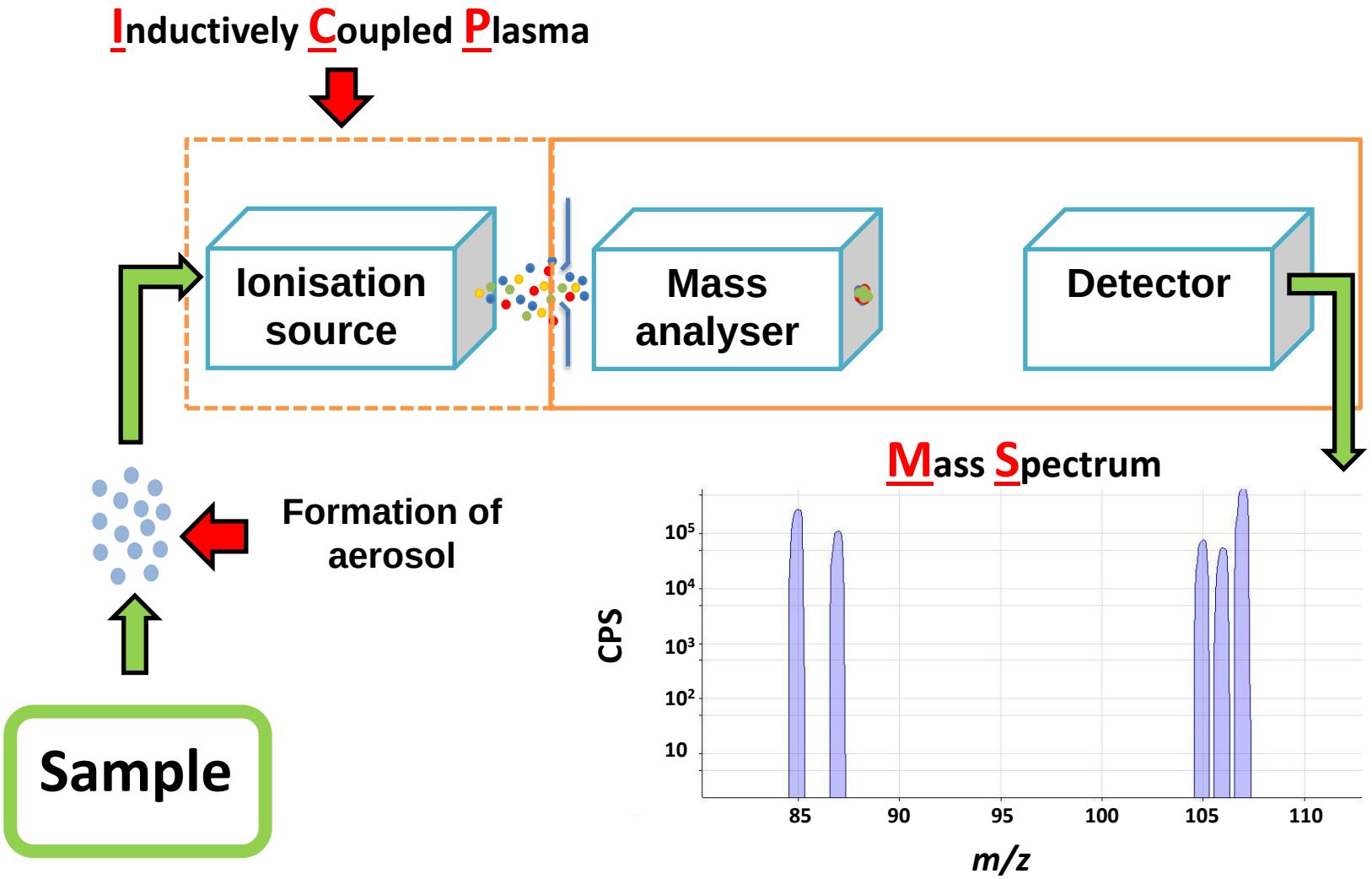
Inductively coupled plasma mass spectrometry (ICP-MS) and Laser ablation (LA) ICP-MS analysis of Cultural Heritage Objects

Päärn Paiste, PhD
Research Fellow in Geology

How an ICP-MS works



For a more detailed explanation look at the video: [Introduction to ICP-MS]

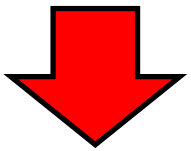
What elements can be measured with ICP-MS

We are measuring particles with different mass, hence ICP-MS can be used for Isotope Ratio measurements

What samples can be analysed with ICP-MS?

