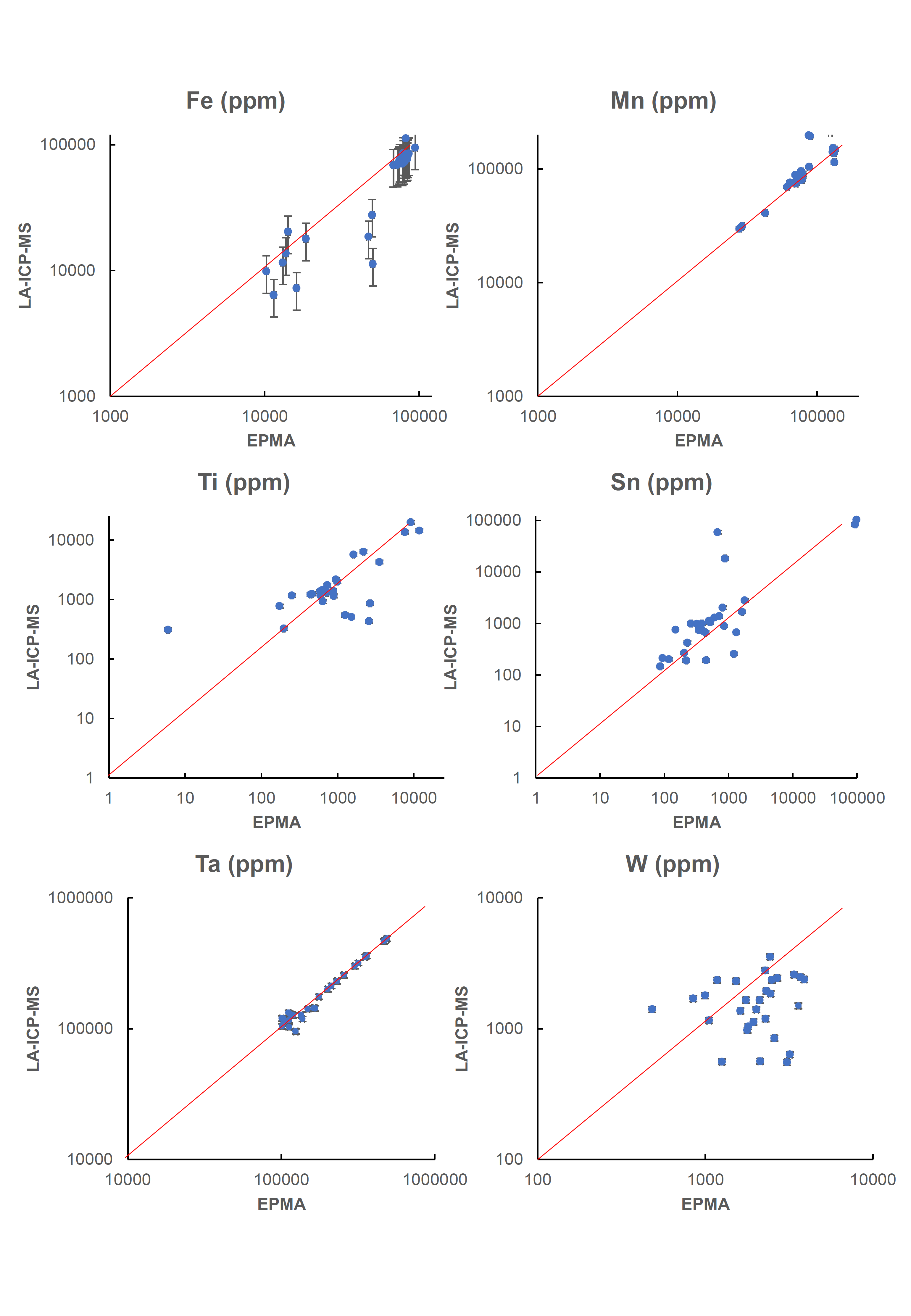
Accuracy and precision tests were run on NIST 612 that served as the secondary external standard under the same working condition for LA-ICP-MS analysis. The accuracy (expressed as difference between the average of obtained element concentration values and the reference values) and precision (expressed as relative standard deviation) for the majority of the analyzed elements are lower than 25% except P and Fe that showed obvious deviation from their reference values (Table 1 in this file). An alternative method for assessing the validity of the LA-ICP-MS data is comparison between the elements were analyzed on the same spot by both LA-ICP-MS and EPMA (see Figure S1 in this appendix). The concentrations of elements including Fe, Mn, Ti, Sn, Ta, and W of CGM obtained by both methods are compared. Elements such as Si, Al, and Ca analyzed by EPMA are close to detection limits and are not suitable for comparison. Fluorine, on the other hand, cannot be analyzed by LA-ICP-MS. The red lines in the diagrams represent the 1:1 line. For the majority of LA-ICP-MS analysis, the concentrations of Fe, Mn, Ti, Sn, Ta, and W are close to their corresponding EPMA concentrations. However, some LA-ICP-MS datapoints show deviation from the 1:1 line, which is likely related to heterogeneity of the analyzed CGM grains because the size of the laser ablation pits (25 µm) is much larger than the electron beam diameter (2 µm). This issue is somehow difficult to avoid when it comes to the CGM with relatively small size and complicated zonings. Both methods for checking the accuracy of LA-ICP-MS analysis indicate that the concentration data for the majority of the analyzed elements are valid.

