Electronic Supplementary Material (ESI) for Journal of Analytical Atomic Spectrometry

Electronic Supplementary Information (ESI)

Rapid screening of boron isotope ratios in nuclear shielding materials by LA-ICPMS – a comparison of two different instrumental setups

Christoph Kurta, Ladina Dorta, Florian Mittermayr, Karl Prattes, Bodo Hattendorf, Detlef Günther and Walter Goessler

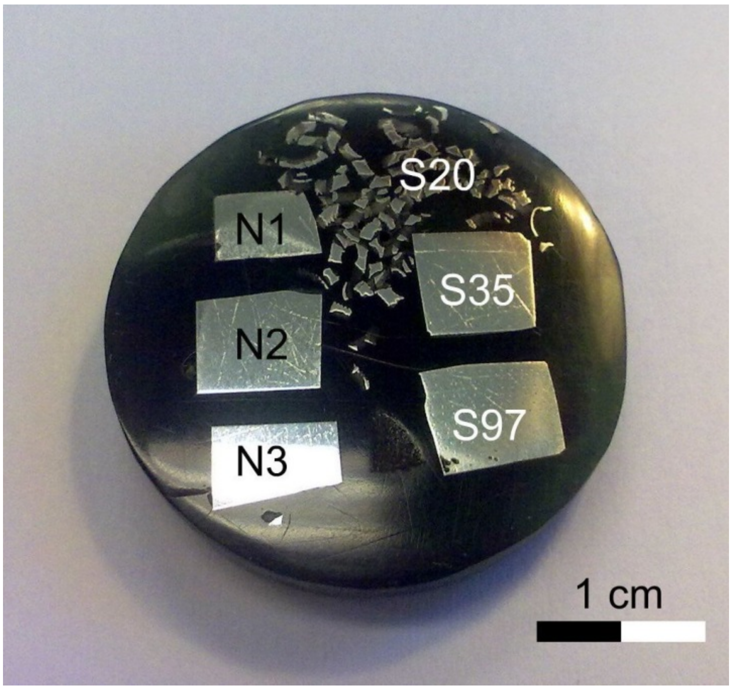

Figure 1 IRM In-house reference materials S20 (metal chips), S35, S97, and process samples N1, N2 and N3 cast in a one inch mold with epoxy resin, polished and ready for EPMA and LA-ICPMS analysis

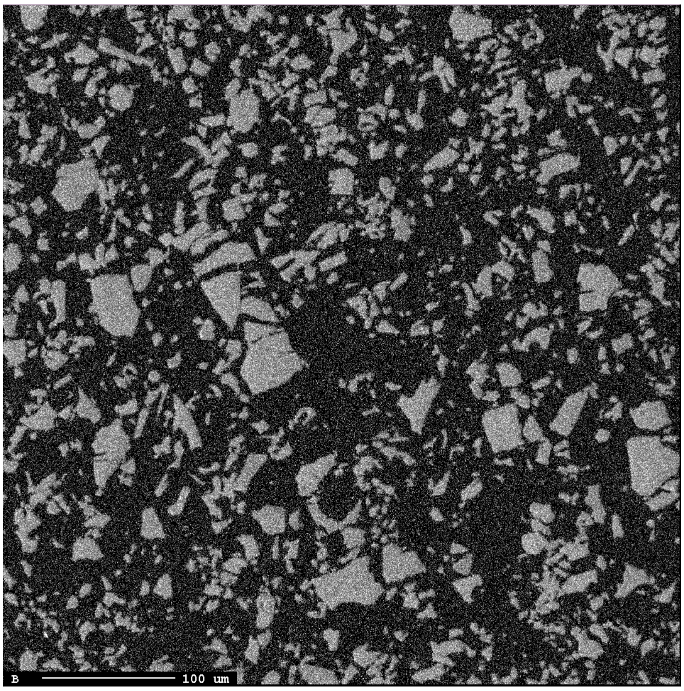

Figure 2 Boron distribution in IRM in house reference material S97, recorded by EPMA (B Kα line at 129.29 mm on a layered dispersion element (LDEB) diffracting crystal-) - mapping size 512 x 512 µm – light areas indicate high boron content (JXA-8200 Superprobe, JEOL, Tokyo, Japan)

