



“Novosti v knjižničarstvu”

05/11/2021



HERITAGE SCIENCE
LAB LJUBLJANA



UNIVERSITY OF LJUBLJANA
FACULTY OF CHEMISTRY
AND CHEMICAL TECHNOLOGY



Historical library collection survey and long-term preservation planning

Dr Floriana Coppola



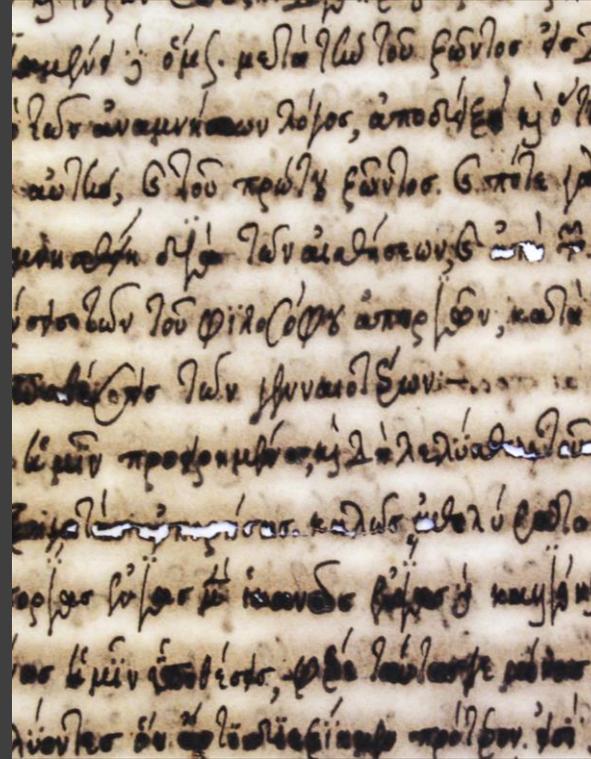
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Supervisor: Prof. Matija Strlič

Degradation of heritage materials is **inevitable** and depends on environmental factors (such as temperature and humidity) and on the material itself



Aged PVC (left) and degradation of cellulose acetate (right).

Rychlý J, Strlič M. Degradation and ageing of polymers. In *Ageing and stabilisation of paper*; Strlič, M, Kolar, J, Eds.; National and University Library: SI, 2005; pp. 25–44.

Ink degradation.

Brown N et al. (2020), *Herit. Sci.*, 8, 88. DOI: 10.1186/s40494-020-00432-w.

Red rot.

British Library (2013) Collection care blog. From <https://blogs.bl.uk/collectioncare>.

Degradation of heritage materials is inevitable and depends on environmental factors (such as temperature and humidity) and on the material itself



Left: a well preserved page from Hartmann Schedel, *Liber Chronicarum*, Nürnberg, 1493. Right: a degraded leaflet from the 1900s. ©National and University Library, Ljubljana, Slovenia. Strlič M, Kolar, J, Scholten, S. Paper and durability. In *Ageing and stabilisation of paper*; Strlič, M, Kolar, J, Eds.; National and University Library: SI, 2005; pp. 3–8.

Archival and library documents intended to be read reach their threshold fitness for use when they become **too brittle** to be handled safely



The consequences of 50 instances of handling representing reading with handling for brittle paper.
Reproduced by Strlič et al. *Herit Sci* (2015) 3:36.
DOI 10.1186/s40494-015-0065-y.



Newsprint from 1918 to 1919, labelled as 'unfit for use' due to the fragile nature of the material.
Reproduced by Strlič et al. *Herit Sci* (2015) 3:33.
DOI 10.1186/s40494-015-0062-1.

Expected lifetime: time for an object or collection to become too brittle to withstand manual handling

Non-destructive methods of analysis and degradation models have been developed to predict the expected lifetime for a collection to become **too brittle to withstand manual handling**.

