8 | 8.07 | 14.2 | 46.3 | 48.5 | 15.3 | 87.5 | 263 | 42.3 | 22.7 | 3.44 | 588 | 1.92 | 18.1 | 21.5 | 4.31 | 800 | 20.6 | 53.8 | 106 | 13.1 | 49.9 | 9.33 | 1.56 | 8.06 | 1.41 | 7.95 | 1.47 | 4.59 | 5.32 | 0.877 | 19.1 | 1.7 |
| SNSW1 | 11.2 | 82.4 | 60.8 | 10.1 | 22.4 | 28.8 | 62.6 | 15.9 | 85.1 | 357 | 32.9 | 19.2 | 5.49 | 556 | 1.55 | 19.8 | 17.3 | 3.06 | 350 | 10.1 | 46.3 | 92.5 | 11.4 | 44.6 | 8.24 | 1.32 | 7.21 | 1.1 | 6.16 | 1.18 | 3.31 | 4.15 | 0.537 | 20.7 | 1.47 |
| SNSW2 | 10.8 | 91.7 | 65.4 | 12.8 | 31.4 | 34.8 | 61.1 | 15.5 | 88.8 | 564 | 31.4 | 16 | 5.98 | 588 | 1.27 | 20.7 | 13.5 | 2.73 | 297 | 8.65 | 42.1 | 84.1 | 9.14 | 37.2 | 6.6 | 1.22 | 5.75 | 1.02 | 5.54 | 1.13 | 3.22 | 3.67 | 0.521 | 27.2 | 2.38 |
| SNSW3 | 12.1 | 79.9 | 65.2 | 13 | 24.8 | 29.1 | 77.8 | 19.2 | 112 | 258 | 31.2 | 19 | 7.75 | 628 | 1.5 | 25.6 | 14.2 | 2.51 | 235 | 7.49 | 41.8 | 81.6 | 9.78 | 38.3 | 7 | 1.41 | 6.31 | 1.09 | 5.99 | 1.15 | 3.13 | 4.02 | 0.515 | 28.5 | 2.39 |
| SNSW4 | 12.9 | 89.4 | 77.4 | 17.1 | 27.4 | 45 | 83 | 20.7 | 113 | 254 | 36.2 | 25.4 | 8 | 636 | 2.75 | 27.5 | 19.3 | 3.38 | 421 | 12.2 | 54.2 | 108 | 12.8 | 49.8 | 9.2 | 1.5 | 7.72 | 1.3 | 6.33 | 1.33 | 3.57 | 4.41 | 0.655 | 28.7 | 2.31 |
| SNSW5 | 12.3 | 83.1 | 66.1 | 12.9 | 23.4 | 27.5 | 75 | 18.7 | 107 | 246 | 32.4 | 18.6 | 7.4 | 602 | 1.47 | 30.2 | 16.2 | 2.49 | 280 | 7.93 | 43.2 | 85.3 | 9.98 | 39 | 7.19 | 1.36 | 6.43 | 1.11 | 5.53 | 1.21 | 3.11 | 3.69 | 0.54 | 25.3 | 2.28 |
| SNSW6 | 11.5 | 79.1 | 57.5 | 10.6 | 19.3 | 24.1 | 68.1 | 17.8 | 102 | 272 | 31.7 | 20.9 | 6.48 | 629 | 1.53 | 23.9 | 15.3 | 2.8 | 284 | 7.83 | 44.1 | 86.2 | 10.4 | 40.2 | 7.28 | 1.33 | 6.73 | 1.04 | 5.63 | 1.12 | 3.18 | 3.5 | 0.54 | 22.2 | 2.19 |
| SNSW7 | 9.53 | 58.7 | 52.9 | 8.63 | 16.9 | 22.9 | 62.7 | 15.9 | 92.2 | 216 | 24.9 | 17.8 | 5.64 | 542 | 1.4 | 19.7 | 11.3 | 2.34 | 306 | 9.06 | 34 | 67.7 | 8.12 | 31.8 | 5.93 | 1.1 | 4.75 | 0.854 | 4.8 | 0.961 | 2.75 | 2.97 | 0.47 | 24.8 | 2.29 |
| SNSW8 | 13.1 | 81.8 | 66.8 | 13.2 | 27.5 | 31.8 | 87.9 | 19.6 | 110 | 206 | 30 | 19.4 | 8.5 | 599 | 1.53 | 25.2 | 14.3 | 2.57 | 285 | 8.48 | 43.7 | 87.9 | 9.97 | 39.9 | 7.67 | 1.33 | 6.17 | 1.11 | 6.07 | 1.14 | 3.4 | 3.44 | 0.541 | 35.6 | 2.5 |
| SNSW9 | 11.5 | 87.7 | 77.5 | 9.27 | 20.8 | 26.6 | 74.8 | 16.4 | 89.7 | 249 | 33.9 | 24.6 | 5.17 | 573 | 2 | 22.9 | 15.8 | 3.55 | 510 | 15.2 | 53 | 101 | 12.4 | 48.8 | 9.6 | 1.57 | 7.5 | 1.25 | 6.82 | 1.3 | 3.84 | 4 | 0.633 | 25.1 | 2.24 |
| SNSW10 | 12 | 84.9 | 65 | 14.7 | 21.8 | 21.3 | 92.8 | 20.9 | 104 | 218 | 33.5 | 40.7 | 5.08 | 565 | 2.88 | 26.8 | 14.8 | 2.25 | 486 | 12.8 | 43.3 | 104 | 9.87 | 38.6 | 7.07 | 1.1 | 6.81 | 1.06 | 6.11 | 1.25 | 3.3 | 4.26 | 0.618 | 21.5 | 2.98 |
| SNSW11 | 12.6 | 78 | 77.3 | 11 | 20.3 | 22.4 | 89.6 | 20.6 | 105 | 242 | 32.8 | 35.3 | 4.88 | 545 | 3.12 | 21.4 | 15.3 | 2.54 | 552 | 14.3 | 47 | 93.4 | 10.7 | 41.2 | 7.58 | 1.17 | 7.07 | 1.07 | 5.85 | 1.19 | 3.61 | 4.39 | 0.569 | 22.1 | 2.41 |
| SNSW12 | 11.8 | 77.2 | 61.4 | 11.8 | 20.1 | 20.2 | 81.6 | 18.4 | 106 | 230 | 30 | 31.6 | 5.21 | 582 | 2.42 | 23 | 15.2 | 2.21 | 391 | 10.8 | 41.1 | 90.5 | 9.44 | 37.1 | 6.83 | 1.12 | 6.55 | 1.08 | 5.71 | 1.12 | 3.04 | 3.71 | 0.513 | 17.4 | 2.43 |
| SNSW13 | 12.9 | 76.4 | 61.5 | 14.4 | 22 | 21.8 | 86.8 | 20.4 | 99.8 | 226 | 31.3 | 35.7 | 4.86 | 575 | 2.8 | 24.9 | 14.6 | 2.31 | 442 | 11.8 | 47.7 | 107 | 10.7 | 40.5 | 7.4 | 1.2 | 6.77 | 1.15 | 5.7 | 1.15 | 3.04 | 3.87 | 0.555 | 19.2 | 2.93 |