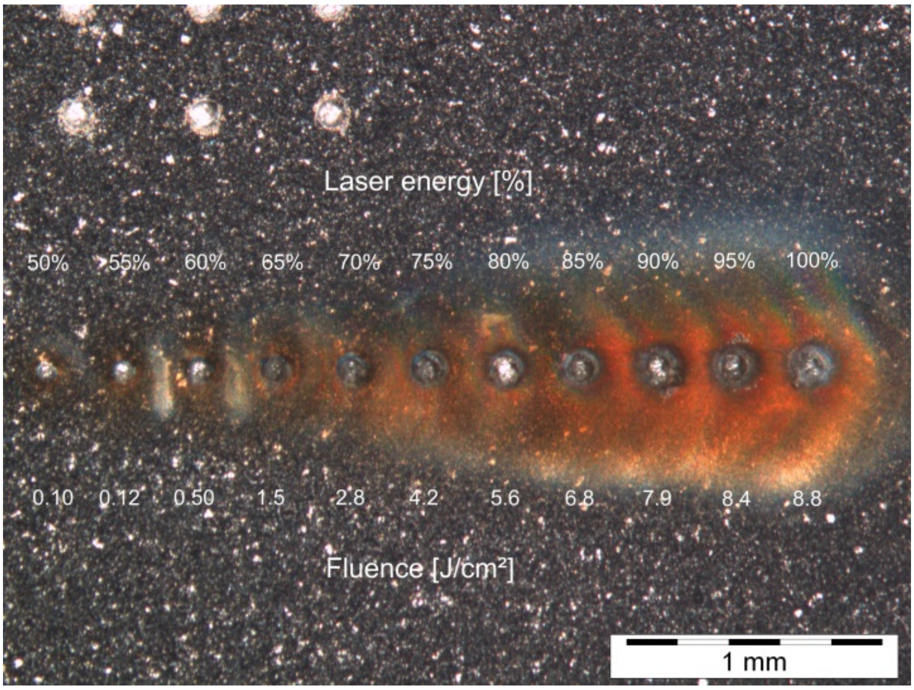

Figure 3 Light microscope picture of 100 µm ablation spots by ns-LA-ICPMS with increasing energy level (50 – 100 % or 0.10 – 8.8 J cm-2) at constant repetition rate (10 Hz) on IRM in-house reference material S97 – higher energy leads to more deposition on the sample