Historical library collection survey → *'Classense Library'* case study



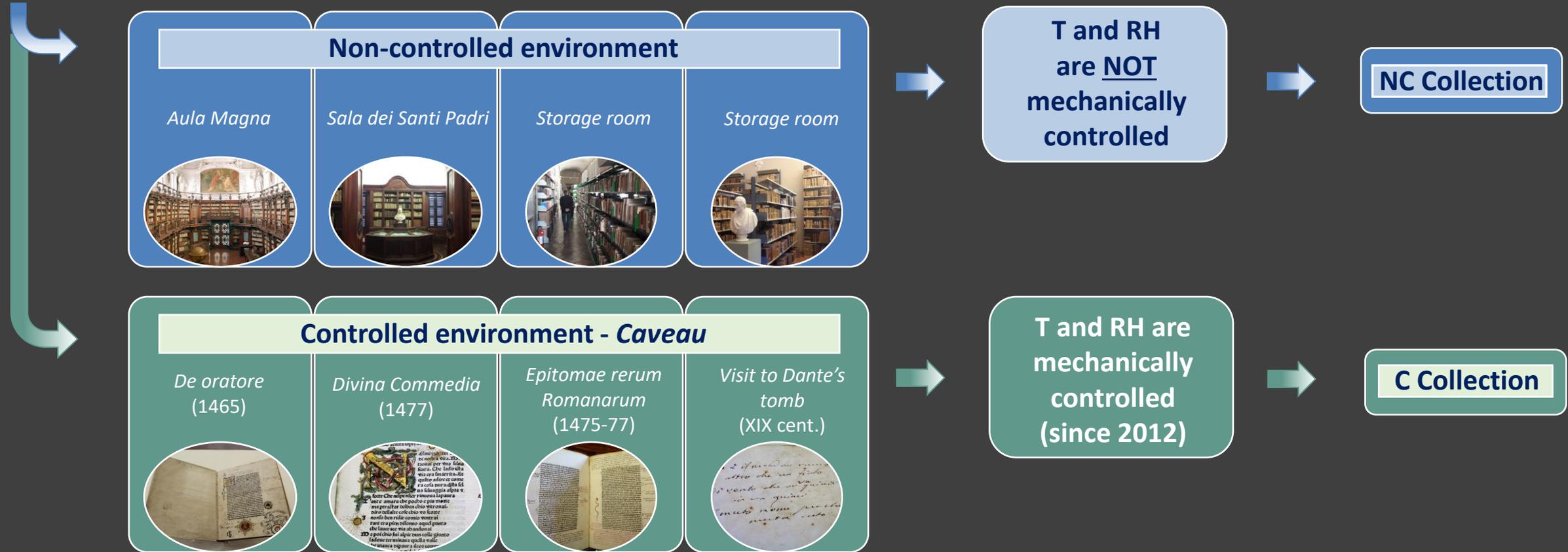
Lat: 44°24'52"N

Long: 12°11'59"E



Istituzione Biblioteca Classense. © Biserni.

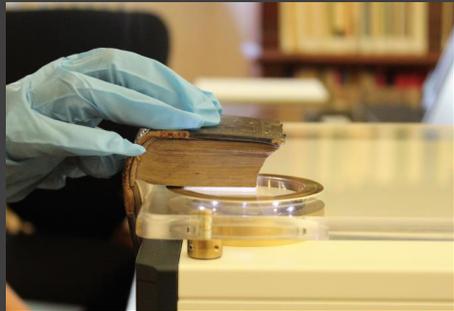
The Classense Library & its collections



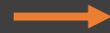
Non-destructive methods of analysis and degradation models have been developed to predict the expected lifetime for a collection to become **too brittle to withstand manual handling.**



Historical library collection survey → '*Classense Library*' case study



Non-destructive measurements on books



Results were used to

using degradation models

to **predict** the *expected lifetime*

to **evaluate** the current conservation state



Non-destructive and non-invasive analysis on about 300 books dated from the 14th to the 20th century

