

# THE CONSERVATION PRESERVATION AND DIGITIZATION OF THE DEAD SEA SCROLLS

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**Tanya Bitler**  
**Tanya Treiger**  
**Asia Vexler**



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העתיקות



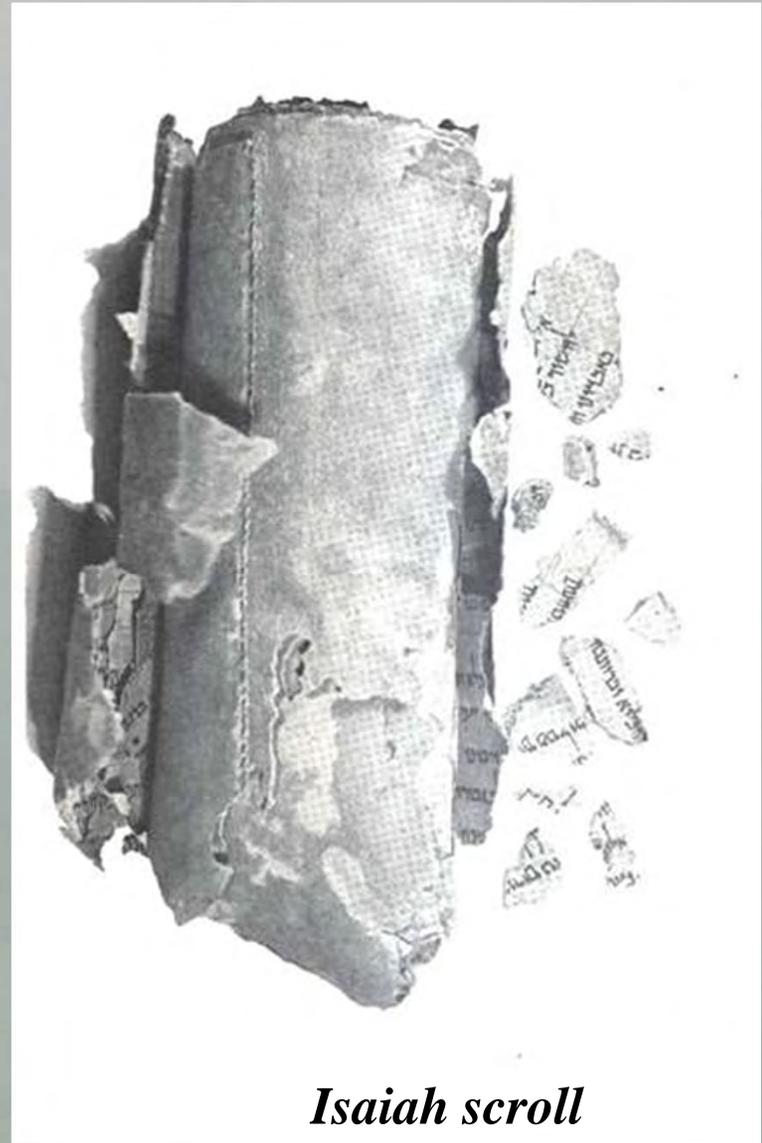
*Cave I*



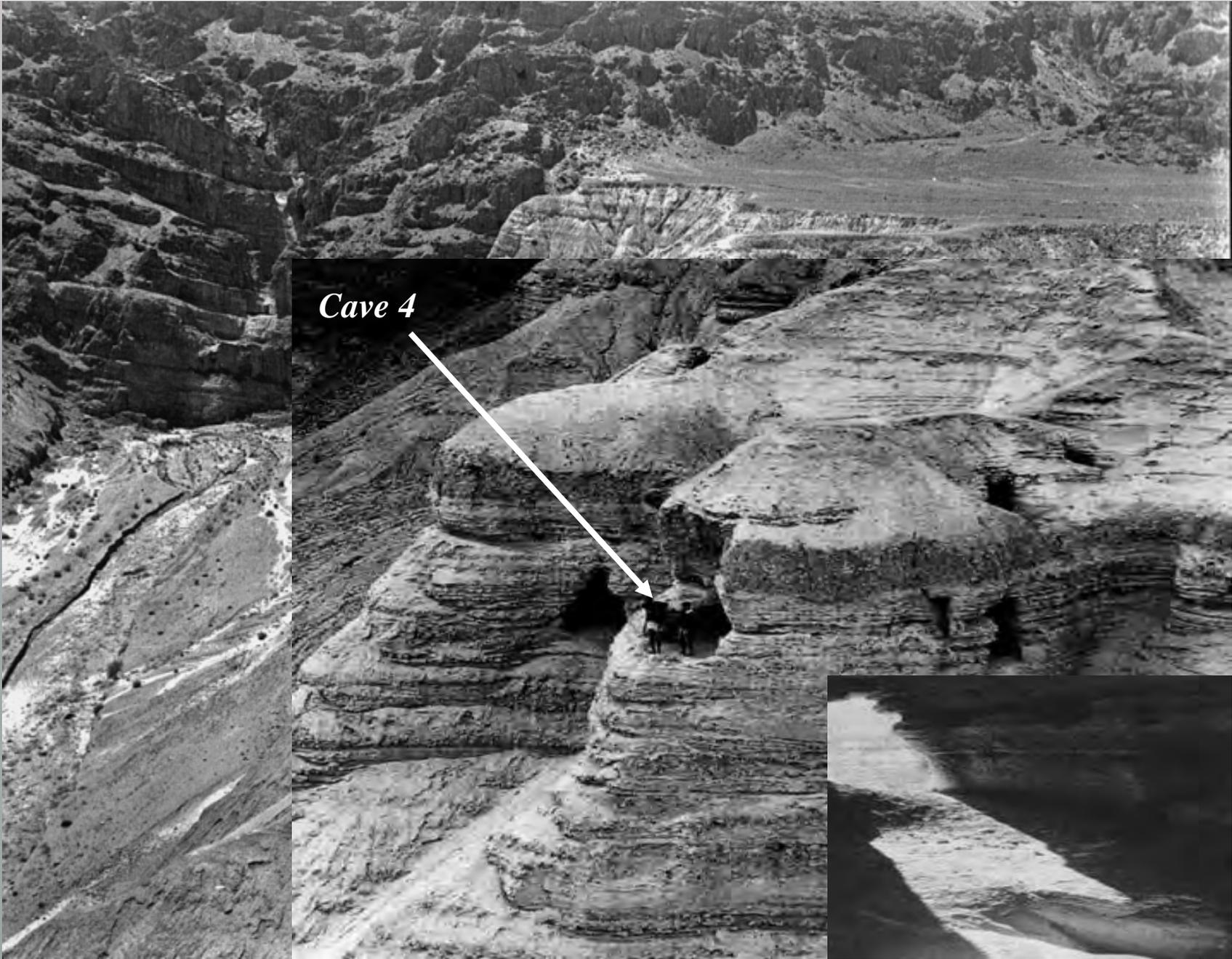
***TWO OF THE FIRST SEVEN SCROLLS FOUND IN CAVE 1***



