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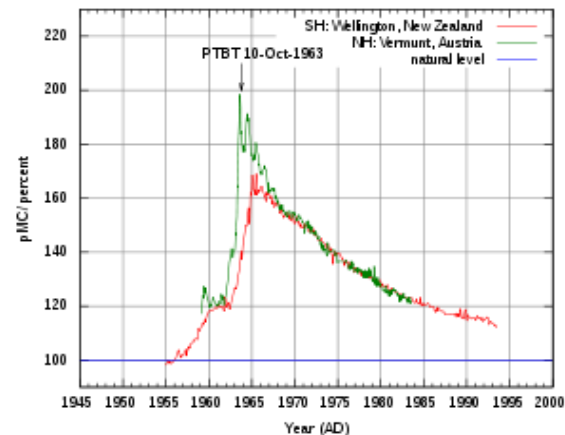
# Developments towards improvement of the background for Radiocarbon Dating of ultra-small DNA samples

Klaus Mair, Jakob Liebl, Peter Steier, Walter Kutschera

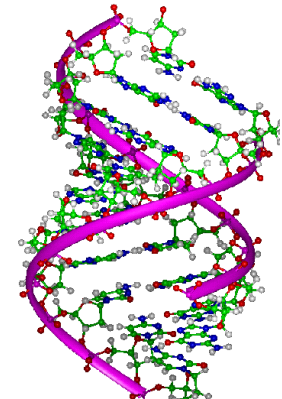
Vienna Environmental Research Accelerator (VERA) Laboratory,  
Fakultät für Physik – Isotopenforschung, Universität Wien,  
Währingerstrasse 17, A-1090 Wien, Austria

# Radiocarbon dating of DNA

- $^{14}\text{C}$  from bomb peak allows the dating of human DNA.



- Cell turnover (neurogenesis) of human neuronal cells is investigated.



# Radiocarbon dating with AMS

## $\mu\text{g C}$ samples

- sample mass 10-100  $\mu\text{g}$
- graphitisation time 2-15 h
- negative ion current in the range of a few  $\mu\text{A C}^-$

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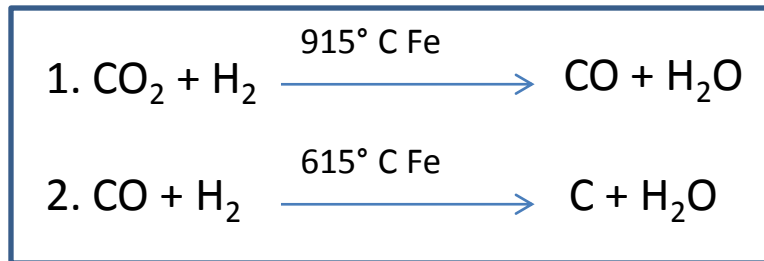
## normal samples

- sample mass  $\sim 1\text{mg}$
- graphitisation time  $< 2\text{h}$
- negative ion current in the range of a few tens of  $\mu\text{A C}^-$

# Preparation of $\mu\text{g}$ C samples

- isolation of sample material of interest
- combustion to  $\text{CO}_2$
- graphitisation:

depends on type  
of sample material



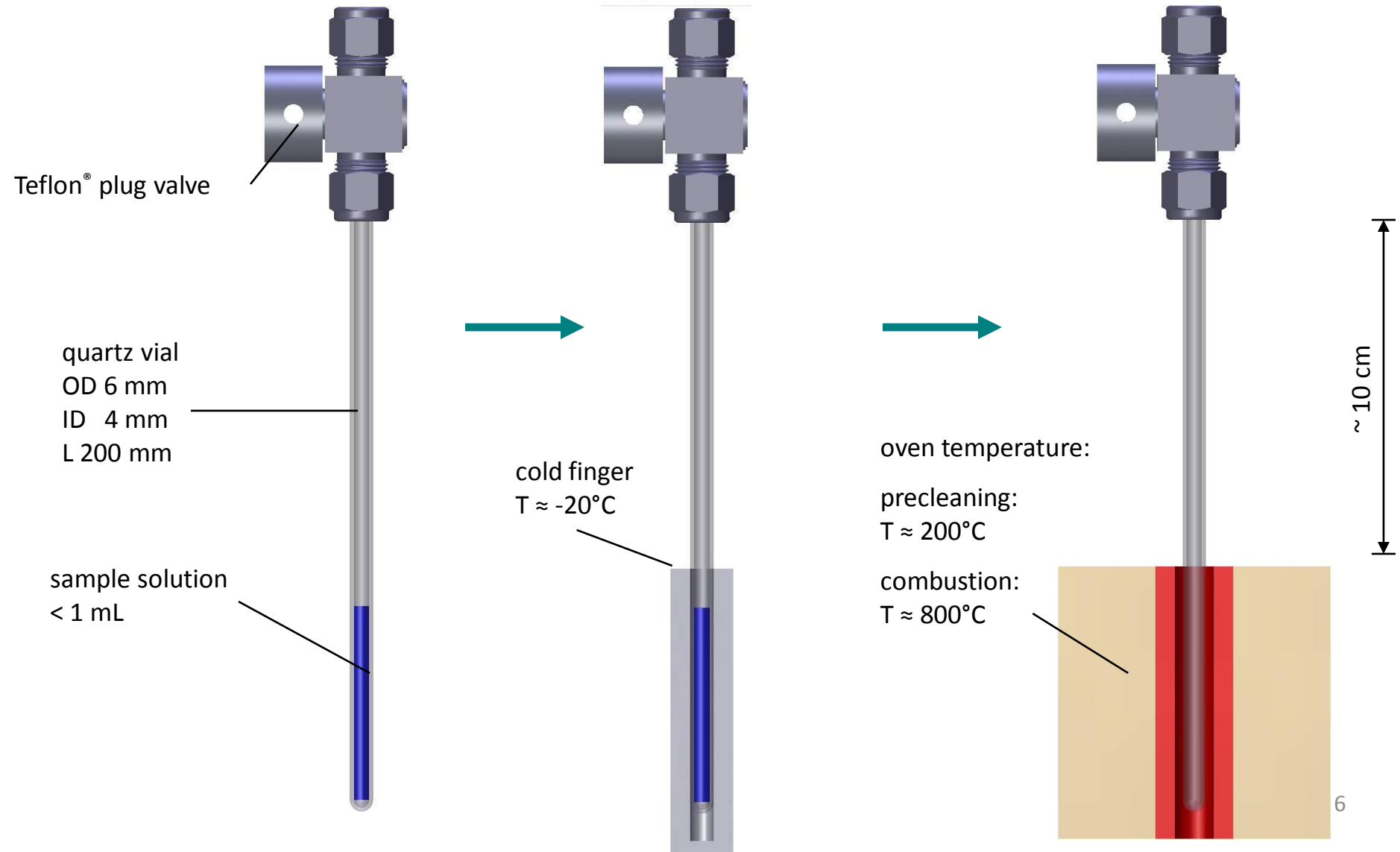
- AMS measurement

# Preparation of $\mu\text{g C}$ samples

sample loading

freeze-drying

prebaking and combustion



# Background of $\mu\text{g C}$ samples

- While sample mass decreases, background mass will not
- Investigated sources of contamination
  - sample pre-treatment
  - combustion
  - graphitisation
  - AMS background

# Background of $\mu\text{g C}$ samples

- sample pre-treatment
  - possible carbon absorption from air (Schmidt et al. 1987)
  - carbon-free environment is needed
  - installation of an argon glove box



# Argon glove box

- gas regeneration system
- activated charcoal for organic solvent removal
- NaOH filter for CO<sub>2</sub> removal