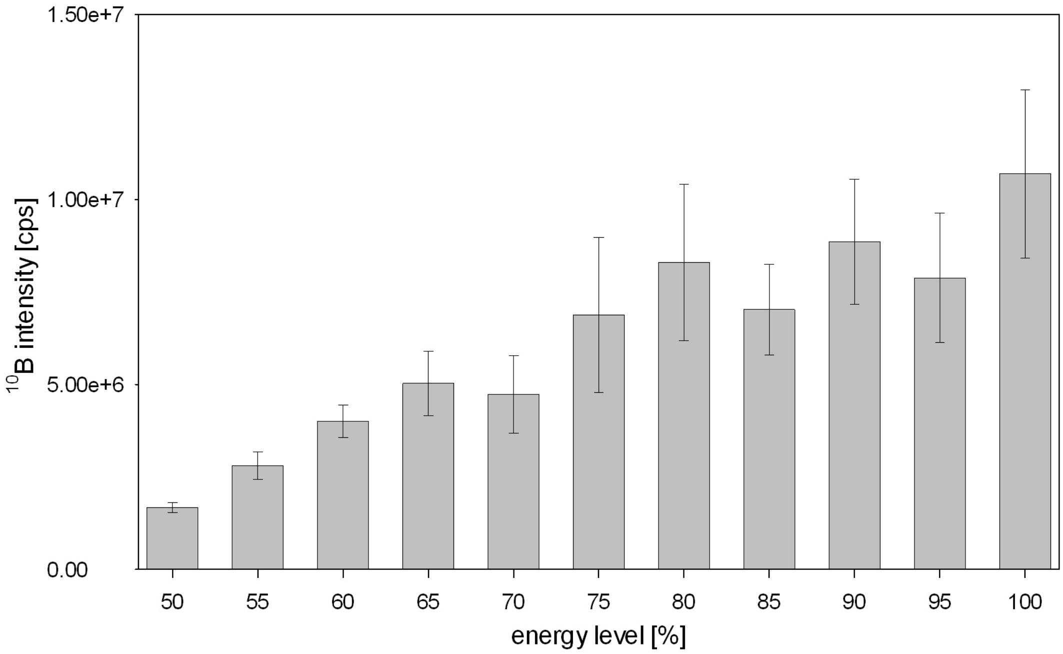

Figure 4 Optimization of laser parameters: Comparison of ^{10}B intensity (IRM S97) with different laser energy levels (50 - 100 %) at constant spot size (100 µm) and repetition rate (10 Hz) using ns-LA (UP-213, New Wave Research, Fremont, CA, USA) and Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany)

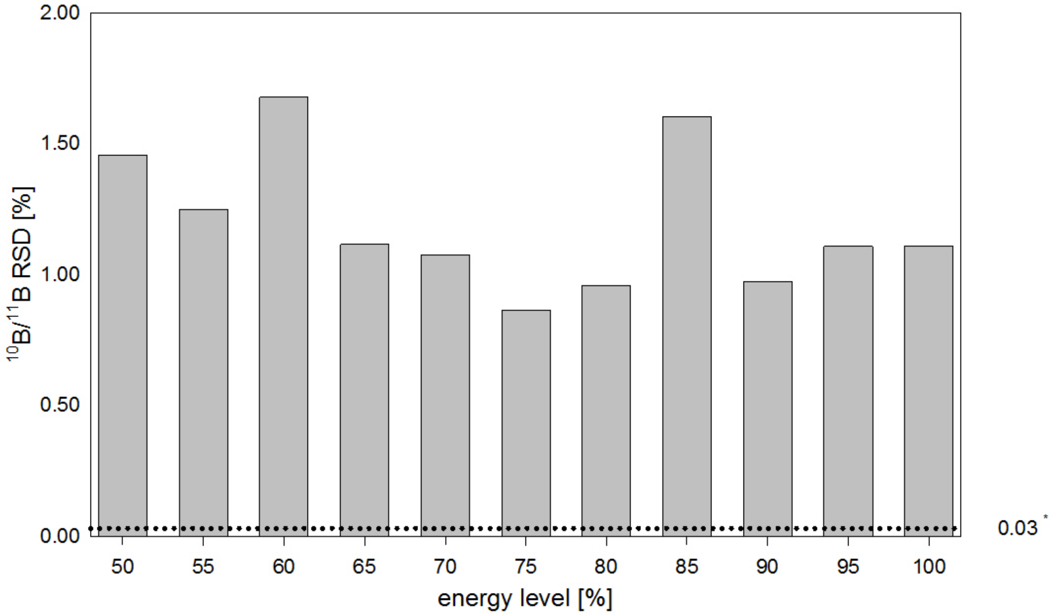

Figure 5 Optimization of laser parameters: Comparison of $^{10}B/^{11}B$ relative standard deviation (RSD) (IRM S97) with different laser energy levels (50 - 100 %) at constant spot size (100 µm) and repetition rate (10 Hz) using ns-LA (UP-213, New Wave Research, Fremont, CA, USA) and Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany)

* dotted line: reference values from Wiltsche H. et al., *Spectrochim. Acta, Part B*, 2009, **64**, 341-346