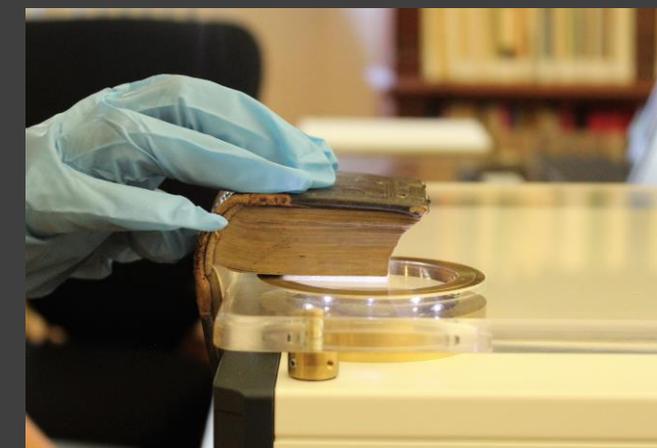


The SurveNIR system (Lichtblau e.K., Dresden) to shine light on a book and to estimate a number of chemical properties:

- pulp (e.g., rag, groundwood)
- acidity
- degree of polymerisation
- tensile strength
- lignin, protein and rosin content



to **evaluate** the current conservation state



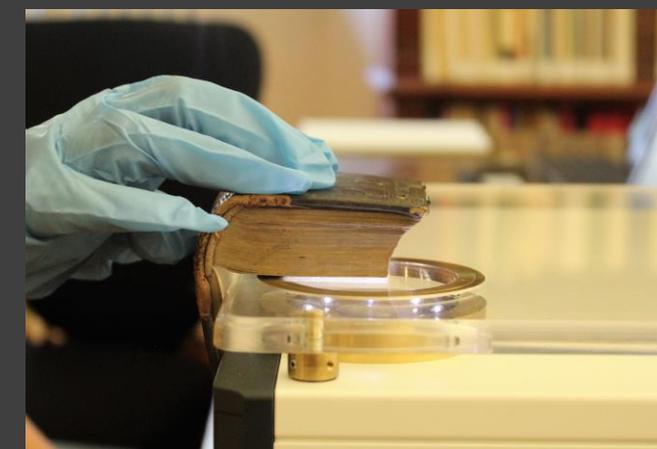
Classense Survey photos:
SurveNIR (Lichtblau e.k., Dresden) and analysis of a miniature book.

Non-destructive and non-invasive analysis on about 300 books dated from the 14th to the 20th century