< 5 ppm CO<sub>2</sub>



# Background measurement using $^{13}\text{C}$ enriched DNA

$^{13}\text{C}/^{12}\text{C}=99:1$   
(natural:  $^{13}\text{C}/^{12}\text{C}=1:99$ )

background from  
pre-treatment and combustion



$^{13}\text{CO}_2/^{12}\text{CO}_2$  measurement  
with quadrupole MS



$\sim 0.12 \mu\text{g C}$

background from  
graphitisation

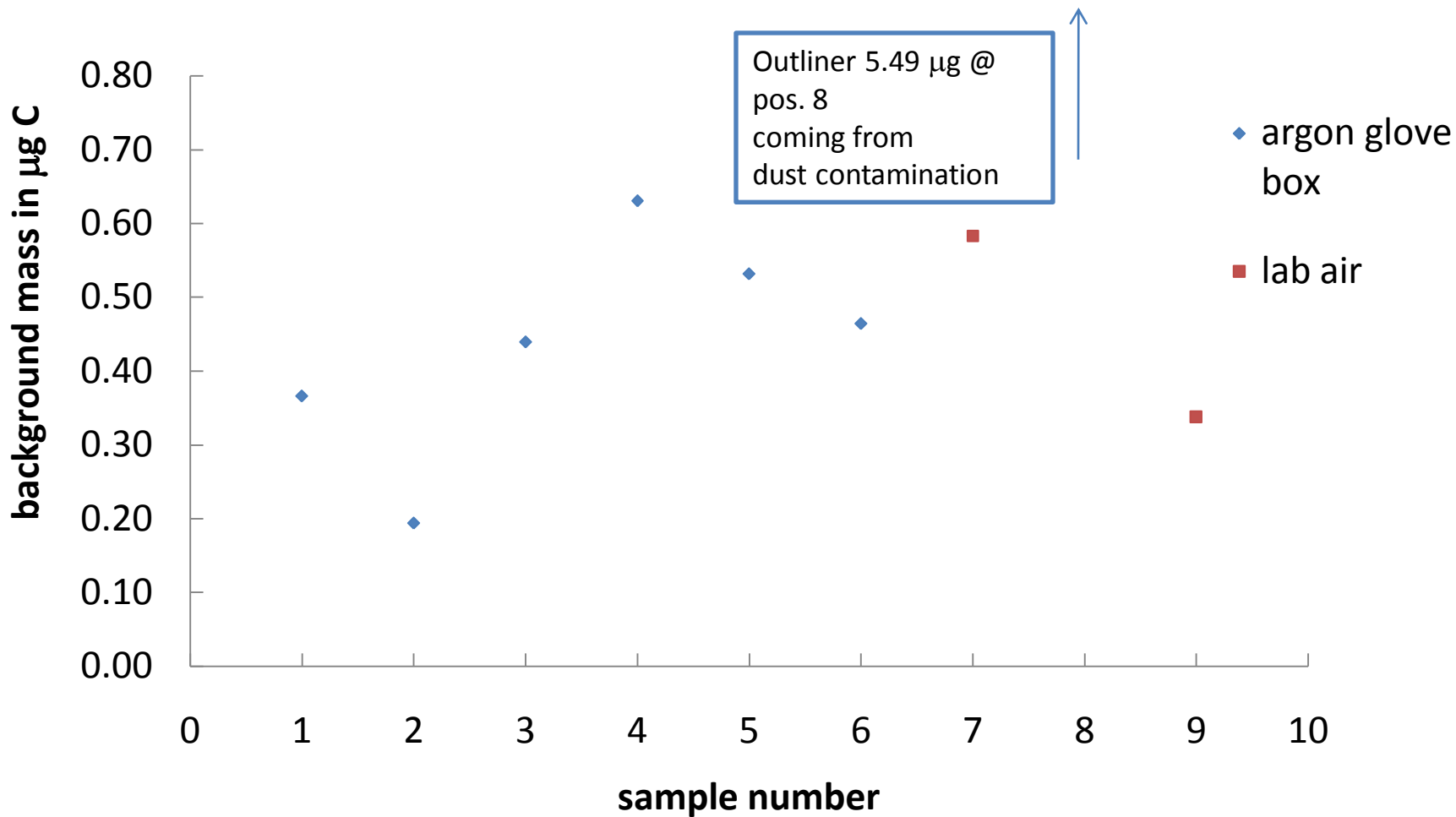


$^{13}\text{C}/^{12}\text{C}$  AMS measurement



$< 0.10 \mu\text{g C}$

# Background from combustion and graphitisation

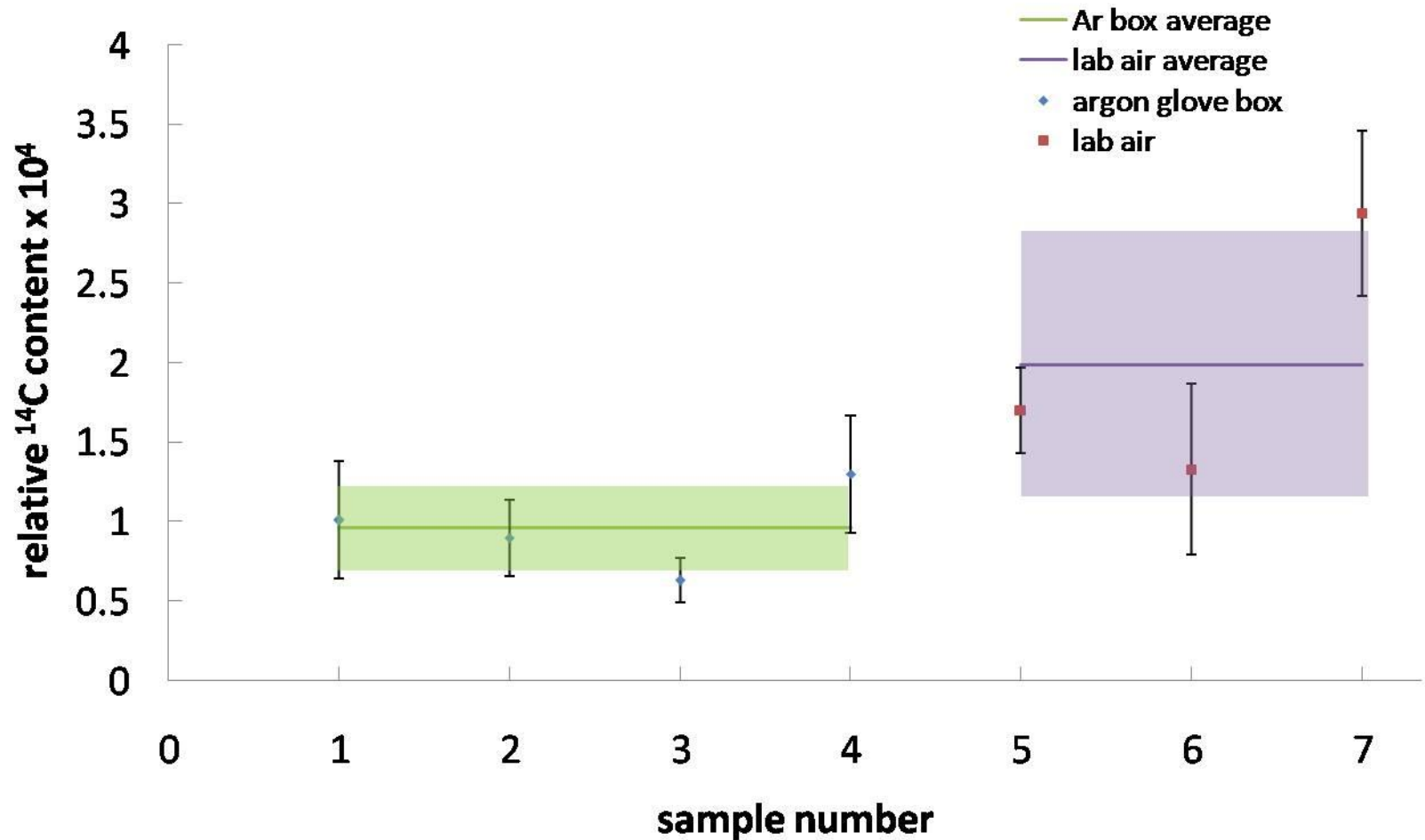


