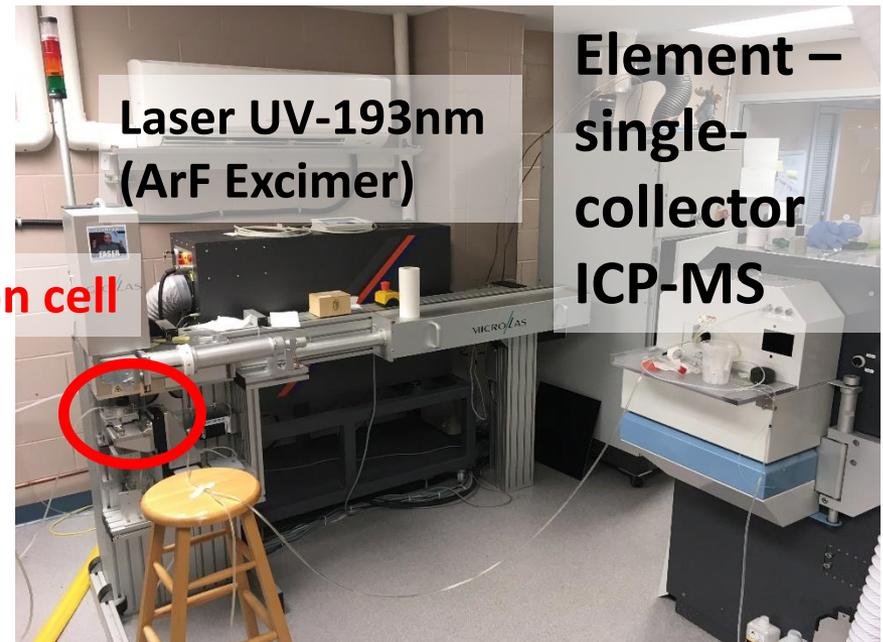
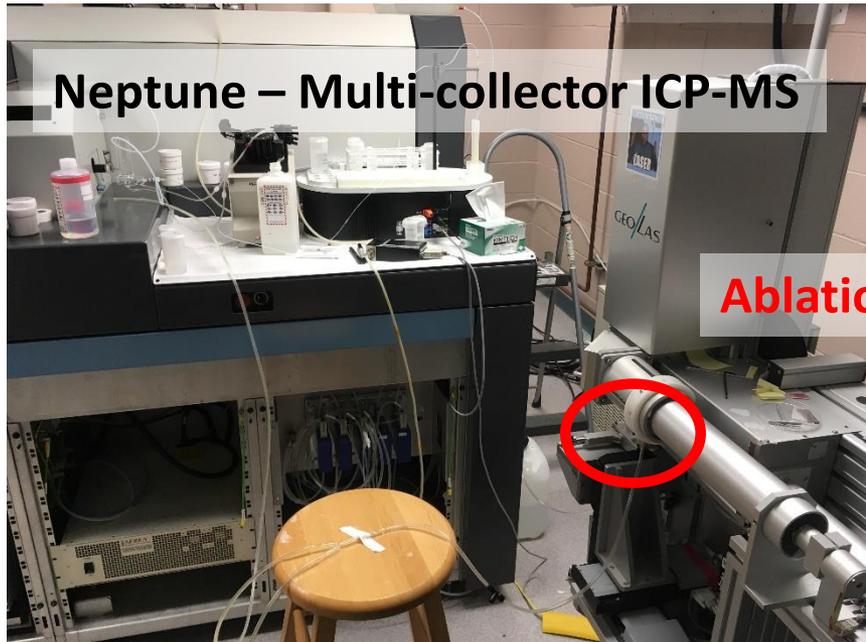


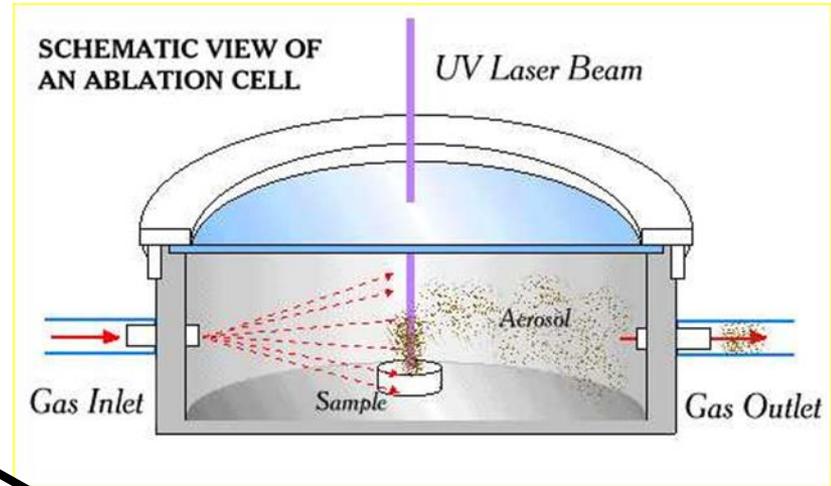
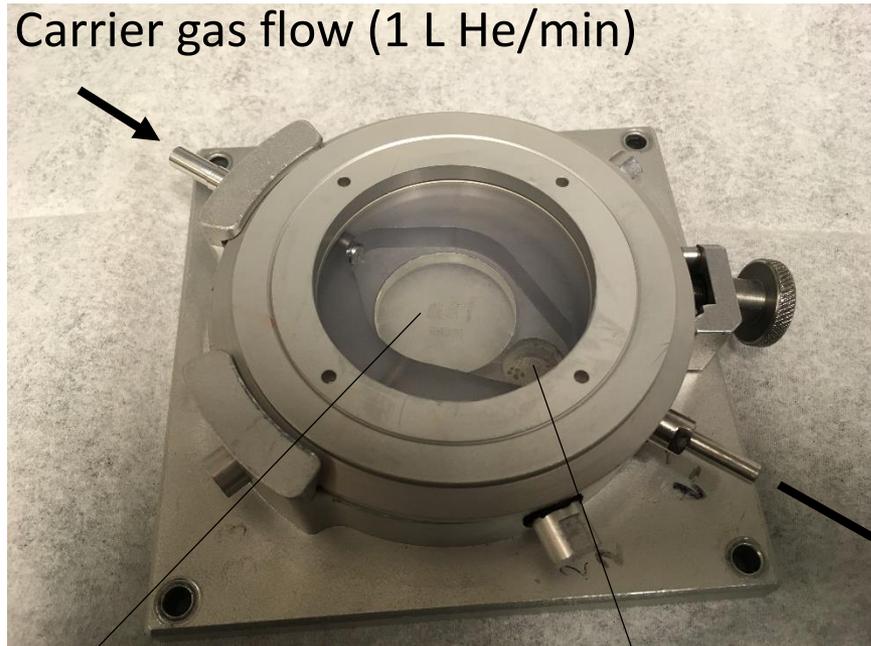
# An Introduction to Laser Ablation ICP-MS

