**Electronic Supplementary Material 4**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample (wt%) | HAS3-01  Gneiss | HAS3-02  AS | SG1-01  Gneiss | SG1-02  Schist | HPS1-01  PS | HPS1-02  AS | HAS1-01  AS | HAS1-02  PS |
| SiO2 | 71 | 43 | 77 | 54 | 36 | 40 | 36 | 39 |
| Al2O3 | 11 | 13 | 12 | 20 | 11 | 10 | 15 | 12 |
| Fe2O3 | 6.1 | 26 | 1.9 | 8.0 | 22 | 20 | 19 | 17 |
| MnO | 0.05 | 0.25 | 0.03 | 0.10 | 1.4 | 1.3 | 1.3 | 1.0 |
| MgO | 1.0 | 5.9 | 0.70 | 4.1 | 4.8 | 2.0 | 3.8 | 7.8 |
| CaO | 1.1 | 0.64 | 0.62 | 0.45 | 18 | 22 | 18 | 16 |
| Na2O | 1.7 | bdl | 3.3 | bdl | bdl | bdl | bdl | bdl |
| K2O | 5.0 | 1.4 | 2.8 | 7.3 | 0.50 | 0.18 | 1.6 | 0.32 |
| TiO2 | 0.06 | 0.13 | 0.14 | 0.83 | 0.64 | 0.50 | 0.20 | 0.71 |
| P2O5 | 0.28 | 0.13 | 0.23 | 0.14 | 0.13 | 0.16 | 0.03 | 0.14 |
| H2O | 1.5 | 7.8 | 1.1 | 4.6 | 3.0 | 1.3 | 3.6 | 4.1 |
| CO2 | 0.05 | 0.05 | 0.04 | 0.07 | 1.9 | 1.3 | 1.0 | 0.34 |
| Total | 98.84 | 98.3 | 99.86 | 99.59 | 99.37 | 98.74 | 99.53 | 98.41 |
| (ppm) |  |  |  |  |  |  |  |  |
| V | bdl | 41 | 32 | 120 | 87 | 86 | 69 | 97 |
| Cr | 22 | 33 | 29 | 89 | 90 | 78 | 51 | 103 |
| Cu | bdl | 0.63 | bdl | bdl | 0.34 | 0.58 | 0.89 | 1.0 |
| Zn | 184 | 277 | 68 | 288 | 202 | 108 | 182 | 253 |
| Ga | 16 | 6.1 | 18 | 29 | 4.3 | 6.2 | 4.1 | 3.8 |
| As | bdl | bdl | bdl | bdl | bdl | bdl | bdl | bdl |
| Rb | 485 | 283 | 260 | 697 | 8.0 | 6.5 | 202 | 9.2 |
| Sr | 50 | 17 | 92 | 66 | 49 | 52 | 41 | 50 |
| Y | 26 | 18 | 16 | 21 | 32 | 32 | 14 | 42 |
| Zr | 21 | 69 | 43 | 181 | 194 | 155 | 29 | 196 |
| Nb | 17 | 15 | 12 | 16 | 15 | 12 | 6.2 | 18 |
| Cd | bdl | bdl | bdl | bdl | 2.0 | 0.67 | 3.5 | 5.6 |
| In | bdl | 108 | bdl | bdl | 43 | 18 | 53 | 64 |
| Sn | bdl | 5817 | bdl | bdl | 2733 | 972 | 2881 | 2824 |
| Cs | bdl | 406 | bdl | bdl | 3.8 | 3.8 | 14 | 5.6 |
| Ba | 178 | 15 | 460 | 1680 | 142 | 56 | 322 | 81 |
| Hf | bdl | 2.5 | bdl | bdl | 5.0 | 3.9 | 1.0 | 6.2 |
| Ta | bdl | 3.4 | bdl | bdl | 1.4 | 1.1 | 0.43 | 2.2 |
| W | bdl | 20 | bdl | bdl | 17 | 29 | 20 | 17 |
| Th | bdl | 2.3 | bdl | bdl | 12 | 15 | 1.3 | 24 |
| U | bdl | 5.1 | bdl | bdl | 1.4 | 3.3 | 0.34 | 4.6 |
| La | 3.4 | 9.1 | 9.4 | 50 | 15 | 42 | 2.7 | 72 |
| Ce | 6.0 | 18 | 14 | 82 | 29 | 79 | 5.7 | 134 |
| Pr | bdl | 2.3 | bdl | 10 | 3.3 | 9.2 | 0.68 | 15 |
| Nd | 3.5 | 8.0 | 6.9 | 34 | 12 | 31 | 2.2 | 45 |
| Sm | 1.2 | 1.8 | 1.5 | 5.7 | 2.9 | 5.4 | 0.83 | 7.9 |
| Eu | 0.15 | 0.69 | 0.37 | 1.6 | 1.7 | 3.2 | 0.63 | 3.8 |
| Gd | 1.3 | 1.8 | 1.2 | 3.9 | 3.4 | 4.4 | 1.3 | 6.8 |
| Tb | bdl | 0.35 | bdl | bdl | 0.63 | 0.69 | 0.27 | 0.99 |
| Dy | 2.1 | 2.2 | 1.4 | 2.3 | bdl | bdl | bdl | bdl |
| Ho | 0.39 | 0.46 | 0.27 | 0.43 | 0.70 | 0.72 | 0.35 | 1.0 |
| Er | 1.3 | 1.6 | 0.84 | 1.3 | 2.2 | 2.4 | 1.2 | 3.4 |
| Tm | 0.23 | 0.29 | 0.15 | 0.20 | 0.34 | 0.40 | 0.18 | 0.63 |
| Yb | 1.7 | 2.1 | 0.92 | 1.6 | 2.1 | 2.5 | 1.2 | 3.9 |
| Lu | 0.24 | 0.33 | 0.13 | 0.27 | 0.30 | 0.35 | 0.18 | 0.56 |