# $^{14}\text{C}$ background measurement

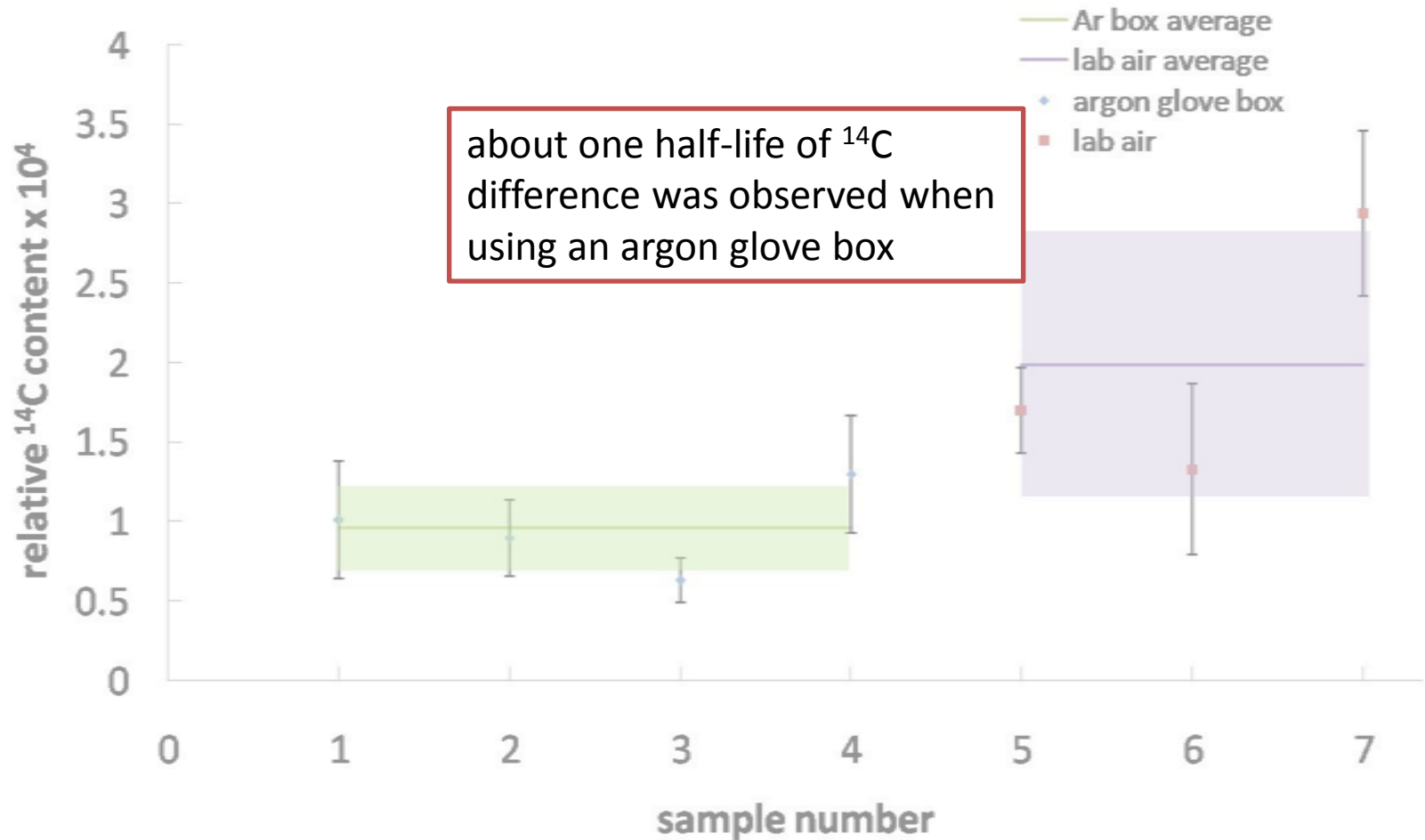
- $^{14}\text{C}$ -free material is needed
- geological graphite from Passau (Kropfmühl AG)
- nominally no  $^{14}\text{C}$
- mg size samples are used
- no chemical pre-treatment