Rebecca Lam, Markus Wälle

# What is Laser ablation ICP-MS (Inductively Coupled Plasma Mass Spectrometry) - Instruments



# Ablation cell

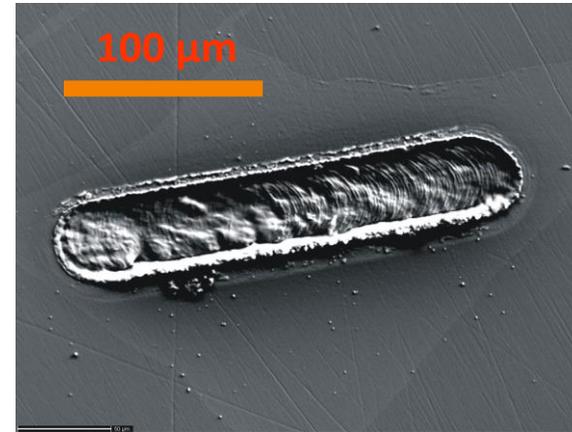
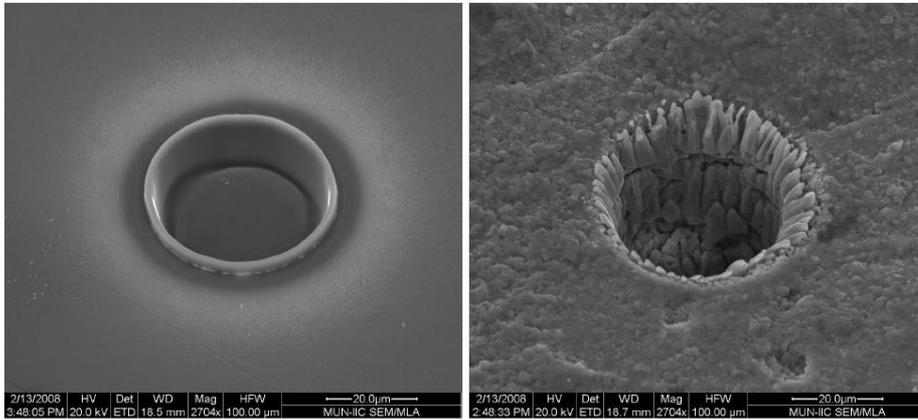


to ICP-MS

samples

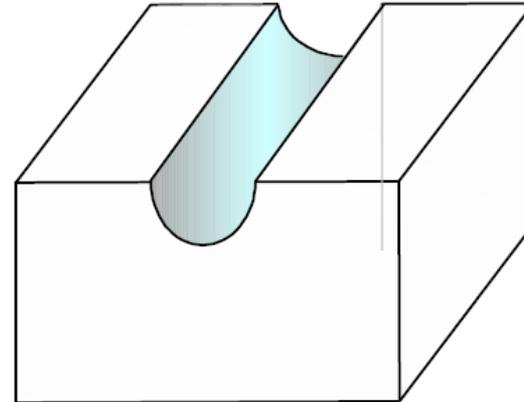
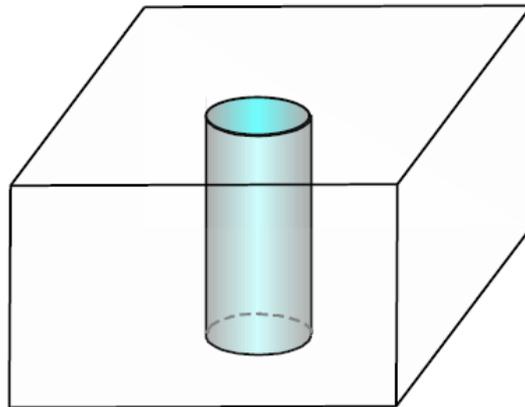
standards

