

# Laser Ablation $^{14}\text{C}$ anomalies in a stalagmite: a hint of an old organic matter pool?

OR:  
no clue from glue

C. Welte<sup>1,2</sup>, J. Fohlmeister<sup>3</sup>, L. Wacker<sup>1</sup>, M. Wertnik<sup>1</sup>, C. Spötl<sup>4</sup>,  
C. Yeman<sup>1</sup>, B. Hattendorf<sup>5</sup>, M. Christl<sup>1</sup>, T. I. Eglinton<sup>2</sup>, H.-A. Synal<sup>1</sup>

<sup>1</sup>Laboratory of Ion Beam Physics, ETHZ, Otto-Stern Weg 5, 8093 Zurich, Switzerland

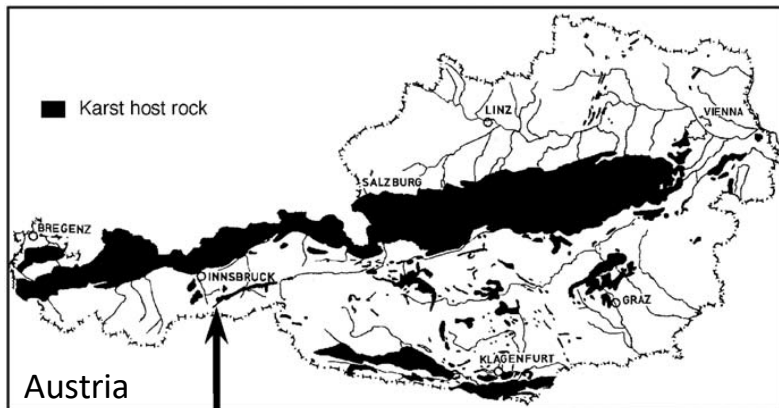
<sup>2</sup>Geological Institute, ETHZ, Sonneggstrasse 5, 8092 Zurich, Switzerland

<sup>3</sup>Institut für Erd- und Umweltwissenschaften, University of Potsdam, Germany

<sup>4</sup>Institute of Geology, University of Innsbruck, Austria

<sup>5</sup>Laboratory of Inorganic Chemistry, ETHZ, Vladimir-Prelog Weg 1, 8093 Zurich, Switzerland

# Study site and motivation



## Objective:

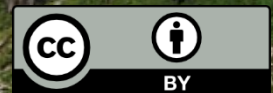
Using combined  $\delta^{13}\text{C}$  and  $^{14}\text{C}$  measurements on stalagmite SPA-127 in order to investigate possible contributions of an old organic matter (OM) reservoir in the karst.

- high alpine region with thin layer of soil [1, 2]
- SPA-127 grew btw. 2500 and 8500 a BP (U/Th-ages with); average growth rate  $\sim 25 \mu\text{m/a}$  [3]

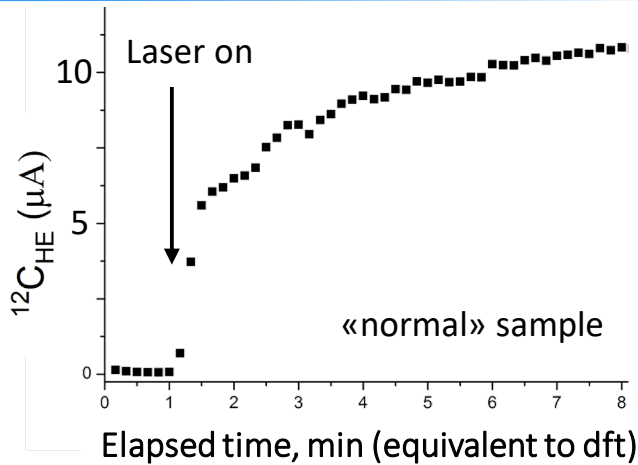
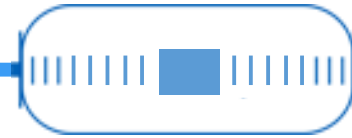
## Entrance Spannagel Cave



- [1] Spötl, C. et al. (2016). Chemical Geology, 435, 60-70.  
[2] Vollweiler, N. et al. (2006). Geophys. Res. Lett., 33, L20703  
[3] Fohlmeister J. et al., (2013). Holocene, 23: 749–754.

