

# ZIP 5.4

## Short Course on Analytical Geochemistry

Location:  
**University of Bern,  
Institute of Geological  
Sciences,  
Baltzerstrasse 3  
CH-3012 Bern  
Switzerland**



---

b  
UNIVERSITÄT  
BERN

**Monday, 18 May, Studer Auditorium, 2<sup>nd</sup> floor.  
Start 08:30h**

**(1.1 & 1.2) Thomas Pettke (University of Bern)**

***Welcoming and discussion round on the expectations the fellows have on the usefulness of geochemical data - so please think about this a bit***

Introduction to analytical geochemistry, including the nature and significance of analytical data (what is a datum, absolute vs. relative measurements, precision vs. accuracy, external standardization approaches, procedural blanks, figures of merit)

**(1.3 & 1.4) Alfons Berger (University of Bern)**

Electron beam analytical techniques and relative quantification techniques

***Lunch break***

**(1.5) Thomas Nägler (University of Bern)**

Instruments for mass spectrometry (TIMS, ICP-MS; SIMS, TOF-MS et al.)

**(1.6 & 1.7) Thomas Nägler (University of Bern)**

Isotope dilution practical (students calculate the isotopic composition and the concentration of an example). Discussion of results and applications where required, e.g., radiogenic isotopes (absolute age dating and isotope tracing) and requirements (chemical sample purification techniques)

## **Tuesday, 19 May: Start 08:30h**

### **(2.1) Thomas Pettke (University of Bern)**

Sample preparation: strategies and significance  
(bulk vs. in-situ; major - trace elements; isotope ratios, and data on other intensive parameters like  $f_{O_2}$ , speciation; contamination, ....)

### **(2.2 & 2.3) Lukas Baumgartner (University of Lausanne; SwissSIMS)**

Secondary ion mass spectrometry (SIMS) in Earth Sciences

### **(2.4) Niklaus Waber (University of Bern)**

Isotope hydrogeology: Basics of traditional and non-traditional isotope systems used in hydrogeochemistry

### ***Lunch break***

### **(2.5) Niklaus Waber (University of Bern)**

Isotope hydrogeology: Application of these isotope systems to groundwater evolution/pollution/remediation/management and low-T water-rock interaction

### **(2.6) Thomas Pettke (University of Bern)**

Mineral separation for bulk mineral analysis: Visit the Min-Sep-Labs  
(crushing including Selfrag, washing, sieving, Frantz magnetic separation, Wilfley table, heavy liquids, hand-picking, .....)

## **Wednesday, 20 May: Start 08:30h**

**Thomas Pettke, with help from Daniel Peters (LAB) (University of Bern)**

### **(3.1& 3.2) Thomas Pettke (University of Bern)**

LA-ICP-MS in-situ analysis: fundamental and practical considerations  
(sample preparation, philosophy of data acquisition and data reduction)

### **(3.3) Marco Burn (University of Bern)**

In-situ LA-ICP-MS geochronology and its applications (ages, zoning)

### **(3.4) Thomas Pettke (University of Bern)**

Measure together one block of LA-ICP-MS data

### ***Lunch break***

### **(3.5 - 3.7) Thomas Pettke (University of Bern)**

Computer Lab:  
Reduction of LA-ICP-MS data using SILLIS and discussion/validation of results

## **Thursday, 21 May: Start 08:30h**

### **(4.1& 4.2) Klaus Mezger (University of Bern)**

Uncertainties in analytical geochemistry and statistical significance of analytical data

### **(4.3) Nicholas Lloyd (Thermo Fisher Scientific, Germany)**

An introduction to MC-ICP-MS: How high-precision isotope ratios are attained. An overview of the methodology and technology and how this contributes to the precision geochemists report.

### **(4.4) Nicholas Lloyd (Thermo Fisher Scientific, Germany)**

An overview of MC-ICP-MS applications: Measuring isotope ratios from Li to Pu. Different modes of operation will be covered, including in-situ and speciation techniques.

### ***Lunch break***

### **(4.5 & 4.6) Peter Ulmer (ETH Zurich)**

Experimental fluid-rock UHP geochemistry:  
Determination of fluid phase relations and compositions at high P-T conditions using the trapping technique and "cryogenic" LA-ICP-MS analysis

### **(4.7) Igor Villa & Thomas Pettke (University of Bern)**

Bulk and in-situ measurement of trace halogen concentrations in rocks and minerals

## **Friday, 22 May: Company Workshop day**

### **Start 08:30h**

#### **Dr. Nicholas Lloyd (Thermo Fisher Scientific, Germany):**

Innovations in MC-ICP-MS: Attaining precision from smaller samples and for minor isotopes.

LA-MC-ICP-MS: Coupling laser ablation with MC-ICP-MS, including split stream with ICP-MS (LASS).

### **Start 10:30h**

#### **Michel Outrequin (Cameca / AMETEK, France)**

Introduction to Electron Microprobe, SIMS and Atom Probe techniques.

Applications in various fields such as Geology, Metallurgy, Semi Conductor industry.

### ***Lunch break***

**Final round table discussion**

between ZIP fellows and company representatives, to foster mutual exchange between users and instrument manufacturers, and to philosophize about future development directions, including potential for future professional careers for fellows in industry.