# Ablation spot(crater)



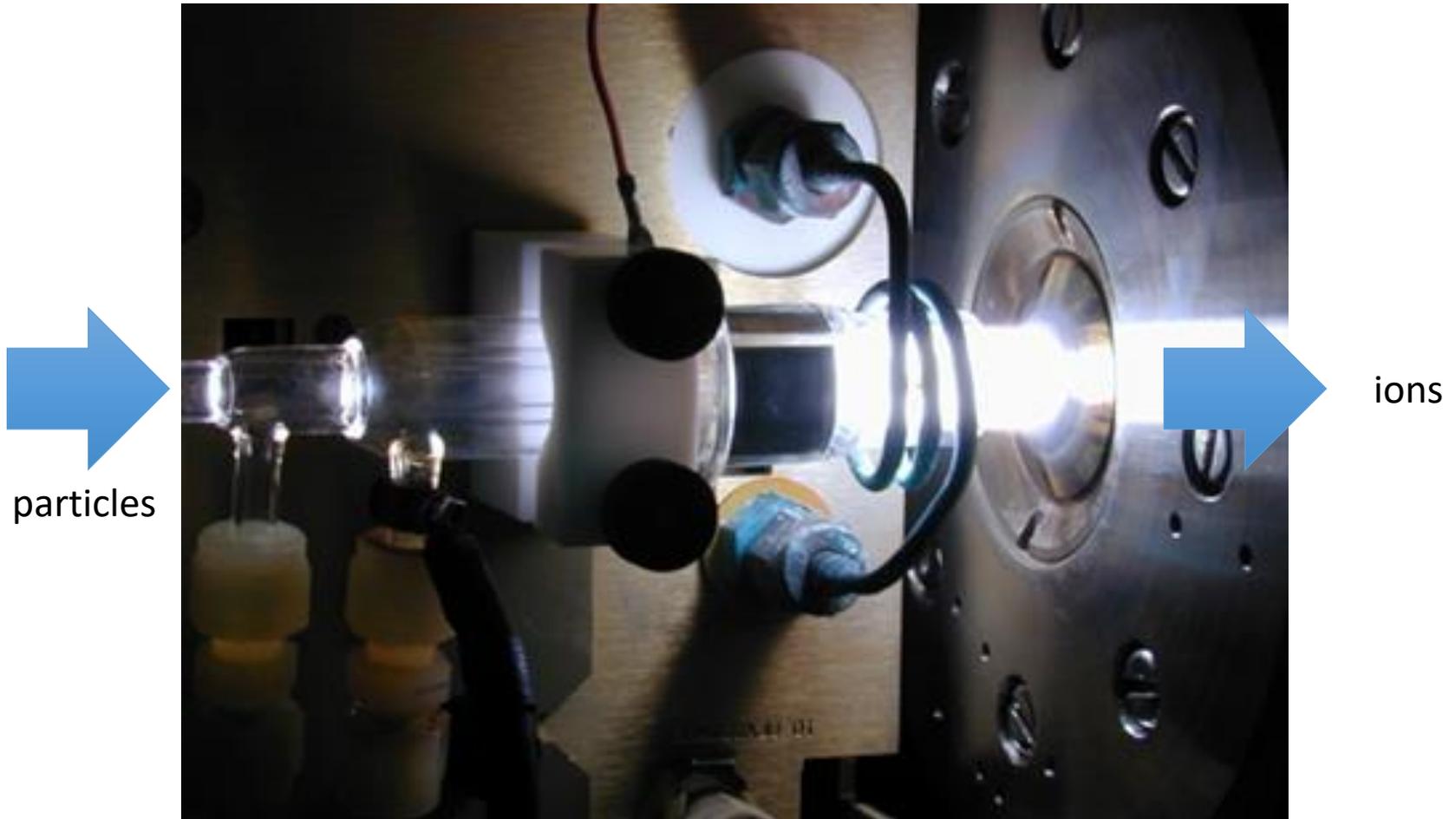
Single laser pit

Laser raster

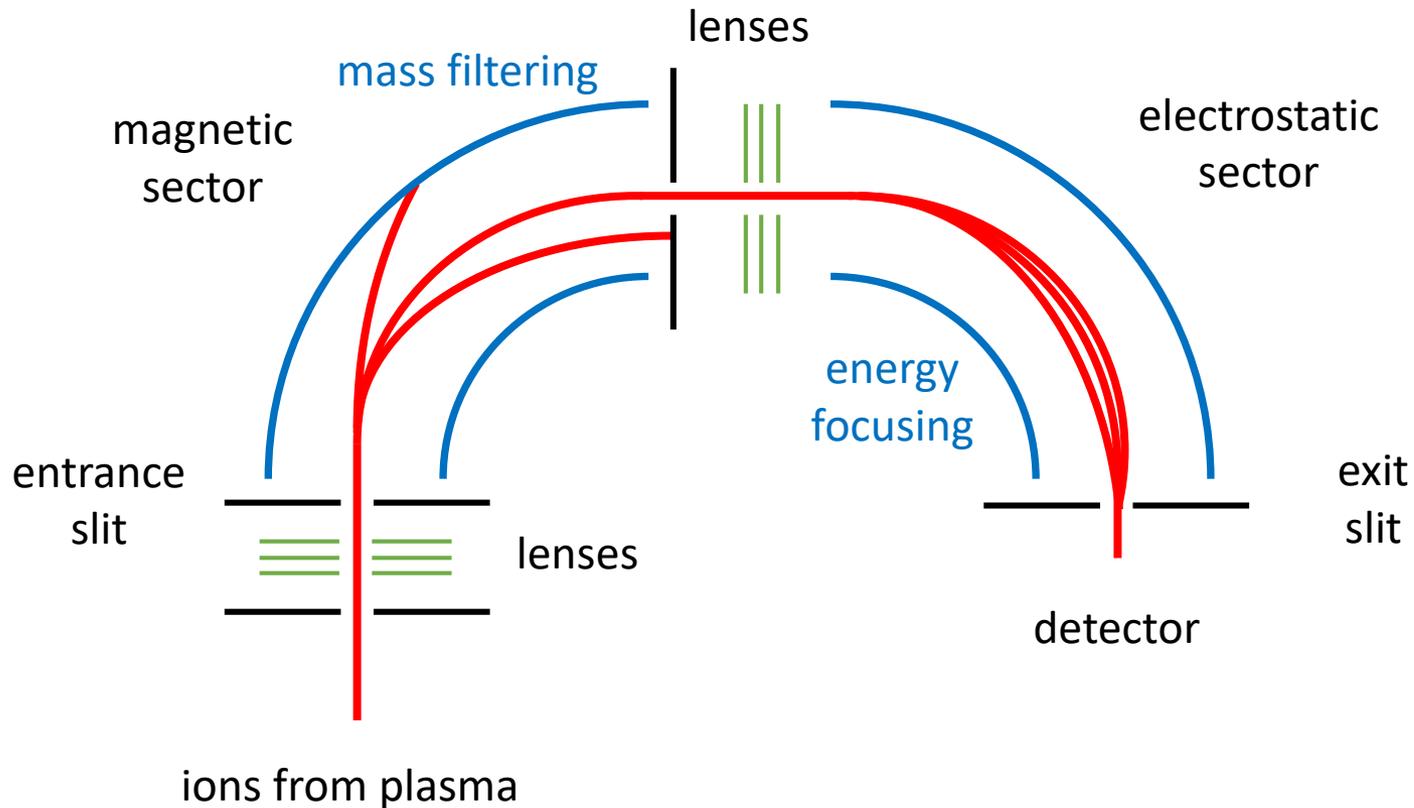


Spot sizes from 20 μm to 100 μm

# Inductively Coupled PLASMA



# Mass Spectrometer



# Single- vs. Multi-collector

- Single-collector:  
One mass per time, scans through mass range (0.1 to 1 sec, depending on number of elements)
- Multi-collector:  
several masses simultaneously (limited range)  
allows high precious ratio measurements  
-> required for isotope ratio analyses!