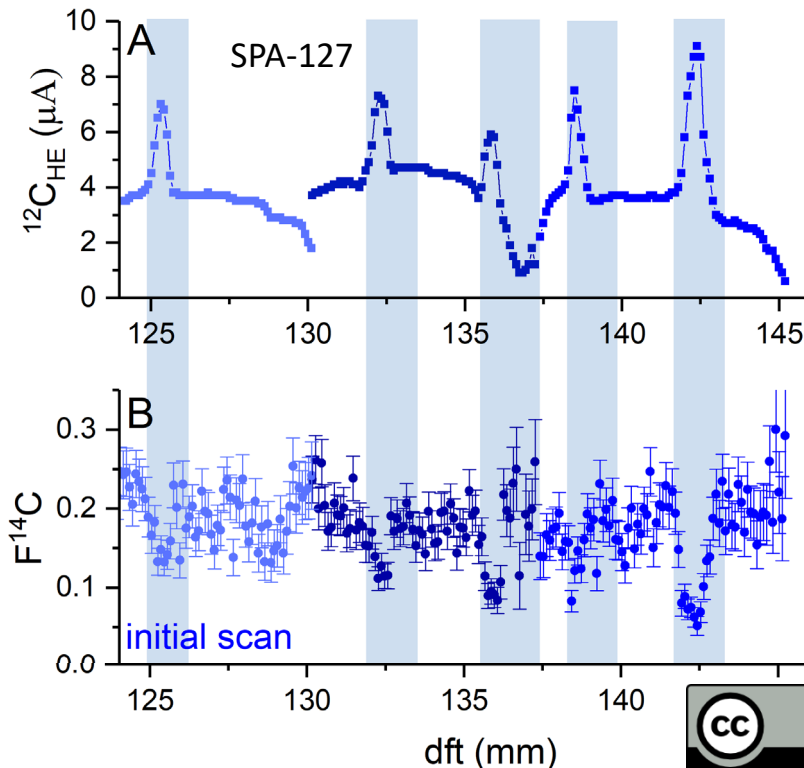


# Laser Ablation AMS\* $^{14}\text{C}$ analysis



## Observations:

- positive **anomalies in ion currents**
- **lower F<sup>14</sup>C** accompany these anomalies
- signal structure could be **reproduced**
  - (i) after removing ~0.5 mm of surface layer
  - (ii) on the stalagmite's archive slab

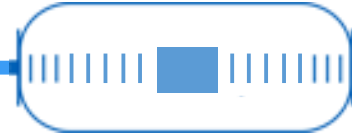


## Measurement parameters

Spot width	75 mm
Frequency	250 Hz
Fluence	8 J/cm <sup>2</sup>
Scanning velocity	10 -20 μm/s
AMS ion current	8 μA