Empty squares with “－” represent missing data in the literatures.

UCC and PASS values are after Taylor and McLennan (1985).

Supplementary Table 3a Concentrations (wt %) of major elements for the <10 μm fraction in the Harbin loess.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | SiO2 | Al2O3 | Fe2O3 | MgO | CaO | Na2O | K2O | MnO | TiO2 | P2O5 | LOI | FeO |
| HS1 | 65.47 | 14.8 | 5.22 | 1.57 | 1.45 | 2.15 | 2.76 | 0.068 | 0.927 | 0.135 | 5.43 | 1.43 |
| HS2 | 65.86 | 14.6 | 4.99 | 1.51 | 1.46 | 2.19 | 2.75 | 0.082 | 0.907 | 0.135 | 5.51 | 0.86 |
| HS3 | 64.52 | 15.08 | 5.74 | 1.4 | 1.69 | 2.02 | 2.69 | 0.06 | 0.982 | 0.173 | 5.63 | 1.04 |
| HS4 | 66.96 | 14.88 | 4.23 | 1.38 | 1.53 | 2.24 | 2.73 | 0.09 | 0.10 | 0.11 | 4.04 | 0.72 |
| HS5 | 67.19 | 14.86 | 4.44 | 1.44 | 1.44 | 2.17 | 2.79 | 0.09 | 0.10 | 0.08 | 3.69 | 0.64 |
| HS6 | 65.72 | 15.25 | 4.46 | 1.45 | 1.47 | 2.01 | 2.78 | 0.10 | 0.93 | 0.13 | 4.74 | 0.88 |

Major elements without recalculation on a volatile-free basis.

