Data repository Mohr-Westheide et al., Discovery of Extraterrestrial Component Carrier Phases in Archean Spherule Layers: Implications for Estimation of Archean bolide sizes

Supplementary Material for Automated feature analysis using a BRUKER QUANTAX EDS system: The method combines morphological with chemical classification in order to detect and classify minerals (Salge et al., 2013). Grains were detected by grey-scale thresholds in back-scattered electron (BSE) micrographs. Spectra were acquired by point measurements in the center of each grain or by scanning the complete grain area. Minerals were classified based on their composition. An area of 495,613 µm² (Fig. 1, purple rectangle) was analyzed with a pixel resolution of 2 µm using an accelerating voltage of 20 kV to detect Ni-Cr-spinel grains with a maximum circle radius > 6 µm. For the analysis of PGE phases, the spatial resolution was enhanced to the sub-µm scale by using a low accelerating voltage of 6 kV. Consequently, only low-energy X-ray lines can be evaluated (Figs. 2a,b) which is possible by improved peak deconvolution algorithms using an extended atomic database (Aßmann & Wendt, 2003). A region of 89,746 µm² (Fig. 1, green rectangle) was analyzed with a BSE pixel resolution of 100 nm in order to classify grains with a maximum circle radius > 250 nm. Regions of interest (Fig. 2c) were further studied by spectrum imaging techniques where a hyperspectral EDS database contains complete spectra for each pixel of the SEM image.
A1 Full data table and plot of INAA results for the 22 sample splits in the ICDP drill core sample BARB 5 (511.29-511.51 m) from the Barite Valley syncline in the BGB. Note sample split 1 is located at the bottom of the sample section, sample split 22 at the top.
A2 Cluster of Ni-Cr-spinel with PGE sulfarsenides in the matrix between individual spinel fragments and PGE metal alloys within Ni-Cr spinel.

A3 Compilation of Ir data from early Archean spherule layers. Evaluating the complete data base of Ir abundances in spherule layer samples in the literature (A3) resulted in: our calculation yielded Ir values from 0.1 to 1518 ppb for S2 (avg. 116 ppb), 0.6 - 2730 ppb for S3 (avg. 164 ppb), 7 - 450 ppb (avg. 128 ppb) for S4, and 0.3 - 735 ppb (avg. 290 ppb) for BARB 5. These Ir concentrations are of equivalent magnitude as those used by Kyte et. al (2003) for estimating Archean bolide/projectile sizes, and still suggest a 30-40% chondrite component, on average, for these layers. However, one has to consider that the Ir concentration in the spherule layer intersections of the BARB 5 core is strongly heterogeneous at the sample scale possibly due to primary heterogeneous fallout from the impact plume,
and not due to dilution by locally derived material as previously reasoned. This is indicated as there is no evidence in the BARB 5 core section for this dilutional process (e.g., addition of clastics). Furthermore, it can not be excluded either that alteration and metamorphic overprint may have affected the primary PGE abundances of spherule deposits.
**TABLE A4. ELECTRON MICROPROBE ANALYSES OF NI-RICH CORES (A) AND ZN-ENRICHED RIMS (B) OF NI-CR SPINELS FROM SPHERULE LAYERS FROM DRILL CORE BARB 5.**

<table>
<thead>
<tr>
<th>Major elements (wt %)</th>
<th>ON TOP OF SL 1 (n = 17, n© = 3)</th>
<th>SL 2 (n© = 114, n© = 4)</th>
<th>SL 3 (n© = 107, n© = 4)</th>
<th>SL 4* (n® = 101, n® = 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Average</td>
<td>SD</td>
<td>Range</td>
</tr>
<tr>
<td>SiO2</td>
<td>0.74</td>
<td>-0.92</td>
<td>0.83</td>
<td>0.05</td>
</tr>
<tr>
<td>Al2O3</td>
<td>0.63</td>
<td>-0.76</td>
<td>0.70</td>
<td>0.04</td>
</tr>
<tr>
<td>TiO2</td>
<td>0.07</td>
<td>0.16</td>
<td>0.11</td>
<td>0.02</td>
</tr>
<tr>
<td>Cr2O3</td>
<td>0.09</td>
<td>-0.10</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>V2O3</td>
<td>0.10</td>
<td>0.70</td>
<td>0.32</td>
<td>0.21</td>
</tr>
</tbody>
</table>

*SD = Standard deviation
†SL = Spherule layer
REFERENCES CITED


Salge, T., Neumann, R., Andersson, C., Patzschke, M., 2013, Advanced mineral classification using feature analysis and spectrum imaging with EDS, in Proceedings: International Mining Congress and Exhibition, 23rd, Turkey, UCTEA Chamber of Mining Engineers of Turkey, p. 357-367.