\* Accelerator mass spectrometer

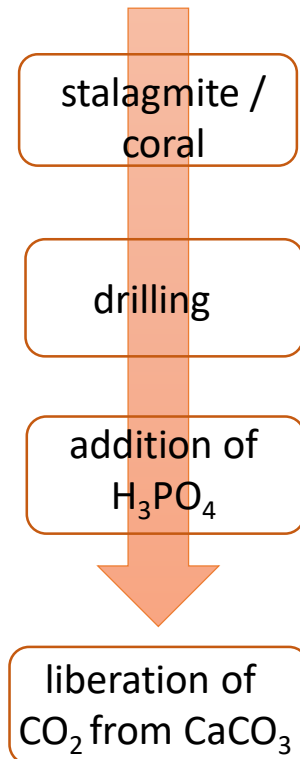
# Hypothesis



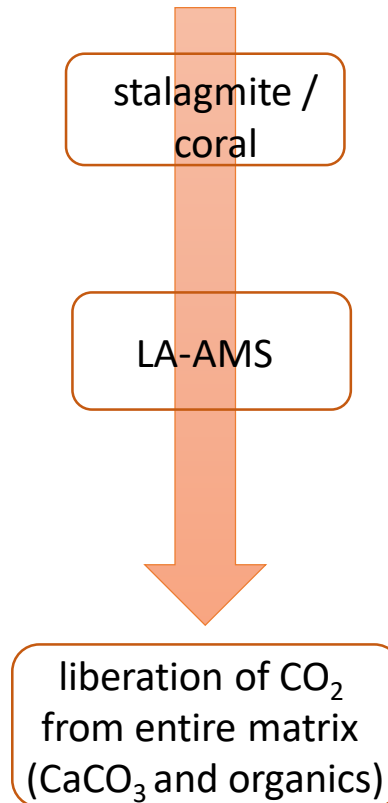
→ Organic matter is present in the matrix of SPA-127!

higher CO<sub>2</sub> conversion efficiencies associated with organic materials compared to CaCO<sub>3</sub> during LA cause increased ion current

## Conventional <sup>14</sup>C analysis of carbonates



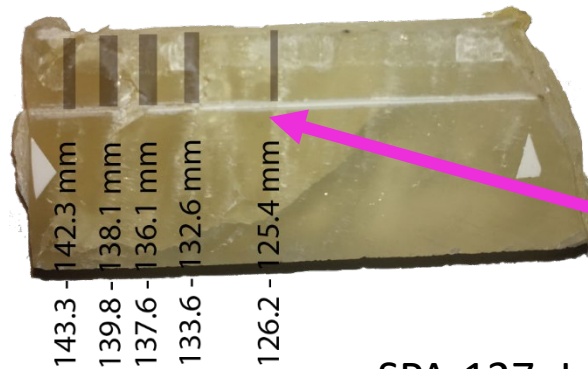
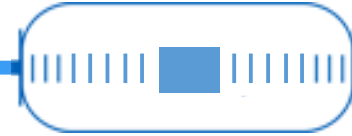
## LA-AMS



Contamination or actual signal?