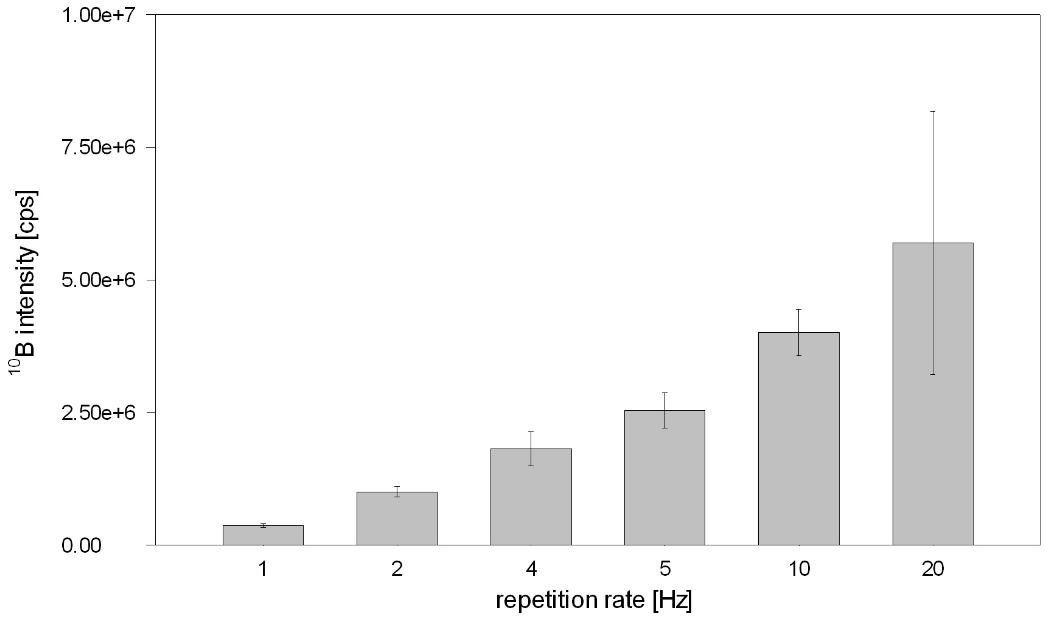

Figure 6 Optimization of laser parameters: Comparison of ^{10}B intensity (IRM S97) with different repetition rate (1 - 20 Hz) at constant spot size (100 µm) and 60 % laser energy (0.5 J cm^{-2}) using ns-LA (UP-213, New Wave Research, Fremont, CA, USA) and Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany)