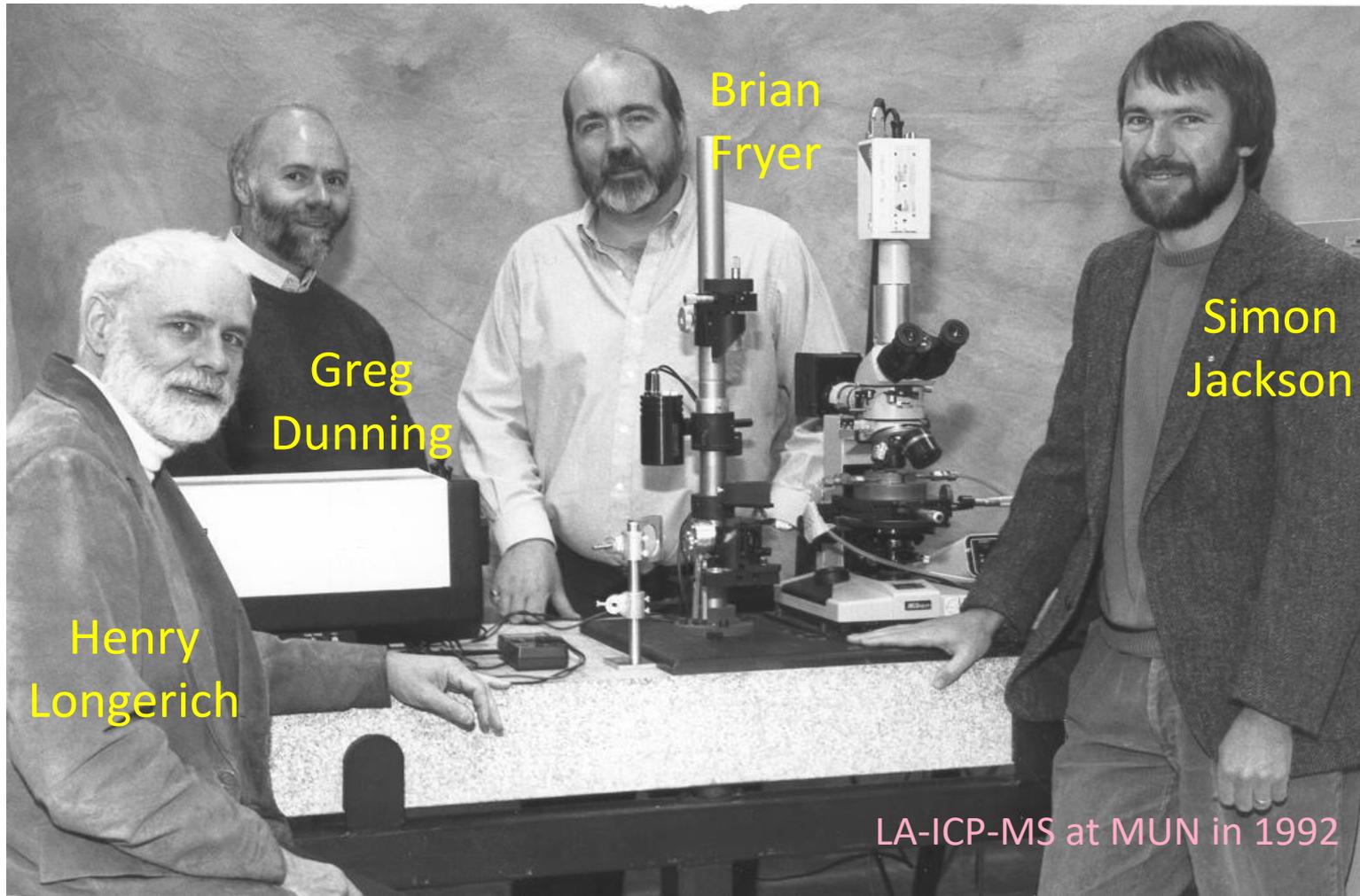
# What can LA-ICP-MS do

- Almost all Elements (except upper right corner of PSE, meaning **no** H, N, O, F, (C) and the noble gases)
- Below mg/kg concentration detection capability for e.g. Rare Earth Elements
- Lateral resolution in tens of microns
- No need of sample digestion

# Drawbacks of LA-ICP-MS

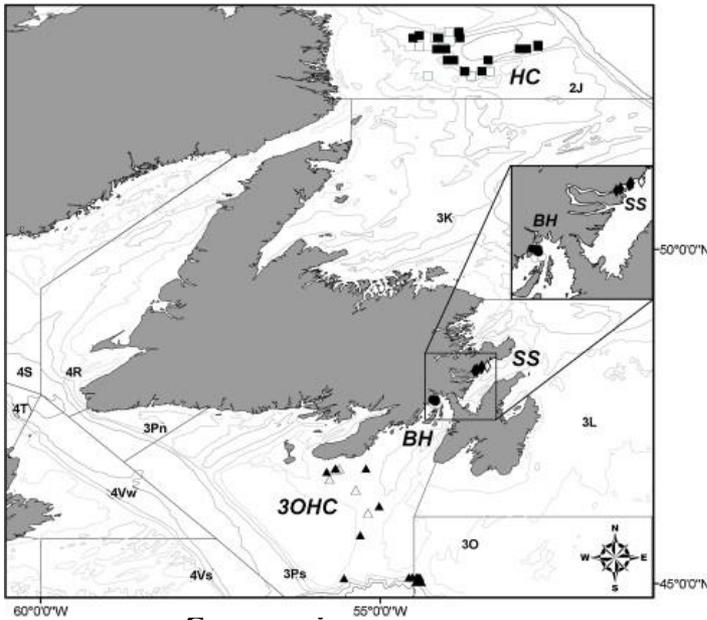
- Internal Standard needed! (Concentration of one element has to be known)
- Standards needed! (more matrix matched the better)
- Sample fits into ablation chamber
- Destructive on small scale

# History of Laser ablation at MUN

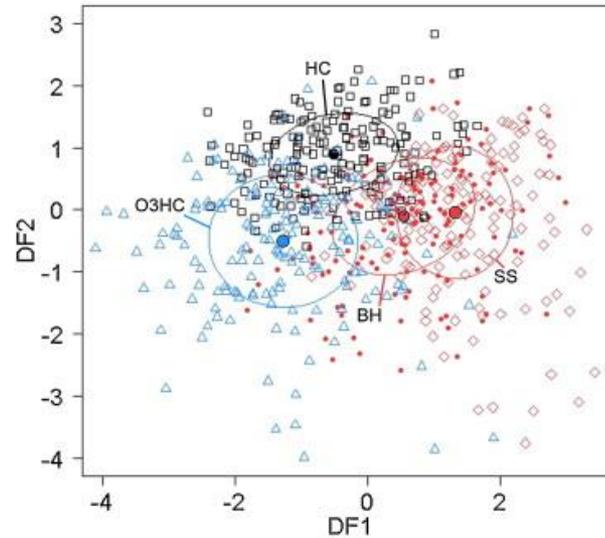


# Trace elements in Otolith

D'Avignon and Rose. Fish Res., 147 (2013)