**Table 1.** Summary of accuracy and precision test on NIST 612.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Elements** | **Reference Values \*** | **Ave (n = 10)** | **SD** | **RSD %** | **Accuracy %** |
| Li | 41.54 | 39.48 | 2.01 | 5.09 | 4.97 |
| Be | 37.74 | 46.82 | 2.08 | 4.44 | 24.06 |
| Na | 103719 | 100497.15 | 3719.65 | 3.70 | 3.11 |
| Mg | 77.44 | 58.14 | 3.95 | 6.80 | 24.92 |
| Al | 11164.6 | 10663.02 | 465.95 | 4.37 | 4.49 |
| Si | 335916.8 | 336195.87 | 5503.27 | 1.64 | 0.08 |
| P | 55.16 | 80.23 | 27.29 | 34.02 | 45.46 |
| Ca | 85262.5 | 90058.25 | 1006.12 | 1.12 | 5.62 |
| Sc | 41.05 | 46.06 | 2.20 | 4.78 | 12.20 |
| Ti | 48.11 | 41.67 | 2.84 | 6.81 | 13.39 |
| V | 39.22 | 39.16 | 0.94 | 2.40 | 0.15 |
| Mn | 38.43 | 39.78 | 1.24 | 3.11 | 3.51 |
| Fe | 56.33 | 249.35 | 83.39 | 33.44 | 342.65 |
| Ga | 36.24 | 33.72 | 0.88 | 2.62 | 6.95 |
| Rb | 31.63 | 29.54 | 0.73 | 2.48 | 6.62 |
| Sr | 76.15 | 81.41 | 1.54 | 1.90 | 6.91 |
| Y | 38.25 | 41.58 | 1.44 | 3.46 | 8.71 |
| Zr | 35.99 | 41.63 | 1.15 | 2.76 | 15.68 |
| Nb | 38.06 | 39.38 | 0.80 | 2.04 | 3.47 |
| Mo | 38.3 | 37.84 | 1.65 | 4.36 | 1.20 |
| Sn | 37.96 | 29.13 | 1.97 | 6.75 | 23.25 |
| Cs | 41.64 | 41.65 | 1.55 | 3.72 | 0.03 |
| Ba | 37.74 | 40.74 | 1.14 | 2.81 | 7.95 |
| La | 35.77 | 37.38 | 1.36 | 3.64 | 4.51 |
| Ce | 38.35 | 39.85 | 1.12 | 2.82 | 3.91 |
| Pr | 37.16 | 38.45 | 1.30 | 3.39 | 3.47 |
| Nd | 35.24 | 37.78 | 1.84 | 4.86 | 7.22 |
| Sm | 36.72 | 39.32 | 2.37 | 6.03 | 7.08 |
| Eu | 34.44 | 37.80 | 1.79 | 4.73 | 9.77 |
| Gd | 36.95 | 37.97 | 1.96 | 5.17 | 2.77 |
| Tb | 35.92 | 39.30 | 2.12 | 5.39 | 9.40 |
| Dy | 35.97 | 38.18 | 1.71 | 4.48 | 6.13 |
| Ho | 37.87 | 40.20 | 1.81 | 4.50 | 6.17 |
| Er | 37.43 | 46.47 | 4.10 | 8.81 | 24.14 |
| Tm | 37.55 | 38.12 | 1.51 | 3.96 | 1.51 |
| Yb | 39.95 | 41.92 | 2.54 | 6.07 | 4.92 |
| Lu | 37.71 | 38.99 | 2.03 | 5.20 | 3.40 |
| Hf | 34.77 | 39.16 | 1.30 | 3.32 | 12.64 |
| Ta | 39.77 | 36.83 | 1.66 | 4.50 | 7.39 |
| Pb | 38.96 | 36.94 | 1.20 | 3.25 | 5.18 |
| Th | 37.23 | 35.81 | 1.93 | 5.38 | 3.83 |
| U | 37.15 | 37.52 | 1.16 | 3.10 | 0.99 |

Abbreviations: SD = standard deviation; RSD = relative standard deviation.

\* The reference values for the analyzed elements are cited from Pearce et al. (1997) [1].



**Figure S1.** Comparison between concentrations of Fe, Mn, Ti, Sn, Ta, and W of CGM obtained using EPMA and LA-ICP-MS.

Red lines represent the 1:1 line. In the diagrams, the lengths of the vertical error bars represent the relative standard deviations (RSD) for elements during LA-ICP-MS analysis (presented in Table 1). For elements including Mn, Ti, Sn, Ta, and W, the lengths of the vertical error bars smaller than the size of the symbols and the error bars therefore do not show up in the diagrams.

References

1. Pearce, N.G.; Perkins, W.T.; Westgate, J.A.; Gorton, M.P.; Jackson, S.E.; Neal, C.R.; Chenery, S.P. A compilation of new and published major and trace element data for NIST SRM 610 and NIST SRM 612 glass reference materials. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis **1997**, *21*, 115–144.