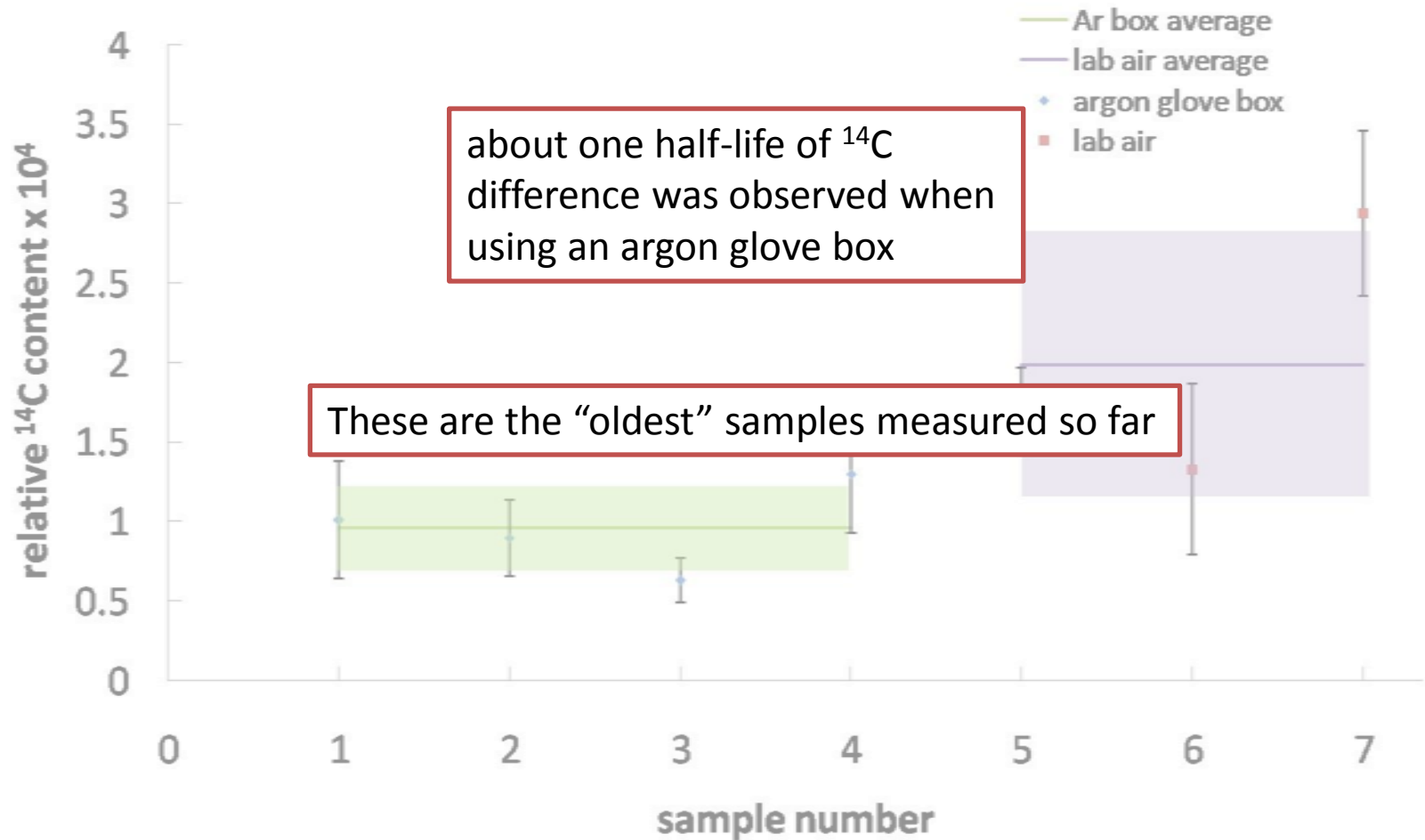
# $^{14}\text{C}$ background measurement