Spawning areas

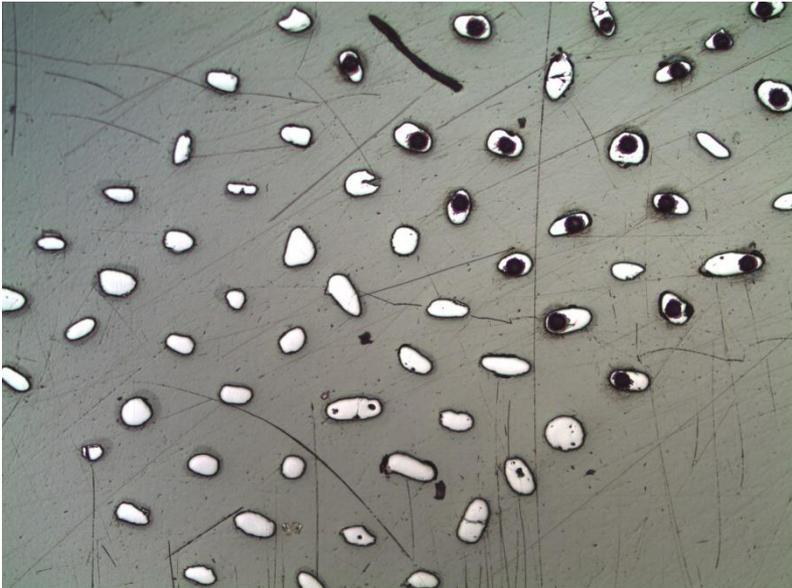


Discrimination function 1 and 2

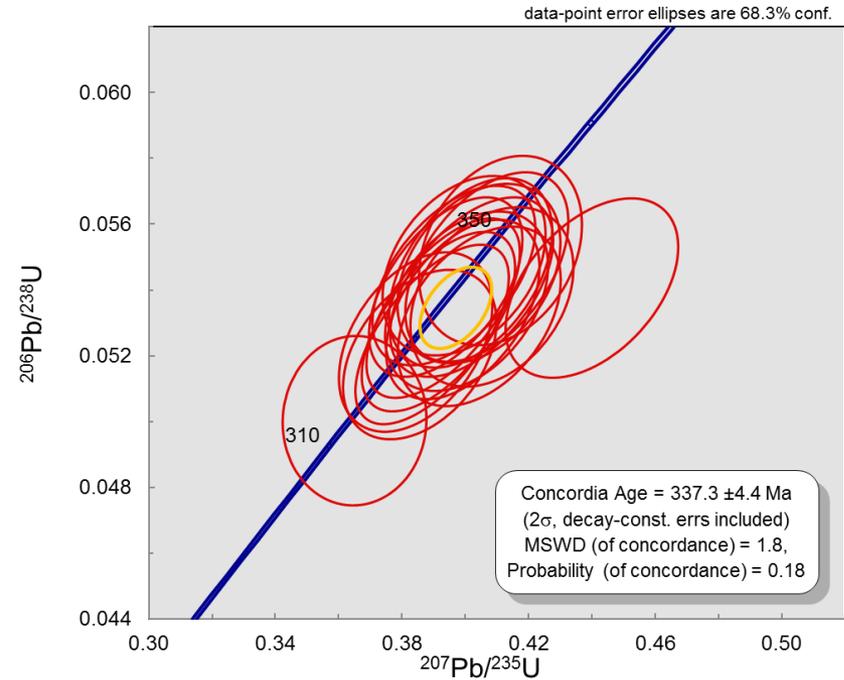
Elemental fingerprint based on  
Mg:Ca  
Mn:Ca  
Sr:Ca  
Ba:Ca