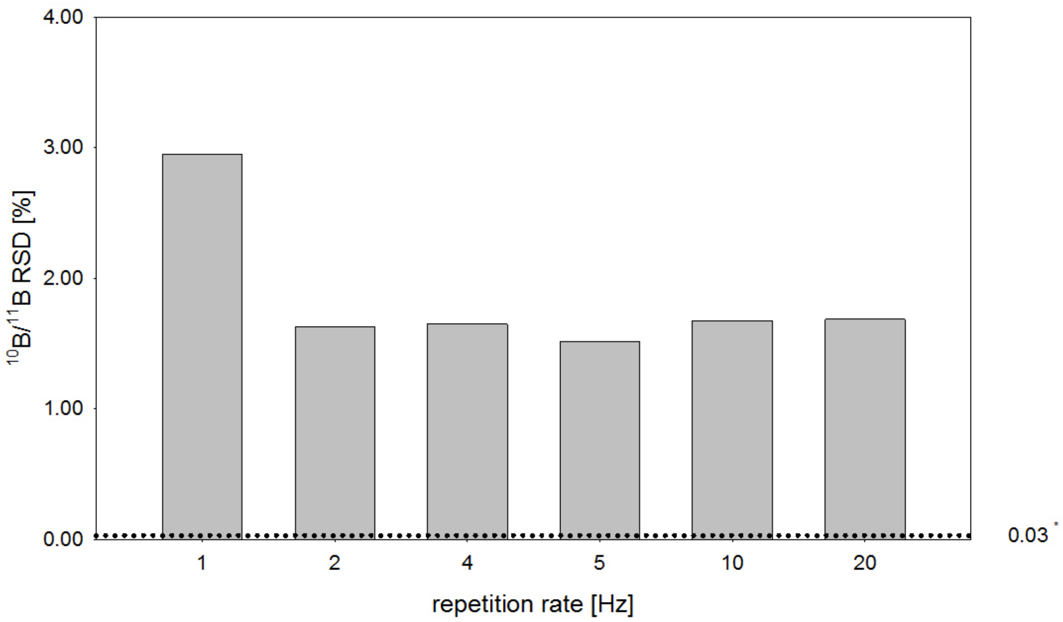

Figure 7 Optimization of laser parameters: Comparison of $^{10}B/^{11}B$ relative standard deviation (RSD) (IRM S97) with different repetition rate (1 - 20 Hz) at constant spot size (100 µm) and 60 % laser energy (0.5 J cm^{-2}) using ns-LA (UP-213, New Wave Research, Fremont, CA, USA) and Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany)

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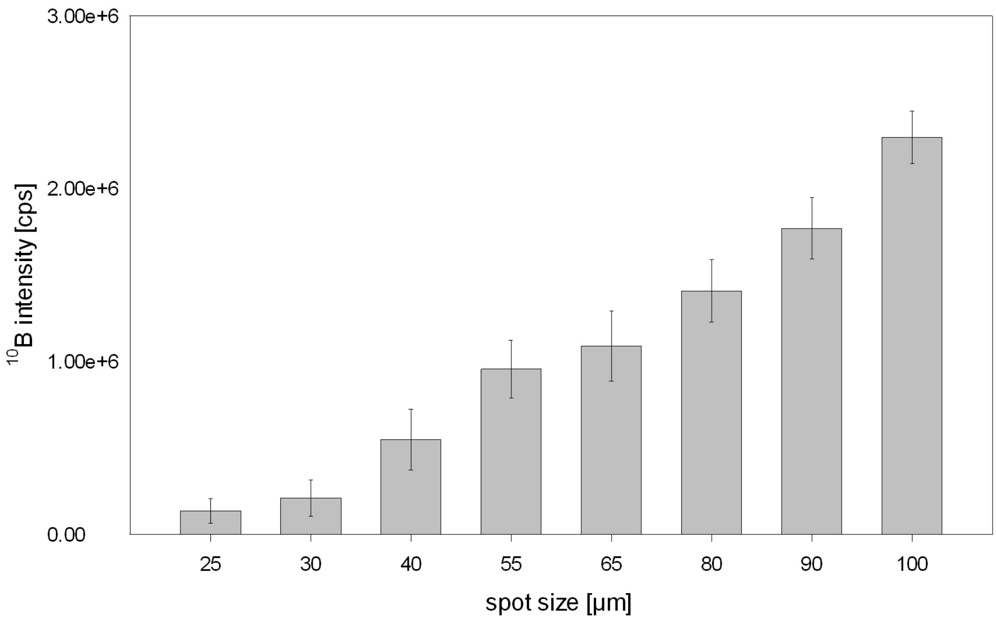

Figure 8 Optimization of laser parameters: Comparison of ^{10}B intensity (IRM S97) with different spot size (25 - 100 µm) at constant repetition rate (5 Hz) and 60 % laser energy (0.5 J cm^{-2}) using ns-LA (UP-213, New Wave Research, Fremont, CA, USA) and Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany)