Total iron as Fe2O3.

the HS1 to HS6 are from Harbin Loess.

Supplementary Table 3b Concentrations (ppm) of trace elements and REE of the <10 μm fraction in the Harbin loess.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Samples | Sc | V | Cr | Co | Ni | Cu | Zn | Ga | Rb | Sr | Y | Nb | Cs | Ba | Ta | Pb | Th | U | Zr | Hf | La | Ce | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Ho | Er | Yb | Lu | Li | Be |
| HS1 | 12.4 | 91.5 | 62.6 | 11.2 | 26.8 | 36.5 | 83.5 | 18.7 | 122 | 193 | 32.3 | 19.2 | 8.43 | 557 | 1.35 | 24.3 | 14.2 | 2.64 | 161 | 5.1 | 41.7 | 77.4 | 9.64 | 37.6 | 7.24 | 1.3 | 6.09 | 1.07 | 5.78 | 1.14 | 3.18 | 3.6 | 0.517 | 34.9 | 2.48 |
| HS2 | 13.7 | 90 | 66.9 | 12.4 | 27.6 | 38.4 | 86.1 | 20.1 | 129 | 209 | 32.9 | 21.7 | 8.81 | 607 | 1.47 | 25.7 | 14.7 | 2.53 | 155 | 4.87 | 44.5 | 81.8 | 10.5 | 40.8 | 7.65 | 1.38 | 6.53 | 1.12 | 6.05 | 1.17 | 3.29 | 3.72 | 0.531 | 36.2 | 2.73 |
| HS3 | 13.3 | 101 | 67.1 | 11.5 | 31.2 | 40.3 | 86.2 | 19.6 | 117 | 200 | 33.3 | 18.4 | 8.58 | 560 | 1.24 | 25.3 | 15.6 | 2.57 | 154 | 4.79 | 45.6 | 87.3 | 10.8 | 41.6 | 7.89 | 1.41 | 6.81 | 1.14 | 6.1 | 1.19 | 3.28 | 3.67 | 0.509 | 37.2 | 2.74 |
| HS4 | 5.943 | 114.6 | 96.66 | 13.27 | 46 | 37.53 | 58.52 | 20.46 | 6.744 | 82.79 | 19.14 | 19.64 | 2.401 | 303.5 | 1.351 | 16.75 | 6.798 | 1.442 | 429.8 | 11.7 | 13.6 | 32.96 | 4.138 | 16.25 | 3.639 | 0.769 | 3.58 | 0.574 | 3.386 | 0.725 | 2.216 | 2.339 | 0.367 | 39.64 | 3.523 |
| HS5 | 4.193 | 110.5 | 90.21 | 15.13 | 42.57 | 35.22 | 58.97 | 19.15 | 10.75 | 84.91 | 16.73 | 19.41 | 2.457 | 311.5 | 1.258 | 16.14 | 6.175 | 1.364 | 434.8 | 11.13 | 13.39 | 30.97 | 3.893 | 14.97 | 3.236 | 0.704 | 3.057 | 0.494 | 2.901 | 0.608 | 1.873 | 2.007 | 0.318 | 35.25 | 3.307 |
| HS6 | 4.633 | 123.4 | 93.14 | 14.6 | 52.26 | 38.06 | 64.28 | 18.3 | 14.52 | 86.46 | 21.65 | 19.38 | 3.012 | 236.3 | 1.198 | 16.36 | 6.82 | 1.492 | 379.9 | 9.638 | 16.05 | 36.6 | 4.585 | 17.69 | 3.922 | 0.825 | 3.783 | 0.591 | 3.442 | 0.724 | 2.16 | 2.269 | 0.349 | 35.29 | 3.342 |