***War Rule***



***Isaiah scroll***



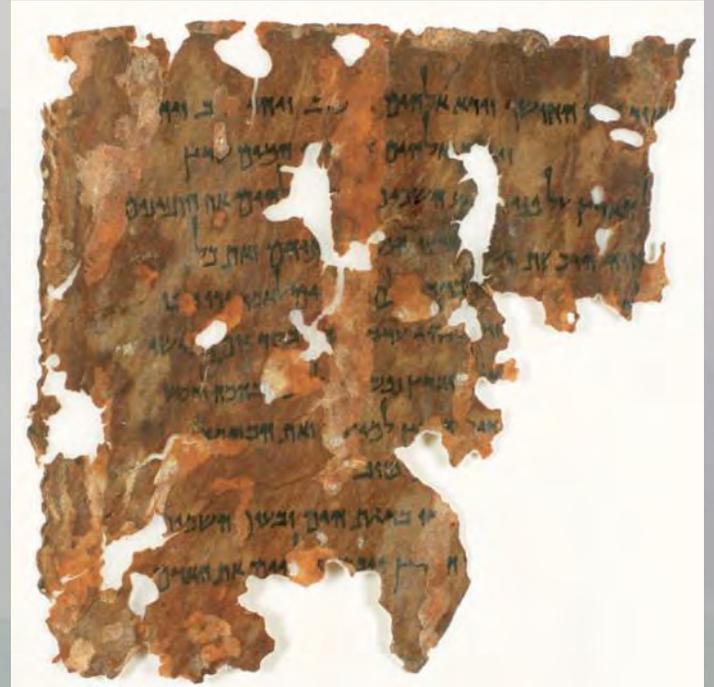
## *FRAGMENTS FROM CAVE 4*



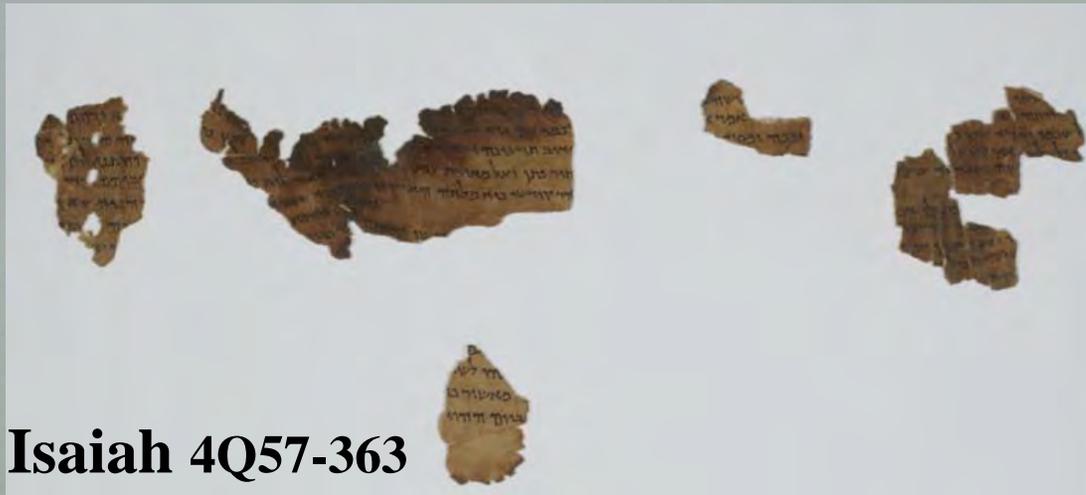
# BIBLICAL SCROLLS



**Exodus 4Q13-695**



**Genesis 4Q4-1071**



**Isaiah 4Q57-363**

# JEWISH LITERATURE - APOCRYPHA, PSEUDO-EPIGRAPHY, PRAYERS



**Jubilees 4Q220-849**



**Enoch 4Q201-821**



**Apocryphon of Daniel 4Q246-209**

# SECTERIAN TEXTS



**Book of War 11Q14-607/1**



**Community Rule 4Q256-905**



**Nahum Commentary 4Q169-980**

# *THE ROCKEFELLER MUSEUM*

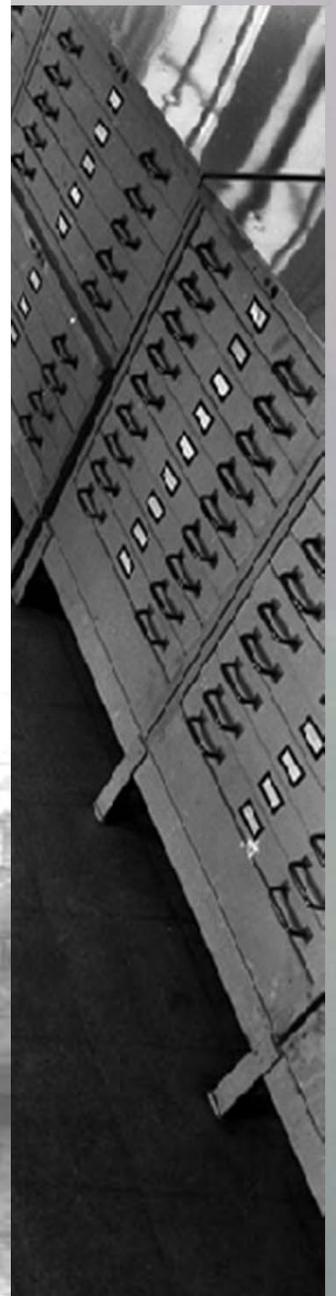
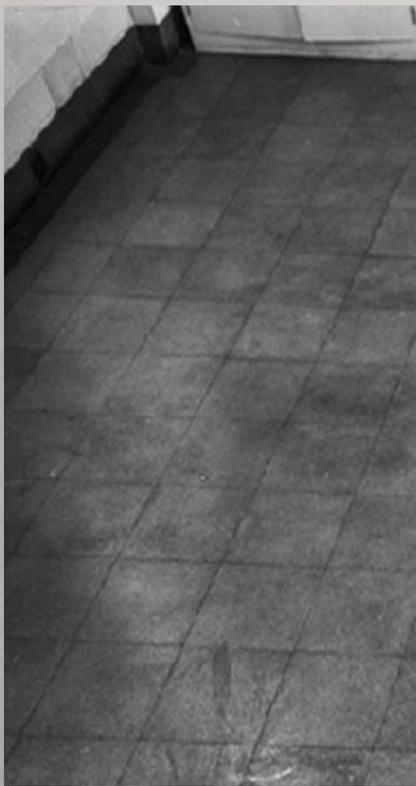