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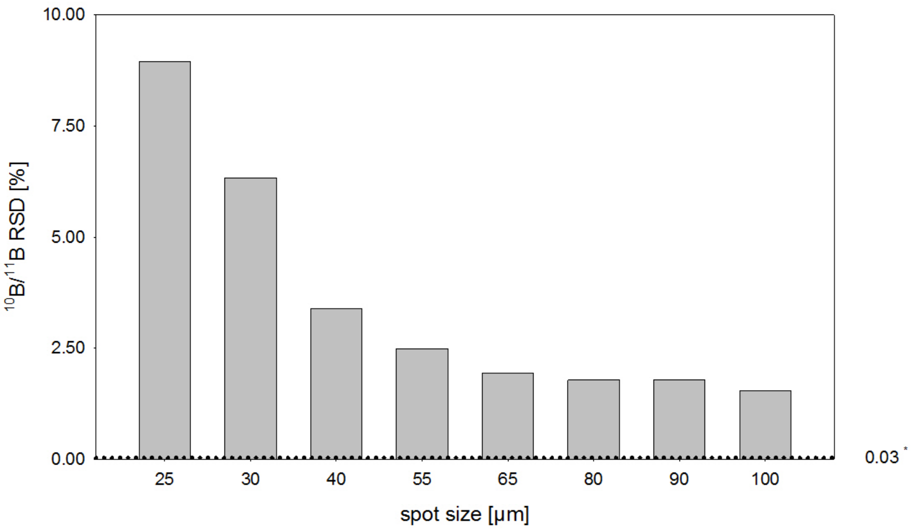

Figure 9 Optimization of laser parameters: Comparison of $^{10}B/^{11}B$ relative standard deviation (RSD) (IRM S97) with different spot size (25 - 100 µm) constant repetition rate (5 Hz) and 60 % laser energy (0.5 J cm^{-2}) using ns-LA (UP-213, New Wave Research, Fremont, CA, USA) and Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany)

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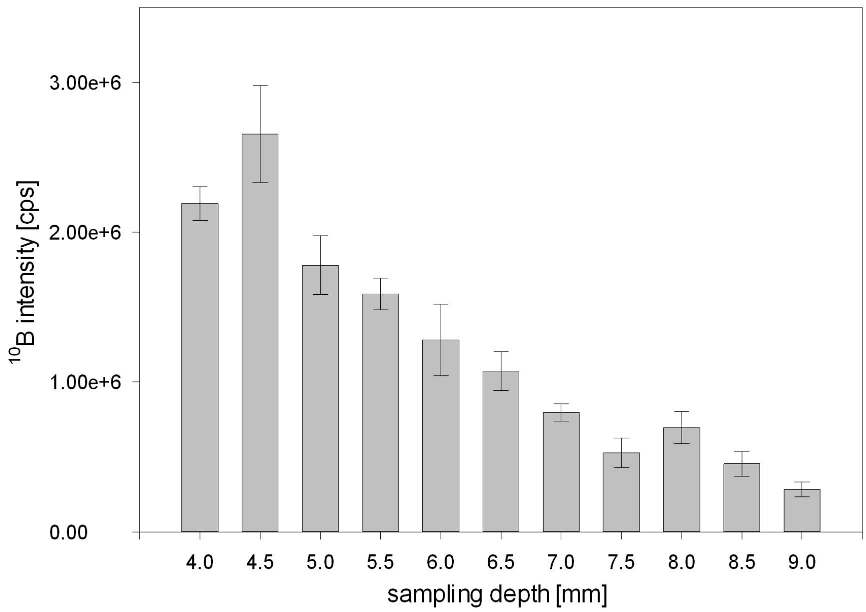

Figure 10 Optimization of ICPMS parameters: Comparison of ^{10}B intensity (IRM S97) with different sampling depth (4.0 - 9.0 mm) using Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany) at constant laser ablation settings (ns-LA, 100 µm, 0.5 J cm^{-2}, 5 Hz)

