

Integrated LA-ICP-MS: Thermo Scientific iCAP Q ICP-MS with Photon Machines Analyte G2 Laser Ablation System

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Key Words

Laser ablation, geochemistry, geochronology

Goal

To demonstrate the integration between the Photon Machines Analyte G2 excimer laser ablation system and the iCAP Q ICP-MS.

Analytical Problem

Productivity and ease of use of LA-ICP-MS is often limited by inadequate hardware and software integration between the two systems.

Instrumentation

The open sample introduction area of the Thermo Scientific™ iCAP™ Q ICP-MS simplifies physical connectivity between the systems by allowing for shorter transfer tubings, minimizing any potential sample transfer affects.

The swing frequency RF generator in the iCAP Q ICP-MS reliably maintains a stable ion source even when introducing He/N₂ gas flows in laser ablation analyses.

Software

Thermo Scientific™ Qtegra™ ISDS control software is used on an ever increasing range of elemental and isotopic techniques from Thermo Scientific. By using a series of plug-ins, direct control of a wide range of accessories is possible from within a single user interface.

The Photon Machines Qtegra plug-in provides bi-directional communication and fully automated triggering without requiring any additional cabling.

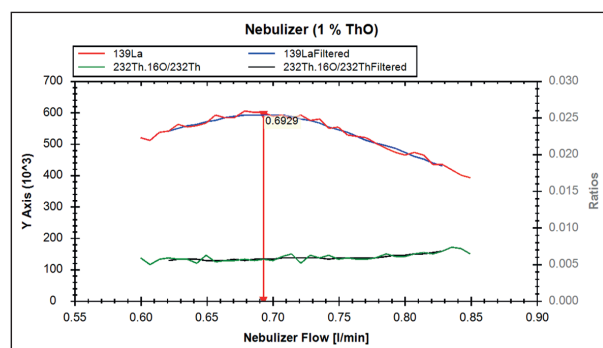


Figure 2: LA-ICP-MS autotuning of Ar make-up gas flow.



Figure 1: The Photon Machines Analyte G2 laser ablation connected to the Thermo Scientific iCAP Q ICP-MS

Routine optimization of a combined LA-ICP-MS system is complicated by the sometimes unstable sampling process. With Qtegra however an autotune procedure is possible for the iCAP Q ICP-MS since:

- Raw intensities are smoothed before the optimum setting is determined, thereby improving day to day reproducibility in LA analyses.
- When optimizing gas flows both elemental sensitivity and oxide formation are monitored simultaneously. In Figure 2 for example, the optimum Ar make-up gas flow must satisfy the defined criteria for both performance indicators.

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Ablation patterns created in the Analyte G2's Chromium software platform are recognized by Qtegra making sample definition for LA-ICP-MS as simple as with an autosampler in solution analyses.

Label	Status	Laser Scan Position Number	Laser Output Setting (%)	Duration (s)	Sample Type
1 RGM	●	1	80	300	UNKNOWN
2 BCR-2	●	21	80	300	UNKNOWN
3 BHVO-2	●	41	80	300	UNKNOWN
4 JB1a	●	61	80	300	UNKNOWN
5 MRG-1	●	81	80	300	UNKNOWN
6 RGM	●	2	80	300	UNKNOWN
7 BCR-2	●	22	80	300	UNKNOWN
8 BHVO-2	●	42	80	300	UNKNOWN
9 JB1a	●	62	80	300	UNKNOWN
10 MRG-1	●	82	80	300	UNKNOWN
11 RGM	●	3	80	300	UNKNOWN
12 BCR-2	●	23	80	300	UNKNOWN
13 BHVO-2	●	43	80	300	UNKNOWN
14 JB1a	●	63	80	300	UNKNOWN
15 MRG-1	●	83	80	300	UNKNOWN
16 RGM	●	4	80	300	UNKNOWN
17 BCR-2	●	24	80	300	UNKNOWN
18 BHVO-2	●	44	80	300	UNKNOWN
19 JB1a	●	64	80	300	UNKNOWN

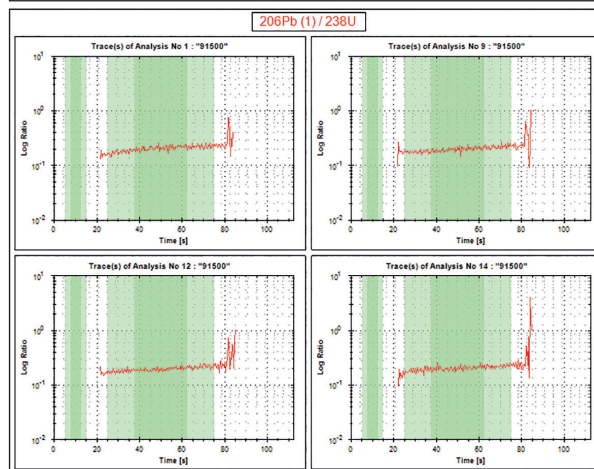
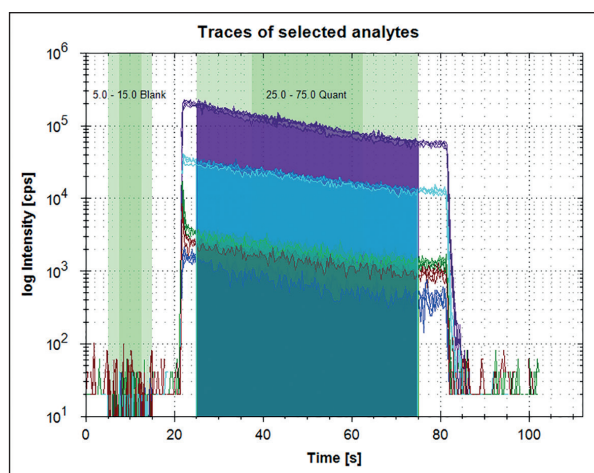
Figure 3: Sample position, laser energy and ablation duration are defined within Qtegra

Visual evaluation of laser ablation data is critical due to the high spatial variability of many geological samples. Real time display (Figures 4a and 4b) of elemental or isotopic profiles in Qtegra software allows the analyst to easily assess results and quickly make changes to subsequent analyses without unnecessarily wasting potentially unique samples.

Integration regions can be globally or individually assigned per ablation and can be moved or adjusted by mouse for quantification.

The full series of quantification strategies are possible allowing for the determination of elemental and isotopic information by laser ablation.

Data can be exported from Qtegra ISDS in a range of standard formats: CSV, XLS, XML etc. For subsequent analysis in specialized laser ablation data reduction packages – for example Iolite – specific export filters are provided.



Figures 4a and 4b. LA-ICP-MS traces can be overlaid (4a) or displayed individually (4b) for rapid data evaluation in elemental and isotopic applications

Solution

The iCAP Q ICP-MS offers unprecedented levels of hardware and software integration for LA-ICP-MS analyses with the Photon Machines Analyte G2. Both routine and cutting edge applications can be addressed using the flexible and powerful software toolset available in Qtegra software.

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