# Dating of Zircons

samples



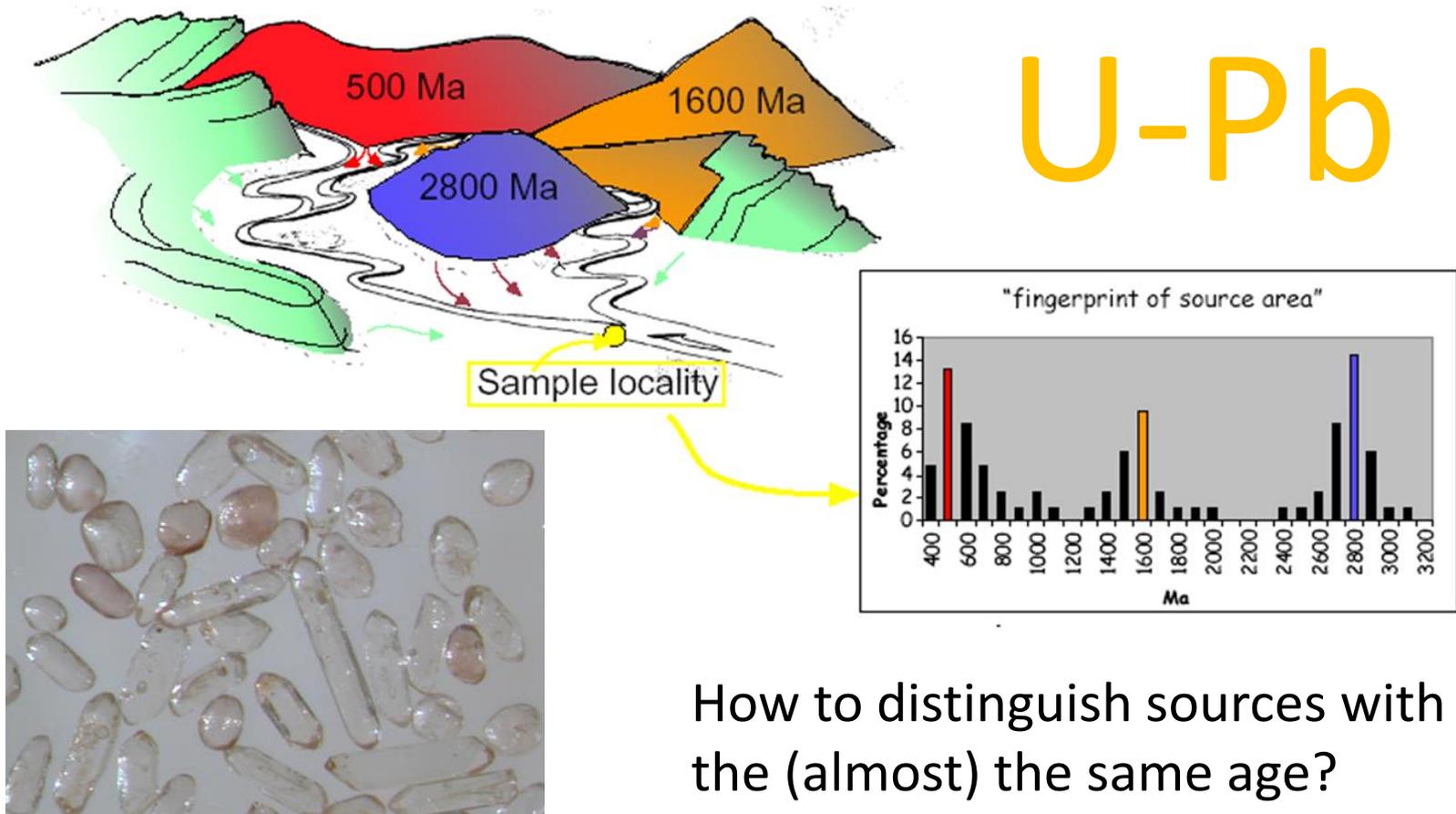
Quality control standard



Concordia diagram

# Dating of Zircons