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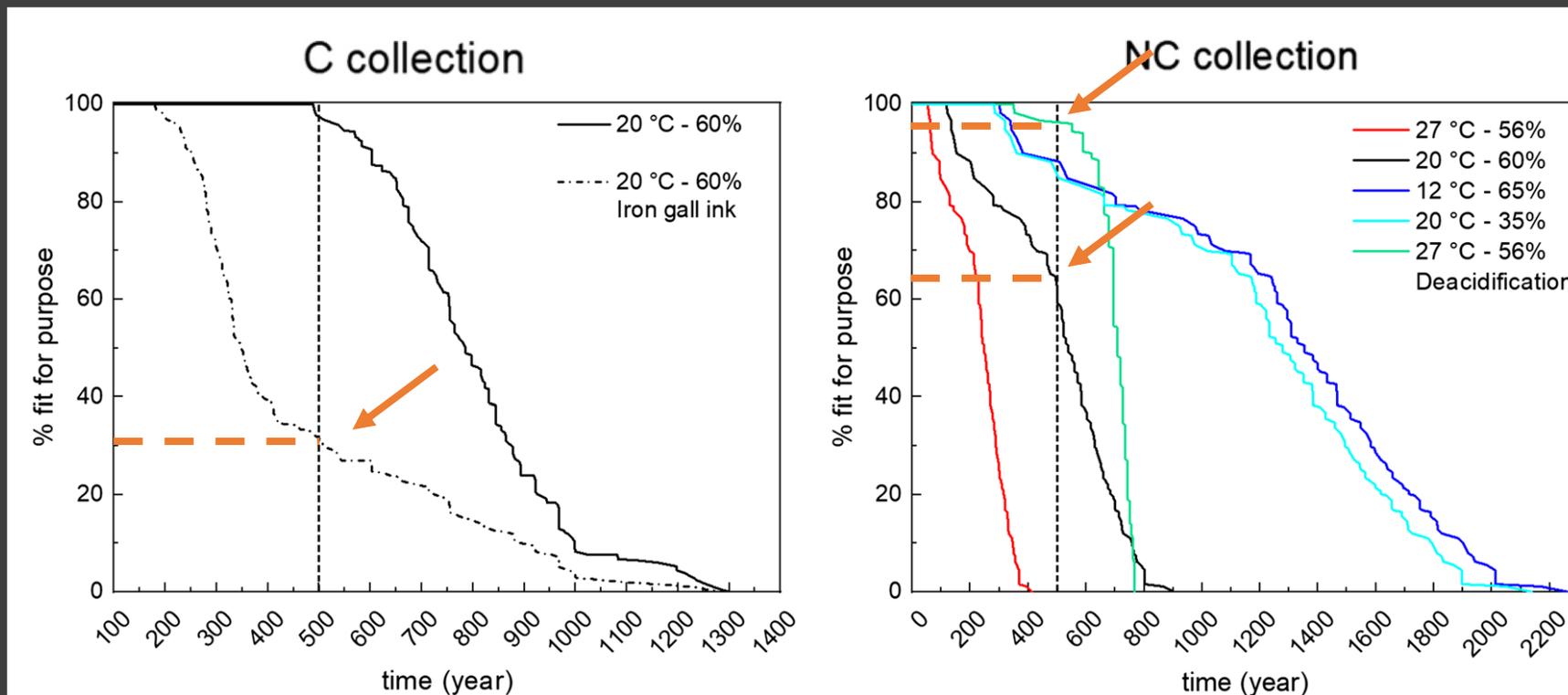


to predict the *expected lifetime*

Classense Survey photos:

SurveNIR (Lichtblau e.k., Dresden) and analysis of a miniature book.

Predictions of the time for a real collection to become too brittle to withstand manual handling (*expected lifetime*) in diverse environmental scenarios