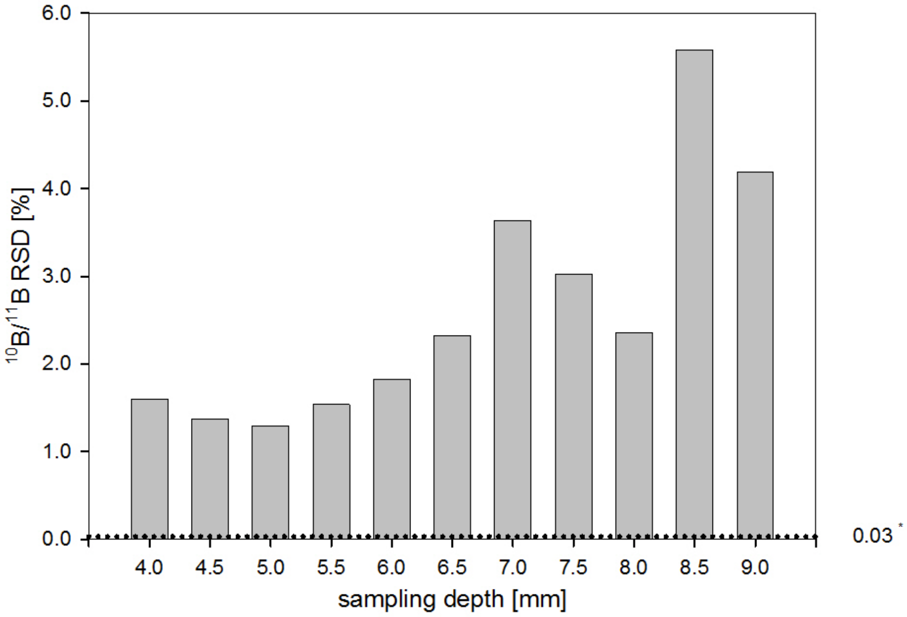

Figure 11 Optimization of ICPMS parameters: Comparison of $^{10}B/^{11}B$ relative standard deviation (RSD) (IRM S97) with different sampling depth (4.0 - 9.0 mm) using Q-ICPMS (Agilent 7700x quadrupole ICPMS, Agilent Technologies, Waldbronn, Germany) at constant laser ablation settings (ns-LA, 100 µm, 0.5 J cm^{-2}, 5 Hz)

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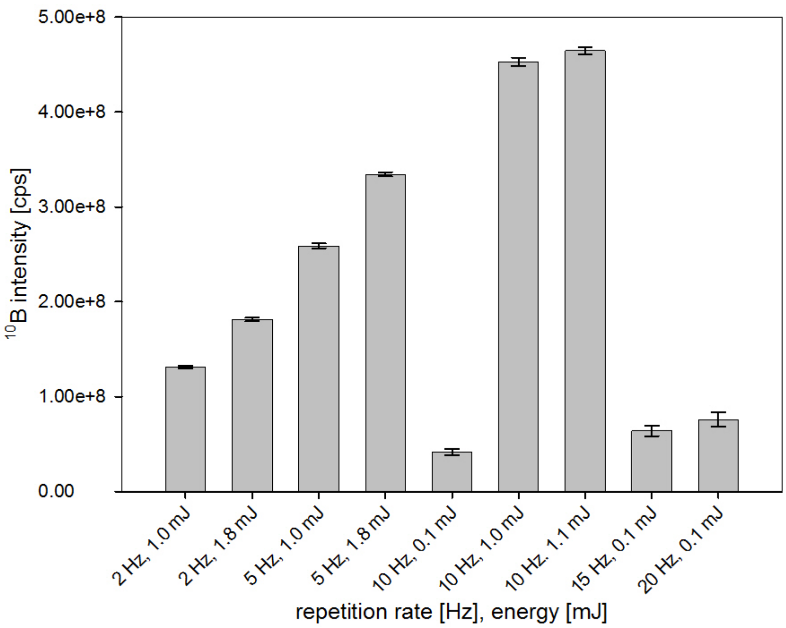

Figure 12 Optimization of laser parameters: Comparison of ^{10}B intensity (S97 IRM) with different repetition rate (2 – 20 Hz) and different laser energy (0.1 – 1.8 mJ) at constant spot size (200 µm) using fs-LA (Legend, Coherent Inc., USA) and MC-ICPMS (Nu Plasma HR MC-ICPMS, Nu Instruments, Wrexham, Great Britain)

