**Table S2.** Representative SEM/EDS spot analysis of allanite.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample**  **No.** | **SiO2 (wt.%)** | **Al2O3** | **Fe2O3** | **CaO** | **La2O3** | **Ce2O3** | **Nd2O3** | **ThO2** | **Total** |
| 123m\_08 | 33.91 | 16.92 | 15.38 | 15.93 | 2.69 | 6.45 | 1.63 | 2.61 | 95.52 |
| 123m\_11 | 33.57 | 16.53 | 15.34 | 14.14 | 3.97 | 8.35 | nd | 2.43 | 94.33 |
| 123m\_16 | 33.55 | 16.26 | 15.76 | 14.85 | 3.71 | 7.45 | nd | 1.98 | 93.56 |
| 123m\_18 | 31.28 | 19.24 | 13.87 | 11.36 | 4.54 | 9.77 | 2.52 | 2.48 | 95.06 |
| 123m\_20 | 31.36 | 15.4 | 16.09 | 13.03 | 5.12 | 8.35 | 1.98 | 2.32 | 93.65 |
| 6\_06b | 33.56 | 15.32 | 15.94 | 13.24 | 4.76 | 9.21 | nd | 2.35 | 94.38 |
| 6\_06e | 33.68 | 16.14 | 15.64 | 14.23 | 3.71 | 7.91 | nd | 3.19 | 94.5 |
| 6\_10 | 33.63 | 16.4 | 15.7 | 14.2 | 3.96 | 7.93 | 2.02 | 2.03 | 95.87 |
| 7\_03 | 33.14 | 15.04 | 14.93 | 12.93 | 5.2 | 9.46 | nd | 2.71 | 93.41 |
| 9\_17 | 34.03 | 16.74 | 15.35 | 15.38 | 4.01 | 6.78 | 1.74 | 1.77 | 95.8 |
| Representative SEM/EDS spot analysis of monazite and cheralite | | | | | | | | | |
| **Sample**  **No.** | **Mineral** | **SiO2 (wt.%)** | **CaO** | **P2O5** | **La2O3** | **Ce2O3** | **Nd2O3** | **ThO2** | **Total** |
| 123m-21 (magnetic) | Monazite | 1.82 | 2.17 | 27.36 | 12.69 | 23.6 | 7.0 | 17.63 | 92.25 |
| 9\_05 (−0.212) | Cheralite | nd | 7.4 | 37.49 | 9.22 | 2.48 | 8.01 | 35.73 | 100.5 |
| Representative SEM/EDS spot analysis of titanite from different grain size fractions | | | | | | | | | |
| **Sample**  **No.** | **SiO2 (wt.%)** | **TiO2** | **Al2O3** | **Fe2O3** | **CaO** | **Na2O** | **RE2O3** | **Total** |  |
| 6\_01 (−0.425) | 29.79 | 36.4 | 1.35 | 1.75 | 26.74 | 0.64 | nd | 96.67 |  |
| 7\_02 (−0.355) | 32.03 | 35.72 | nd | 1.12 | 26.67 | nd | nd | 95.54 |  |
| 8\_01 (−0.300) | 28.64 | 37.39 | nd | 1.82 | 28.80 | nd | nd | 96.66 |  |
| 9\_10 (−0.212) | 29.00 | 38.72 | nd | 1.72 | 29.00 | nd | nd | 97.96 |  |
| 9\_16 (−0.212) | 32.19 | 37.33 | 1.57 | 1.14 | 27.13 | nd | nd | 99.36 |  |

Numbers in parenthesis refer to the undersize grain size fraction and magnetic fraction denoted as “m”.