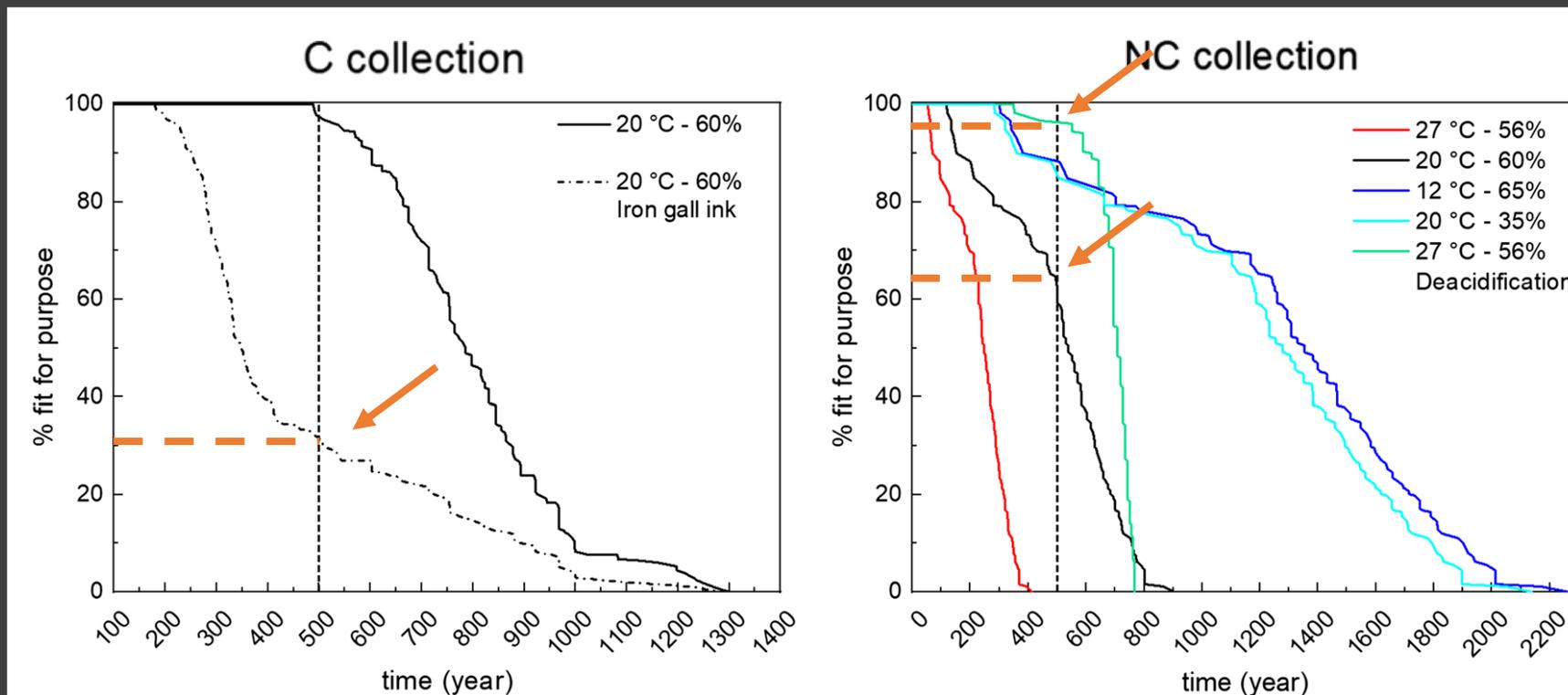
Collection Demography App

https://hsl.shinyapps.io/app_2_0/



Demographic plots. Reproduced by Coppola et al. *Herit Sci* (2020) 8:89. DOI 10.1186/s40494-020-00430-y.

Predictions of the time for a real collection to become too brittle to withstand manual handling (*expected lifetime*) in diverse environmental scenarios



Collection Demography App

https://hsl.shinyapps.io/app_2_0/



Demographic plots. Reproduced by Coppola et al. *Herit Sci* (2020) 8:89. DOI 10.1186/s40494-020-00430-y.

Which is the uncertainty associated with both **non-destructive methods of analysis** and **degradation models**?



“All models are wrong, but some are very useful”

Martens, H.; Næs, T. Multivariate Calibration; John Wiley & Sons: New York, USA, 1989

Explore the sources and contributions of uncertainty, such as:

- Heterogeneity of materials;
- Sampling (margins, gutter, number of pages);
- Models;
- ...



Uncertainty for dating



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Sample	Background	Dating	Error	Reference
Western paper	4 layers	1650-1850	8.6	Trafela et al. (2007), Anal Chem, 79. DOI: 10.1021/ac070392t
		1851-2005	8.6	
Contemporary paper	1 layer	1985-2012	3.6	Silva et al. (2018), Anal Chim Acta, 1031. DOI: 10.1016/j.aca.2018.06.031
		1985-2012	3.7	
Chinese paper	5 layers	1790-2000	24	Brown et al. (2017), Herit Sci, 5. DOI: 10.1186/s40494-017-0158-x
		1901-2000	15	
Parchment	Recto & Verso	1179-1793	72	Možir et al. (2011), Appl Phys A, 104. DOI: 10.1007/s00339-010-6108-z
Fiber-based gelatine silver prints	Verso	1914-1986	7.9	Martins et al. (2012), Anal Bioanal Chem, 402. DOI: 10.1007/s00216-011-5566-2
			6.1	



Dating archival materials

Which are the most critical contributions to the overall prediction uncertainty for dating archival materials?

marie skłodowska-curie actions
Grant agreement N. 101032212 chemometrics
uncertainty classical statistics
UNCERTIR functions paper heritage science
modelling
Bayesian statistics IR spectroscopy
future scenarios predictions dating characterisation Ljubljana
heritage materials non-destructive

*Hvala za
vašo pozornost!*

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