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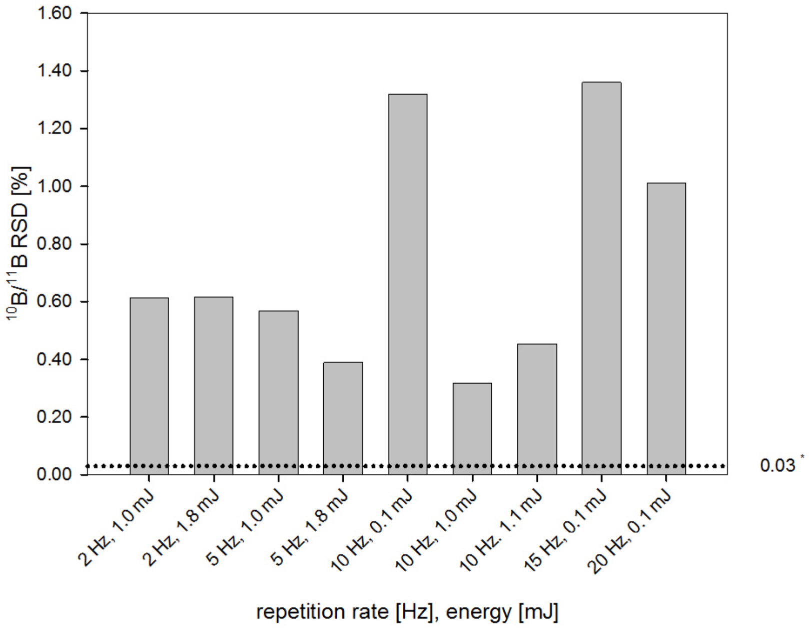

Figure 13 Optimization of laser parameters: Comparison of $^{10}B/^{11}B$ relative standard deviation (RSD) (IRM S97) with different repetition rate (2 - 20 Hz) and different laser energy (0.1 - 1.8 mJ) at constant spot size (200 µm) using fs-LA (Legend, Coherent Inc., USA) and MC-ICPMS (Nu Plasma HR MC-ICPMS, Nu Instruments, Wrexham, Great Britain)

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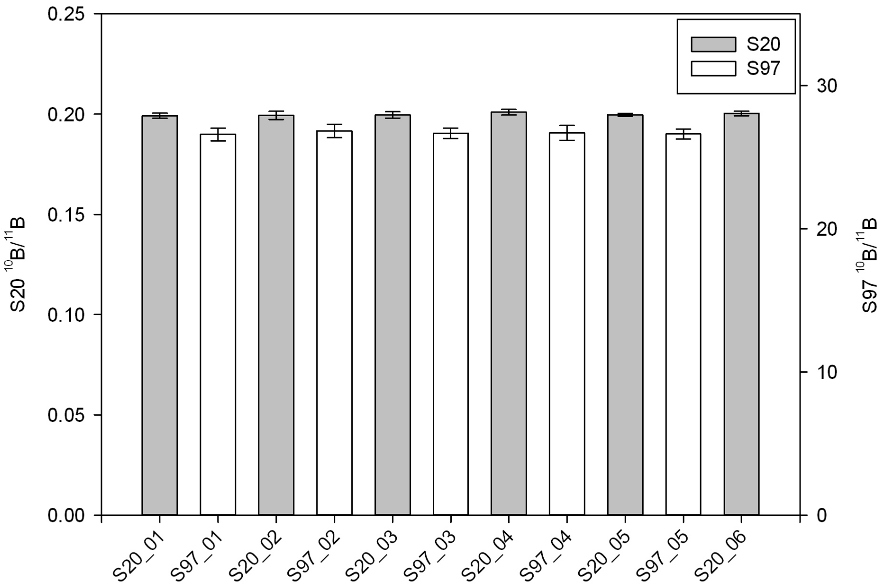

Figure 14 Measurement sequence for mass bias correction of IRM S97 using IRM S20 as standard (ns-LA-ICPMS). The arithmetic mean of two IRM S20 values is used to correct the IRM S97 value in the middle.