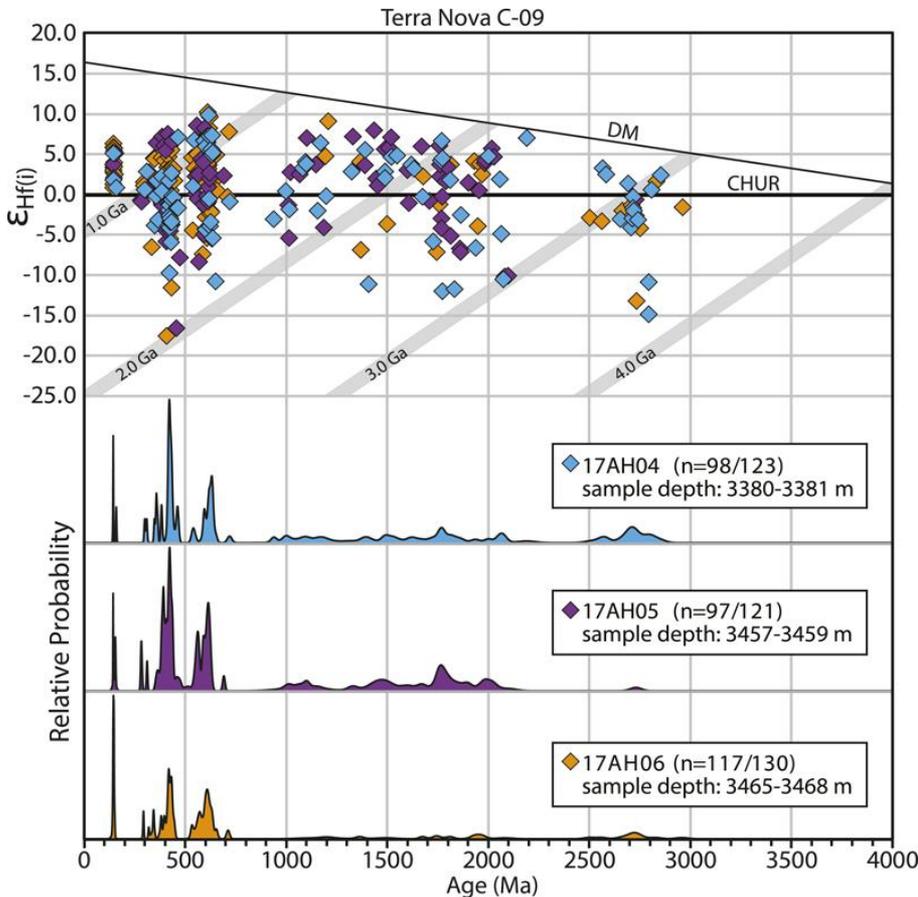
# U-Pb



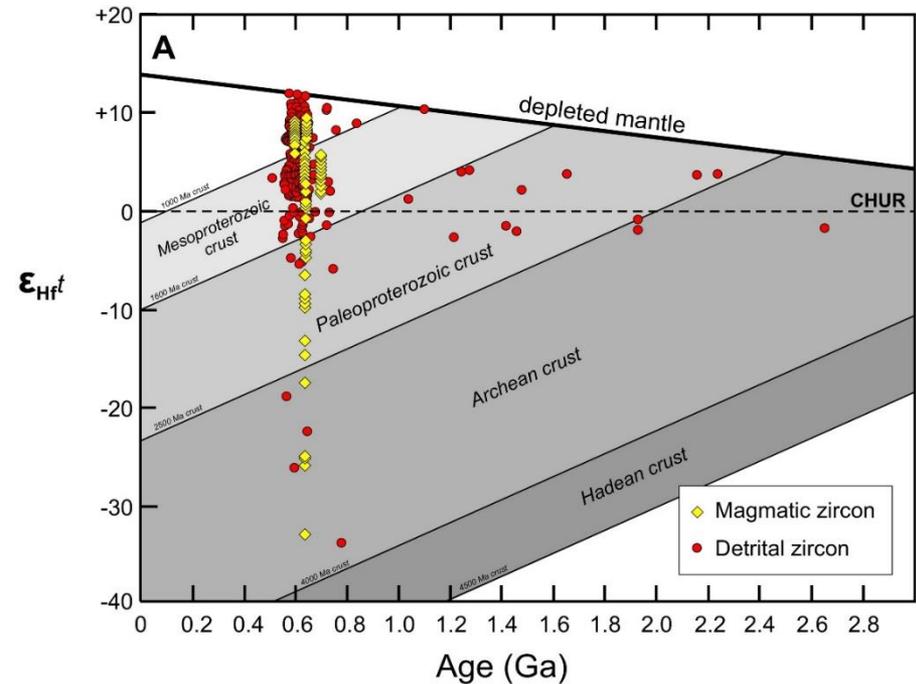
How to distinguish sources with the (almost) the same age?

