

Elemental and isotopic analysis of dust for authentication of historic manuscripts

Johanna Irrgeher¹*, <u>Sara Widhalm¹</u>, Serena Tourey¹, Patricia Engel², Thomas Prohaska¹

*Johanna.irrgeher@unileoben.ac.at

¹ Chair of General and Analytical Chemistry, Montanuniversität Leoben, Austria

² University for Continuing Education, Krems, Department für Bauen und Umwelt, Zentrum für Kulturgüterschutz, Dr. Karl Dorrekstr. 30, 3500 Krems, Austria

Is it possible to allocate archaeological manuscripts to their respective origin solely by using elemental and isotopic analysis of dust?





Areas of interest & Focus of study



Fig. 1: Kremsmünster Abbey (Upper Austria) and Zwettl Abbey (Lower Austria) and sampling of dust from manuscripts

Dust = indicator of the time and place where a manuscript was made and stored?

Investigation of authentic manuscripts preserved in two Austrian abbeys

- Kremsmünster (documents dated back to 12th century)
- Zwettl (documents dated back to 17th century)

to investigate the potential of elemental and isotopic pattern comparison in historic dust as indicator of authenticity.

Samples & Methodology DUST (historic books) (authentic samples) DUST (surroundings abbeys) (authentic samples) SAMPLING OF DUST 1 x 1 cm clean room wipes Image: Sample of the s

Geologische Übersichtskarte der Republik Österreich © Geologische Bundesanstalt



Fig. 3: Geological map of Austria zooming into the region, where the two abbeys of interest are located. (Source: Groß, Götzl, Kriegl, Heidinger, Kralik, Sachsenhofer, Goldbrunner, Hartl, Pytlak, Gusterhuber, Fölsen, Irrgeher: Deep Groundwater Systems in Upper Austria, 2021)

X

Focus of this work:

I. Establishment of tracer elemental ratios such as Sr/Ca and ⁸⁷Sr/⁸⁶Sr isotope ratios in dust by analyzing authentic manuscripts from two abbies located in geologically different regions.

II. Analysis of local dust compared to historic dust sampled inside of historic manuscripts.

Results				
Elemental pattern				
1000)	3.00			 The Sr/Ca mass fraction ratio showed very good agreement of surrounding dust and dust sampled in historic manuscripts. Dust sampled at the different abbovy reflect the expected
	2.50	ZW	ETTL	
, µg/g *	2.00	ENVIRONMENT	BOOKS	
a*1000 (µg/g /	1.50			
	1.00	_	•• T	geological background ratios.
			MUNSTER	 The two locations Zwettl and







Fig. 4: Sr/Ca elemental mass fraction ratio of dust sampled from the environment and historic books in Kremsmünster and Zwettl (Error bars correspond to U(k=2))

Strontium isotope ratios

- 0.71600 0.71400 0.71200 0.71200 0.71000 0.71000 0.70600 0.70000 0.70000
- Kremsmünster differ significantly in their Sr/Ca mass fraction ratio.
- The ⁸⁷Sr/⁸⁶Sr ratio shows very good agreement of surrounding dust and dust sampled in historic manuscripts.
- Dust sampled at the different abbeys reflect the expected geological background ratios.
- The two locations Zwettl and Kremsmünster differ
 significantly in their ⁸⁷Sr/⁸⁶Sr
 isotope ratio.



Fig. 5: 87 Sr/ 86 Sr isotope ratios in dust from the environment of Kremsmünster and Zwettl as well as from historic books in Zwettl (Error bars correspond to U(k=2))

Conclusion

Is it possible to allocate archaeological manuscripts to their respective origin solely by using elemental and isotopic analysis of dust?



YES, first results on selected elemental ratios and Sr isotope ratios indicate a significant difference in patterns

between the two locations of interest.





DATA PROCESSING & UNCERTAINTY CALCULATIONS

Fig. 2: Schematic of methodolgy



Chair of General and Analytical Chemistry | Franz-Josef-Straße 18, 8700 Leoben, Austria