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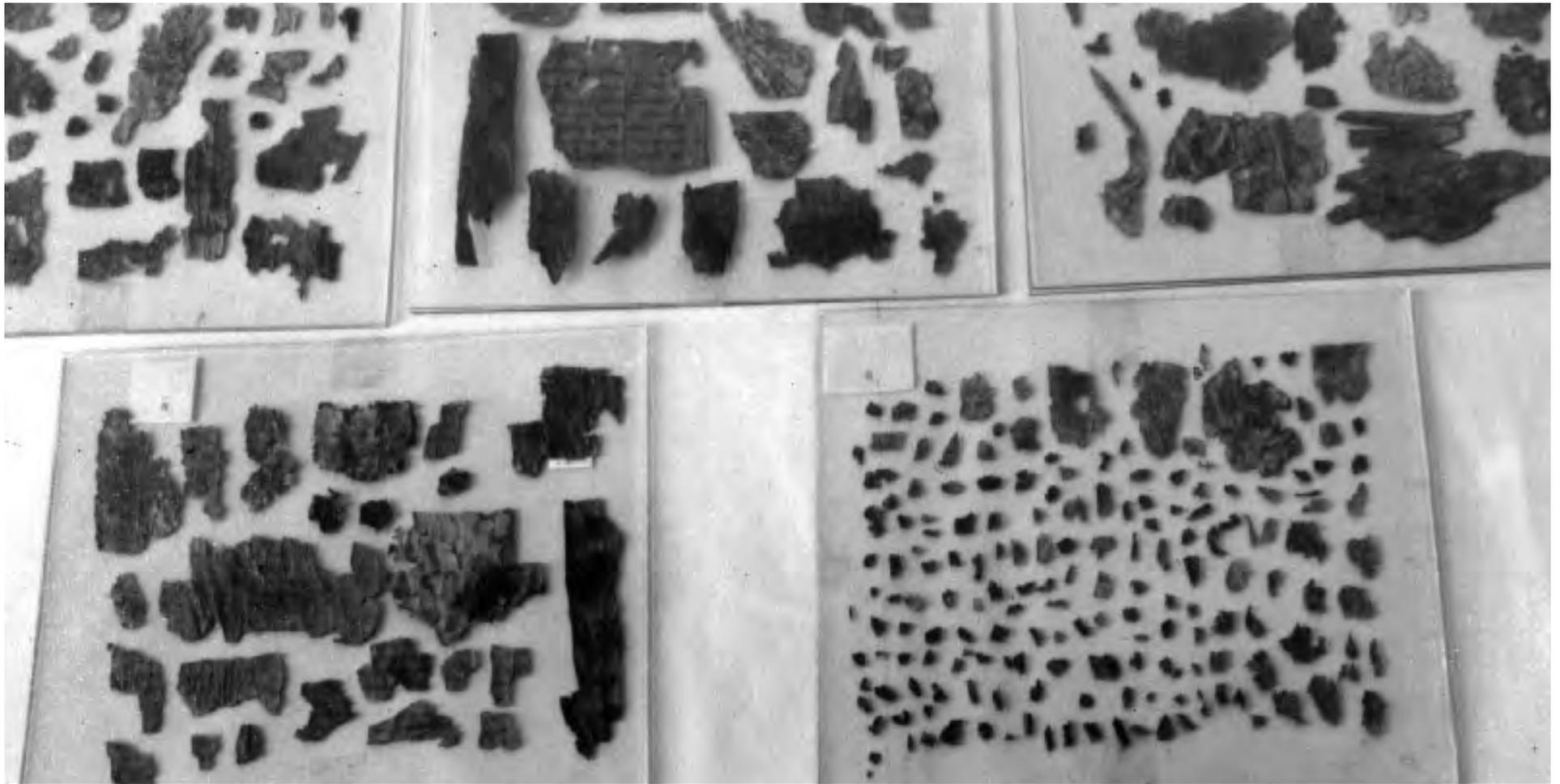
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# *THE FIRST SCHOLARS*