AS: amphibole skarn, PS: pyroxene skarn

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample (wt%) | CSV1-01  Gneiss | CSV1-02  AS | CSV2-01  Gneiss | HGS1-01  GS | HMS1  MS |
| SiO2 | 71 | 40 | 76 | 54 | 7.8 |
| Al2O3 | 13 | 8.6 | 13 | 18 | 0.6 |
| Fe2O3 | 5.1 | 30 | 0.78 | 5.9 | 89 |
| MnO | 0.16 | 0.66 | 0.06 | 0.23 | 0.14 |
| MgO | 0.66 | 2.4 | 0.31 | 4.3 | 0.26 |
| CaO | 3.7 | 10 | 1.1 | 8.1 | 0.71 |
| Na2O | 3.5 | 0.43 | 3.8 | 3.5 | bdl |
| K2O | 1.3 | 1.6 | 3.8 | 2.1 | 0.08 |
| TiO2 | 0.05 | 0.05 | 0.07 | 0.72 | 0.05 |
| P2O5 | 0.26 | 0.20 | 0.32 | 0.14 | 0.06 |
| H2O | 1.0 | 2.2 | 0.72 | 1.9 | 0.40 |
| CO2 | 0.08 | 0.76 | 0.12 | 0.08 | 0.04 |
| Total | 99.81 | 96.9 | 100.08 | 98.97 | 99.14 |
|  |  |  |  |  |  |
| (ppm) |  |  |  |  |  |
| V | bdl | 22 | bdl | 134 | 25 |
| Cr | 13 | 22 | 23 | 125 | 29 |
| Cu | bdl | 68 | bdl | 7.9 | 0.34 |
| Zn | 246 | 86 | 156 | 255 | 202 |
| Ga | 25 | 1.9 | 21 | 18 | 4.3 |
| As | bdl | bdl | bdl | bdl | bdl |
| Rb | 164 | 57 | 319 | 160 | 8.5 |
| Sr | 127 | 85 | 103 | 304 | 7.4 |
| Y | 22 | 29 | 20 | 25 | 3.6 |
| Zr | 29 | 39 | 21 | 113 | 15 |
| Nb | 15 | 11 | 17 | 15 | 0.94 |
| Cd | bdl | 0.82 | bdl | 2.2 | bdl |
| In | bdl | 131 | bdl | 2.6 | 11 |
| Sn | bdl | 4017 | bdl | 72 | 1649 |
| Cs | bdl | 13 | bdl | 42 | 11 |
| Ba | 95 | 396 | 206 | 383 | 8.4 |
| Hf | bdl | 2.0 | bdl | 3.1 | 0.37 |
| Ta | bdl | 2.2 | bdl | 1.1 | 0.14 |
| W | bdl | 30 | bdl | 18 | 15 |
| Th | bdl | 7.4 | bdl | 11 | 0.59 |
| U | bdl | 13 | bdl | 2.5 | 0.42 |
| La | 4.6 | 12 | 3.6 | 38 | bdl |
| Ce | 7.8 | 23 | 9.0 | 74 | bdl |
| Pr | bdl | 2.7 | bdl | 8.5 | bdl |
| Nd | 4.1 | 11 | 3.7 | 33 | 1.0 |
| Sm | 1.2 | 2.9 | 1.3 | 6.1 | 0.55 |
| Eu | 0.26 | 1.3 | 0.15 | 1.2 | bdl |
| Gd | 1.2 | 3.1 | 1.3 | 5.2 | bdl |
| Tb | bdl | 0.59 | bdl | 0.87 | bdl |
| Dy | 2.0 | 3.8 | 2.3 | 4.6 | bdl |
| Ho | 0.38 | 0.72 | 0.44 | 0.86 | bdl |
| Er | 1.3 | 2.3 | 1.5 | 2.7 | bdl |
| Tm | 0.22 | 0.37 | 0.28 | 0.43 | bdl |
| Yb | 1.6 | 2.6 | 1.9 | 2.7 | bdl |
| Lu | 0.22 | 0.36 | 0.25 | 0.40 | bdl |

GS: garnet skarn, AS: amphibole skarn, MS: magnetite skarn