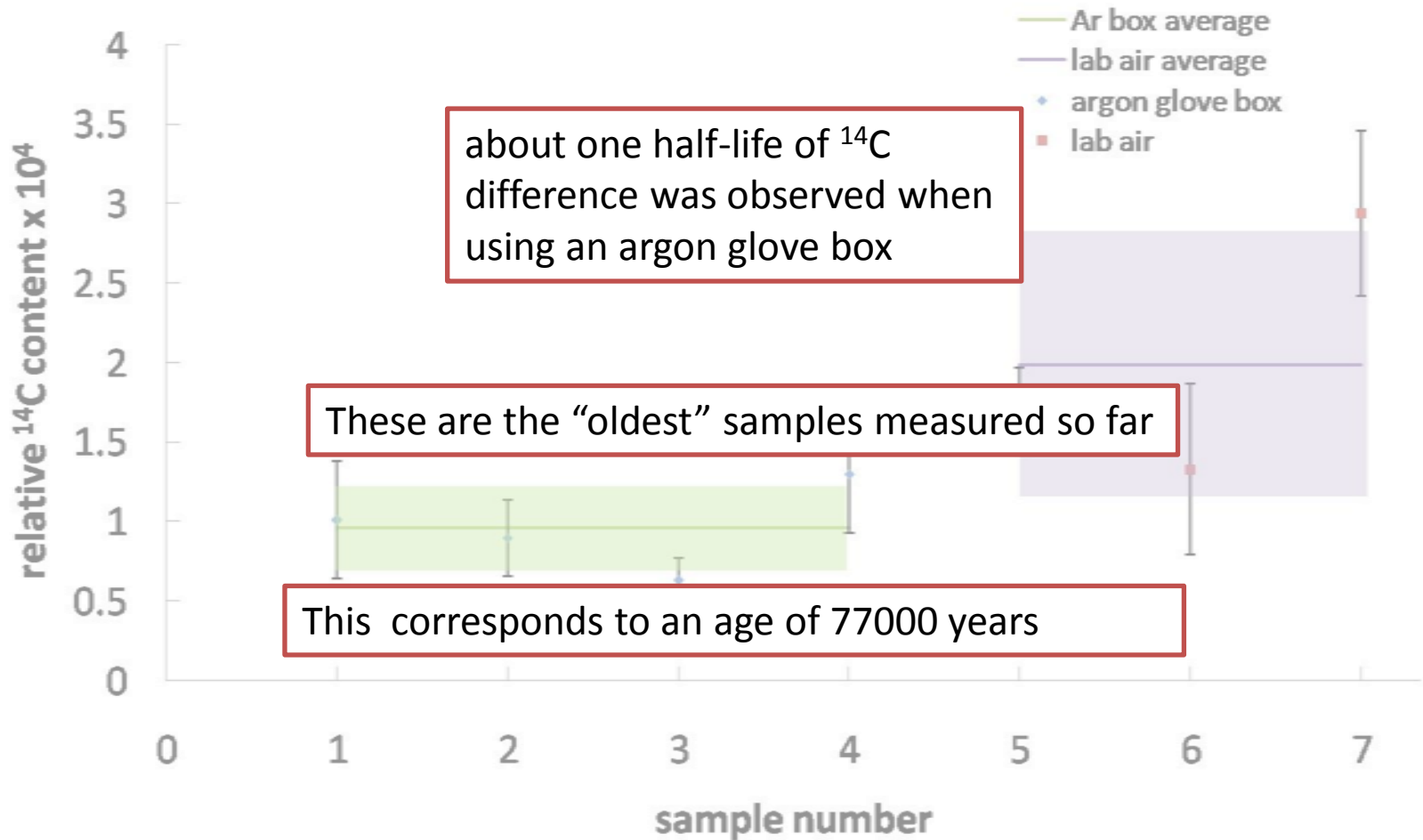
# $^{14}\text{C}$ background measurement



# $^{14}\text{C}$ background measurement



# $^{14}\text{C}$ background measurement





# Conclusions

- For the untreated mg-size geological graphite samples we observed a reduced  $^{14}\text{C}$  background when handling samples under argon.
- Previous measurements on  $\mu\text{g}$ -size samples established an overall carbon background of 0.12-0.15  $\mu\text{g C}$  (without Ar treatment), which is the best result so far.
- Measurements with  $\mu\text{g}$ -size samples enriched in  $^{13}\text{C}$  did not show an effect when working under argon as compared to laboratory air.
- The remaining (small) carbon background is therefore likely due to other sources.

Thank you for your attention