# *THE SCROLLERY*

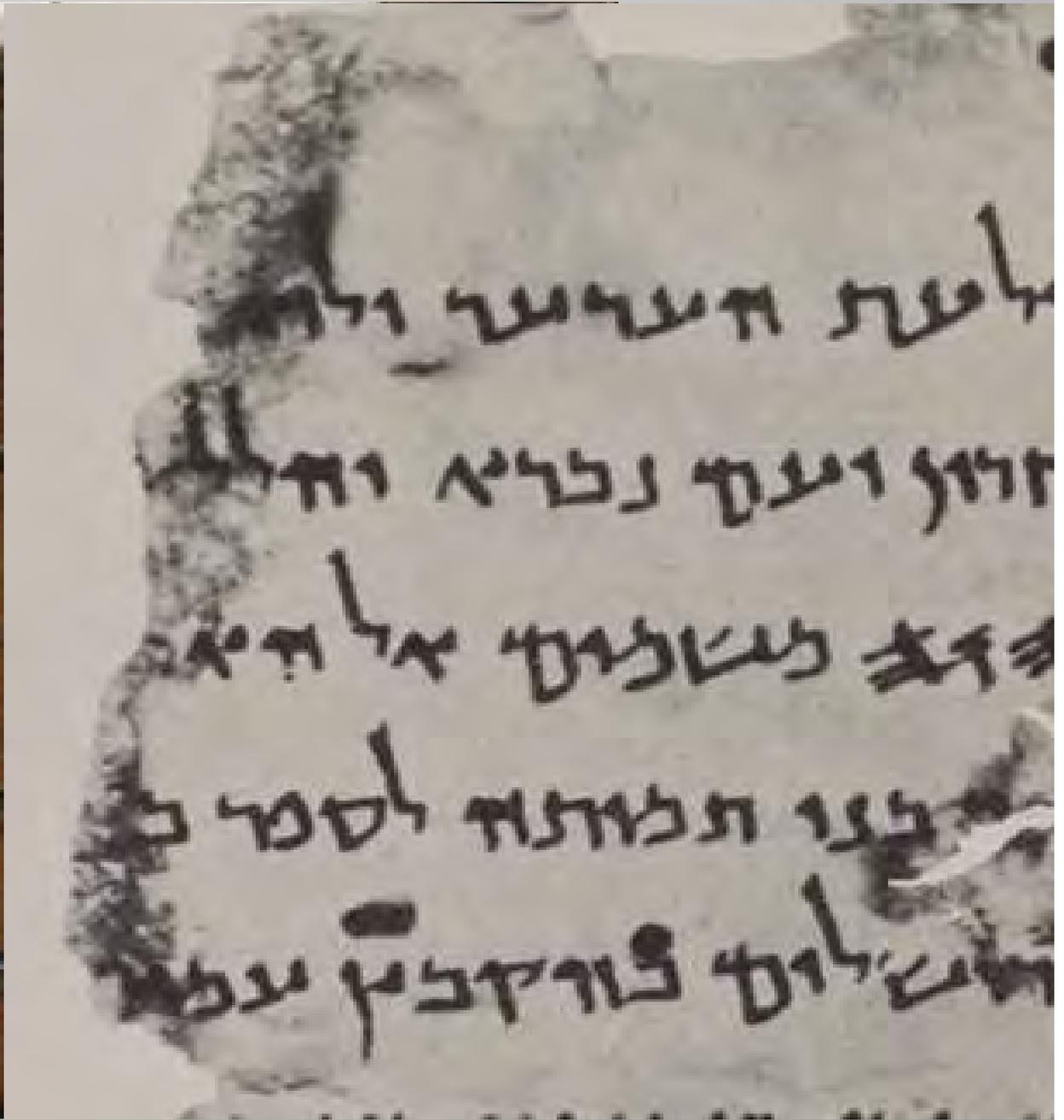




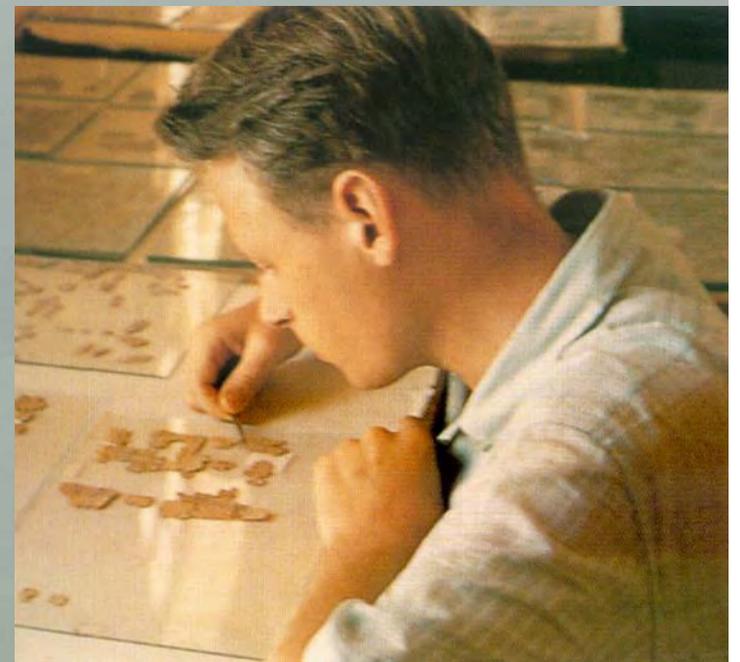