Samples are mainly introduced into ICP-MS as liquids

- **Anything that can be dissolved can essentially be analysed!**
- **Sample digestion and preparation time can vary from a few hours to a few weeks**
- **Sample size can vary from a few mg (grain of sand) to a few hundred mg**
- **ICP-MS is extremely sensitive ⇨ samples can be easily contaminated**



Before taking samples for ICP-MS analysis consult with an experienced lab technician!

For a more detailed overview look at the video: Analysis with ICP-MS method

Different types of ICP-MS

Chemical composition
+ some isotopic ratios

Courtecy of Agilent, Inc.

ICP-(Q-)MS
HR/SF-ICP-MS
ICP-TOF-MS

More versatile but lower precison

Only Isotopic Ratios

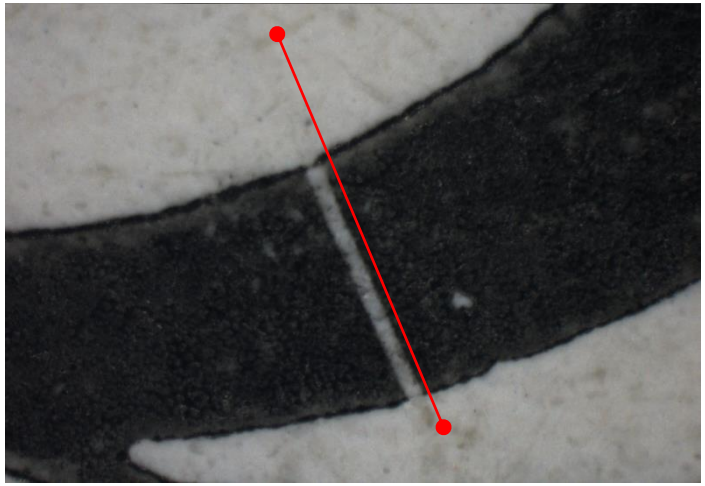
Courtecy of AMETEK, Inc.

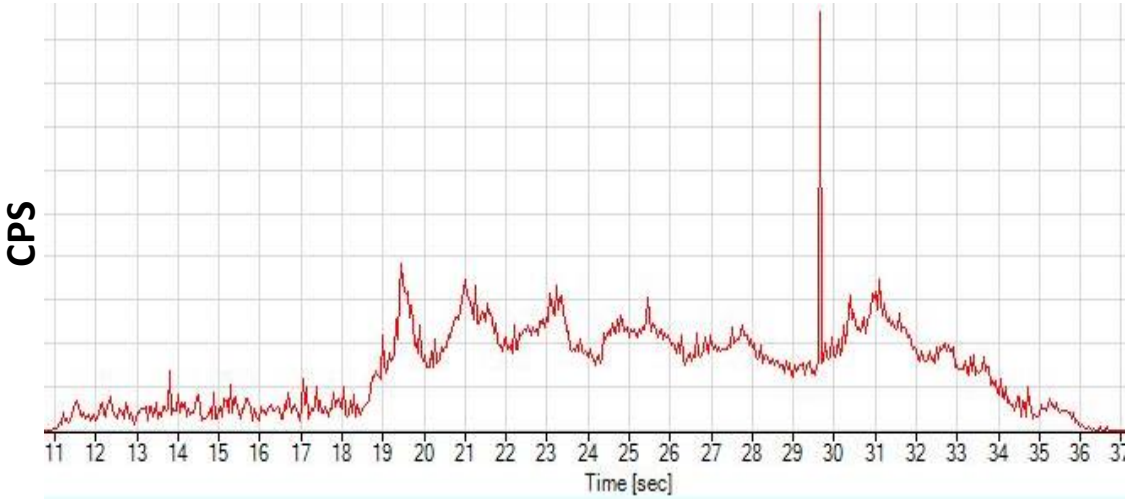
MC-ICP-MS

Orders of magnitude better precison

Laser Ablation (LA) ICP-MS

- Used for *In Situ* analysis of solid samples
- Laser pulse is used to generate dry aerosol – spot size of the laser beam ranges from tens to hundreds of µm
- Destructive method of analysis – will leave a hole!
- To quantify the elemental composition of a sample a reference material with similar composition (matrix) must be used





40 µm Ø laser line accross a letter on a paper and the resulting Pb spectrum

For a more detailed overview look at the video: Analysis with LA-ICP-MS method

Summary

Used to acquire elemental or isotopic composition

Destructive method of analysis!
Solid samples usually need to be dissolved

In Situ analysis of solid samples is possible with Laser Ablation but a suitable reference material is required for quantitative analysis

Very sensitive analysis –> can be used for ultratrace analysis but easy to contaminate samples

Needs a skilled operator and has high running costs

Analysis can be costly!