INSTITUTE OF ENVIRONMENTAL PHYSICS

HGSFP

UNIVERSITÄT HEIDELBERG
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Data treatment and systematic analysis of MC-ICP-MS ^{230}Th/U-dating of secondary carbonates

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Abstract information and OSPP judging option

Key questions

Line I	^{233}U	^{234}U	^{235}U	^{236}U	^{238}U
Line II	^{229}Th	^{230}Th		^{232}Th	
Line III		^{229}Th	^{230}Th		

Faraday cup (FC)

Secondary Electron Multiplier (SEM)

SEM – FC measurement protocol for MC-ICP-MS

→ How to ensure a reproducible and easy to use data analysis?

→ What is the accuracy influence of corrections on activity ratios and ages?

Data treatment

→ is shown in the live presentation

→ Graphical User Interface (GUI) consisting of three tabs

- → Input (raw data corrections and ratio calculations)
- → Inspect (outlier correction)
- → Analysis (age calculation)

→ easy constant editing and reanalysis of data

https://github.com/EnvArchivesHD/UTh_Analysis

Corrections influencing accuracy

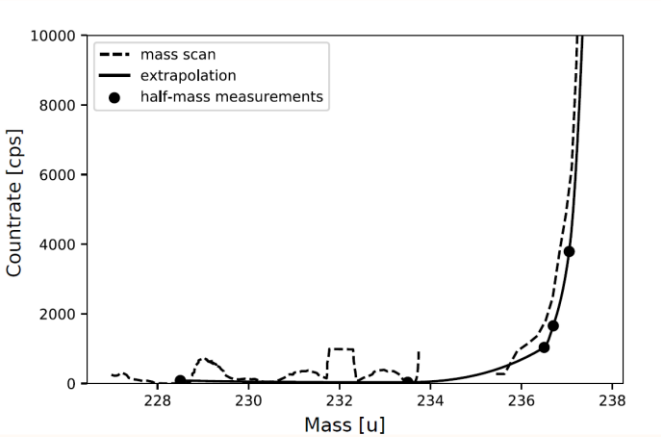
Hydride formation:

ThH^+, UH^+
Measured on 233 amu and 239 amu

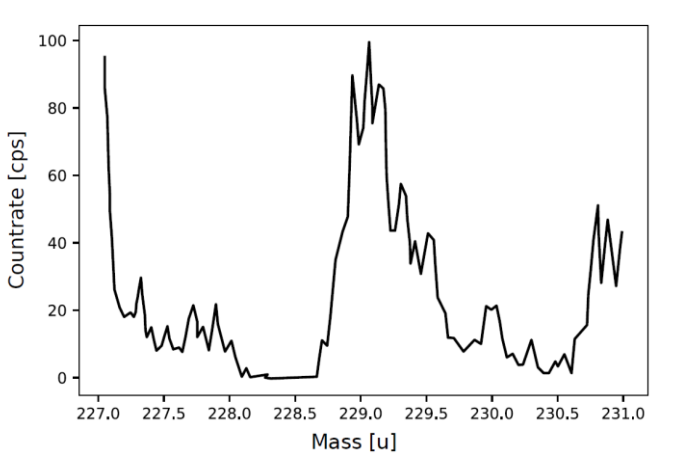
Instrumental background:

After acid washout before every sample

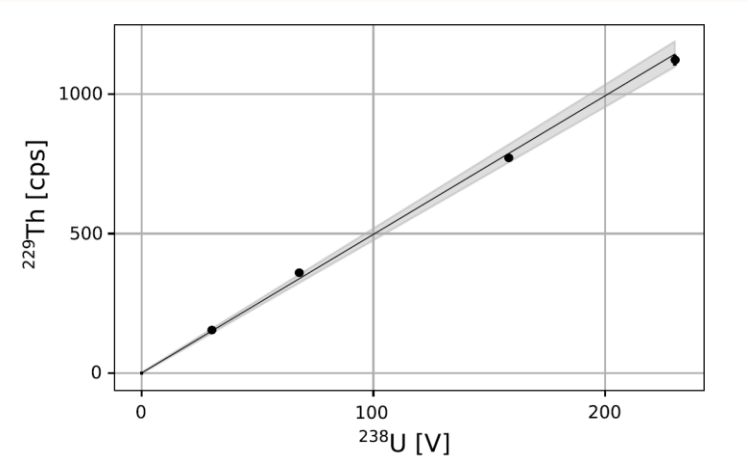
Tailing:



"Ghost signals":



Scattered peak on 229 amu



Linear dependency on ^{238}U concentration

→ ~ 5 cps/ V ^{238}U for ^{229}Th and ~ 0.4 cps/ V ^{238}U for ^{230}Th

→ need to be subtracted

Accuracy effects

Which impact does *getting those corrections wrong* have on the accuracy of $^{234}U/^{238}U$, $^{230}Th/^{238}U$ and ages?

Sample ID	Material	Origin	Age [a]
E8-21	Stalagmite	Estrella cave, Mexico	407.8 ± 8.0
GeoB coral	Cold water coral	Azores, Portugal	47 380 ± 144
SPA-52	Flowstone	Spannagel cave, Austria	134 889 ± 138

→ Instrumental background and tailing could cause permille age offsets

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Can be controlled well

→ Tailing could cause permille age offsets

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→ Missing ghost signals: more than 10 % age offset!

→ Missing ghost signals: still permille level age offset!

Conclusions

- Graphical user interface and its features help with reproducible and comprehensible data analysis
- Measurement protocol allows for a routine precision level of 5ε for $^{234}U/^{238}U$ and low permille level for $^{230}Th/^{238}U$
- Baseline checks of similar setups for interference peaks are relevant!