# Hf isotopes in zircons

Hutter and Beranek. AAPG Bulletin, 104 (2020)



Pollock et al. Can J. Earth Sci., 52 (2015)

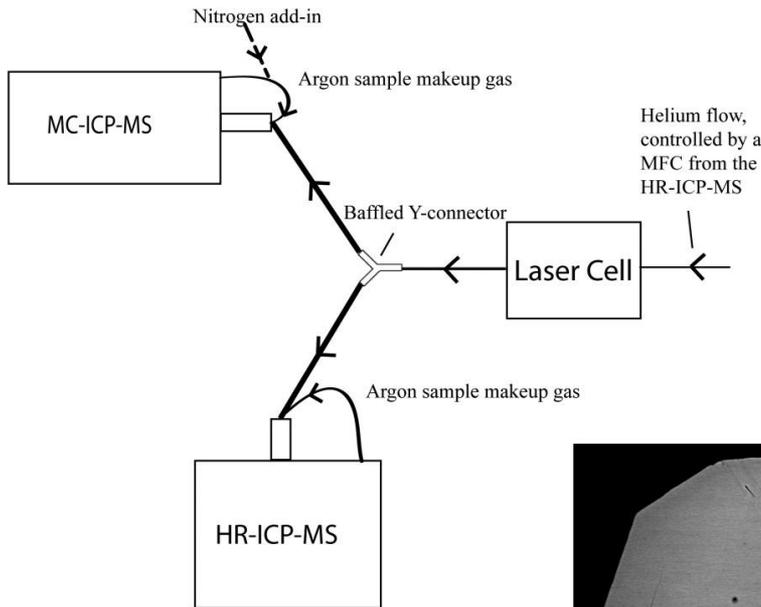


Different crustal and mantle processes lead to  $^{176}\text{Hf}/^{177}\text{Hf}$  variations in zircons

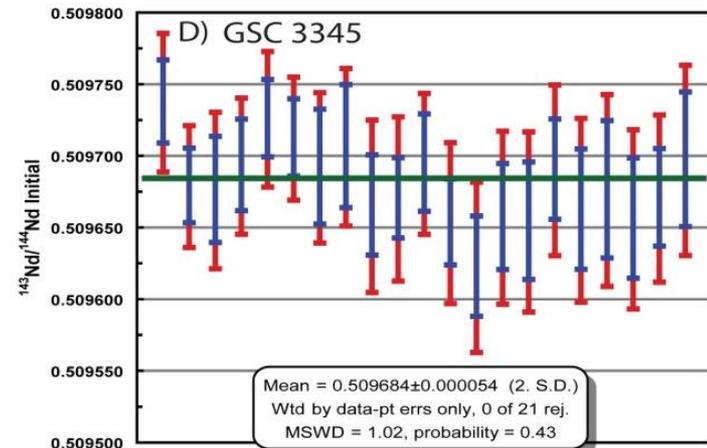
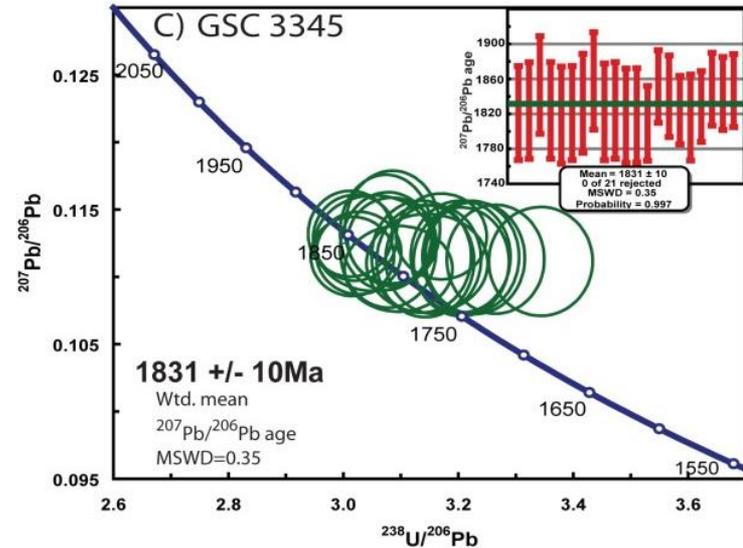
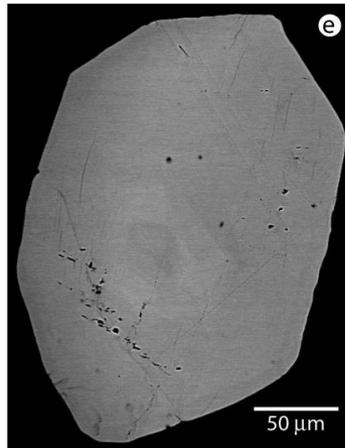
- Differentiate sources with the similar ages
- Information about environment where zircon was formed

# Laser ablation split-stream

Goudie et al. *Geochem, Geophys, Geosy*, 15 (2014)



Simultaneous measurement of U-Pb and Nd isotopes in monazite



**Thank you for your attention**

**Questions?**