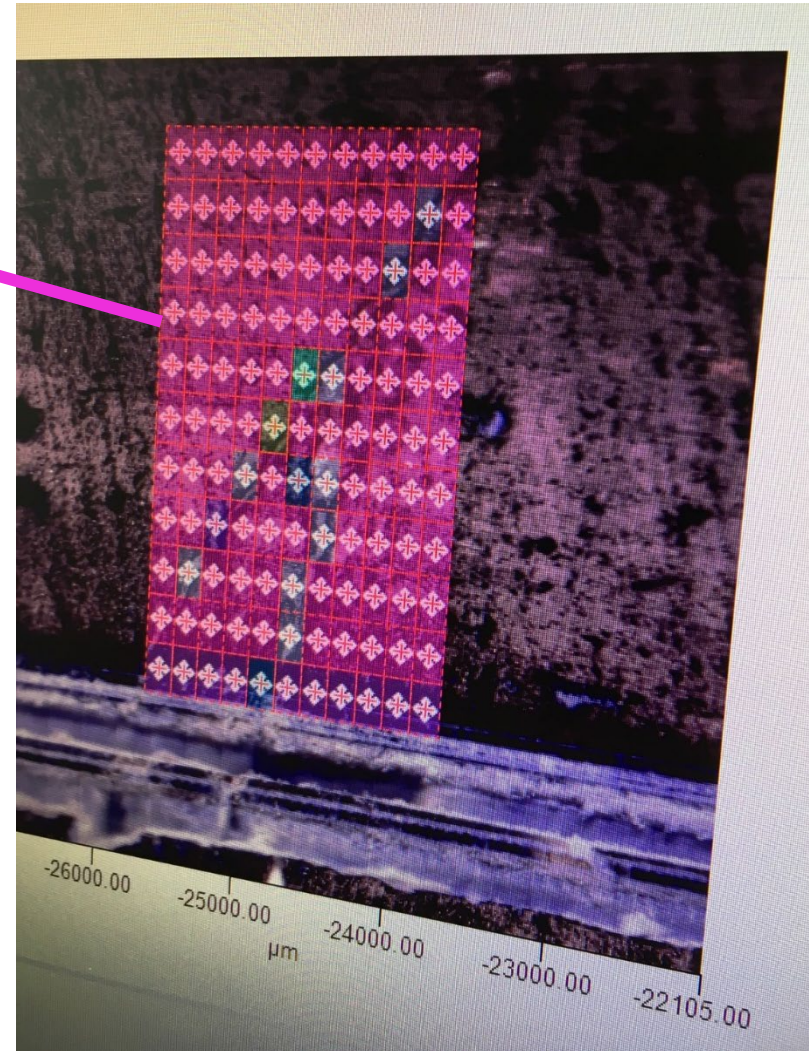


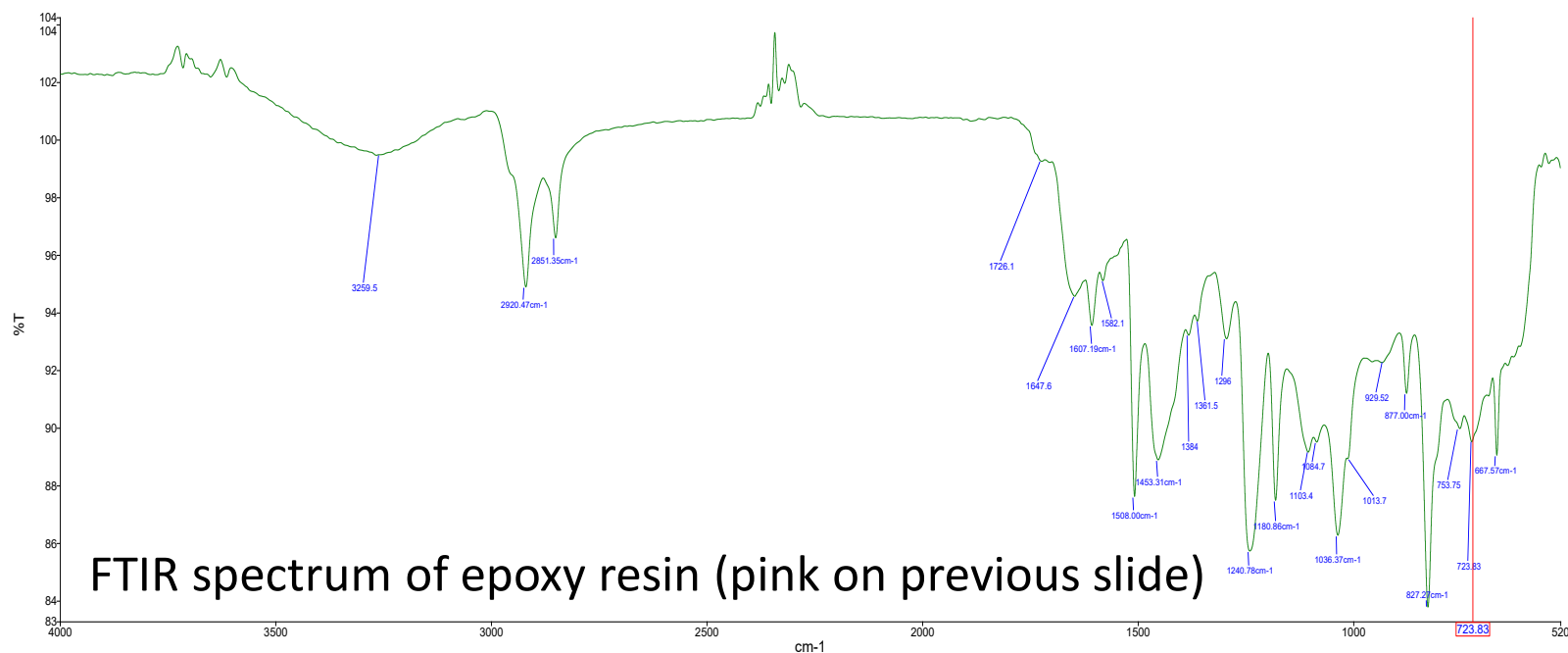
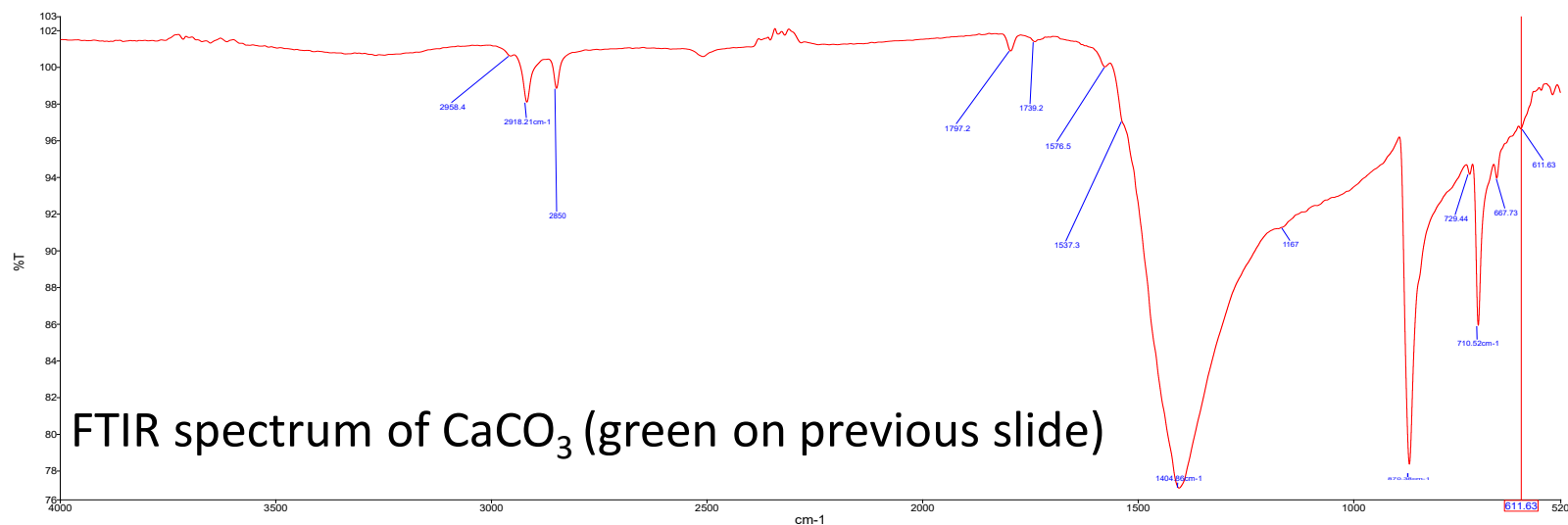
# Answer brought by FTIR\*



SPA-127: LA-AMS anomalies  
were found in grey areas

FTIR spectra are recorded along a crack,  
squares colored in blue-green-yellow show a  
totally different spectra than those colored in  
pink. (Two spectra are displayed for  
comparison in next slide)





# Laser Ablation $^{14}\text{C}$ anomalies in a stalagmite: a hint of an old organic matter pool?

aka epoxy

- $^{14}\text{C}$  analysis of carbonates by LA-AMS yields combined signal of organic and inorganic matrix components
- special care has to be taken when embedding samples in epoxy
- LA-AMS bears potential to investigate organic components in carbonates

Acknowledgements: Laura Hendriks for FTIR analysis



This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.