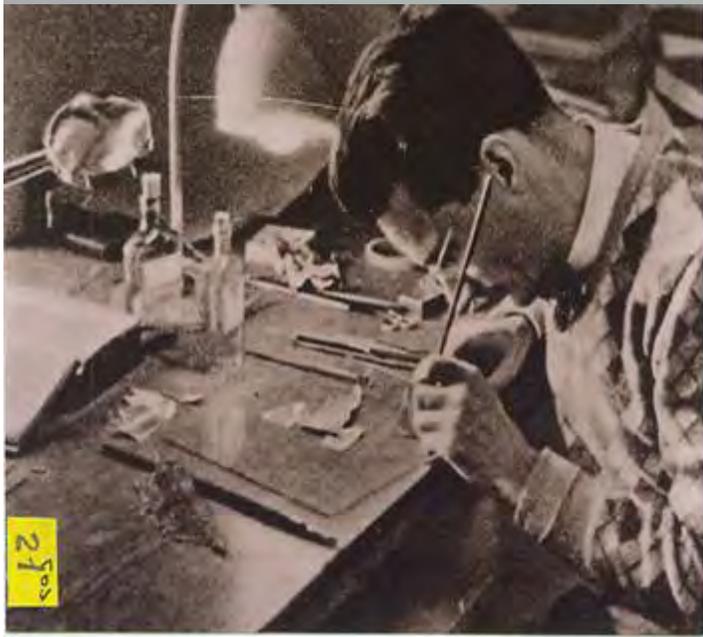
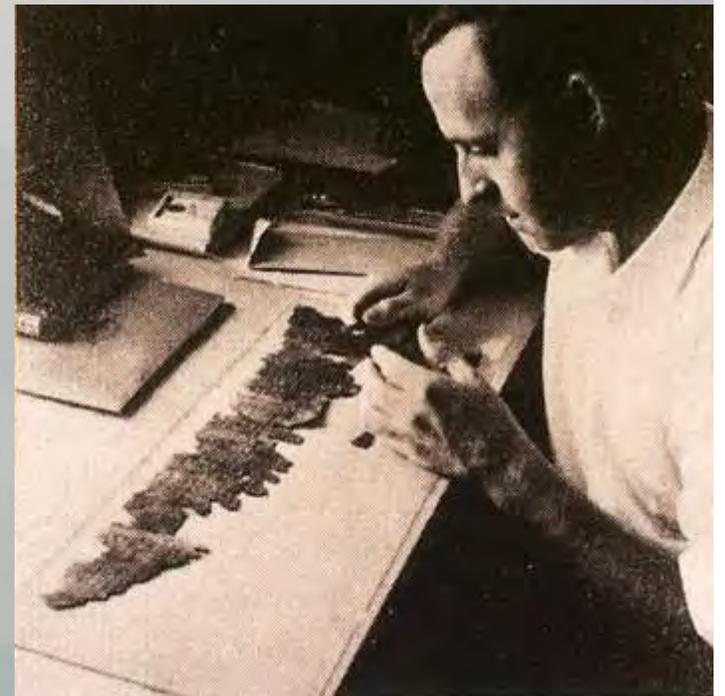
***THOUSANDS OF FRAGMENTS WERE ARRANGED IN PLATES***



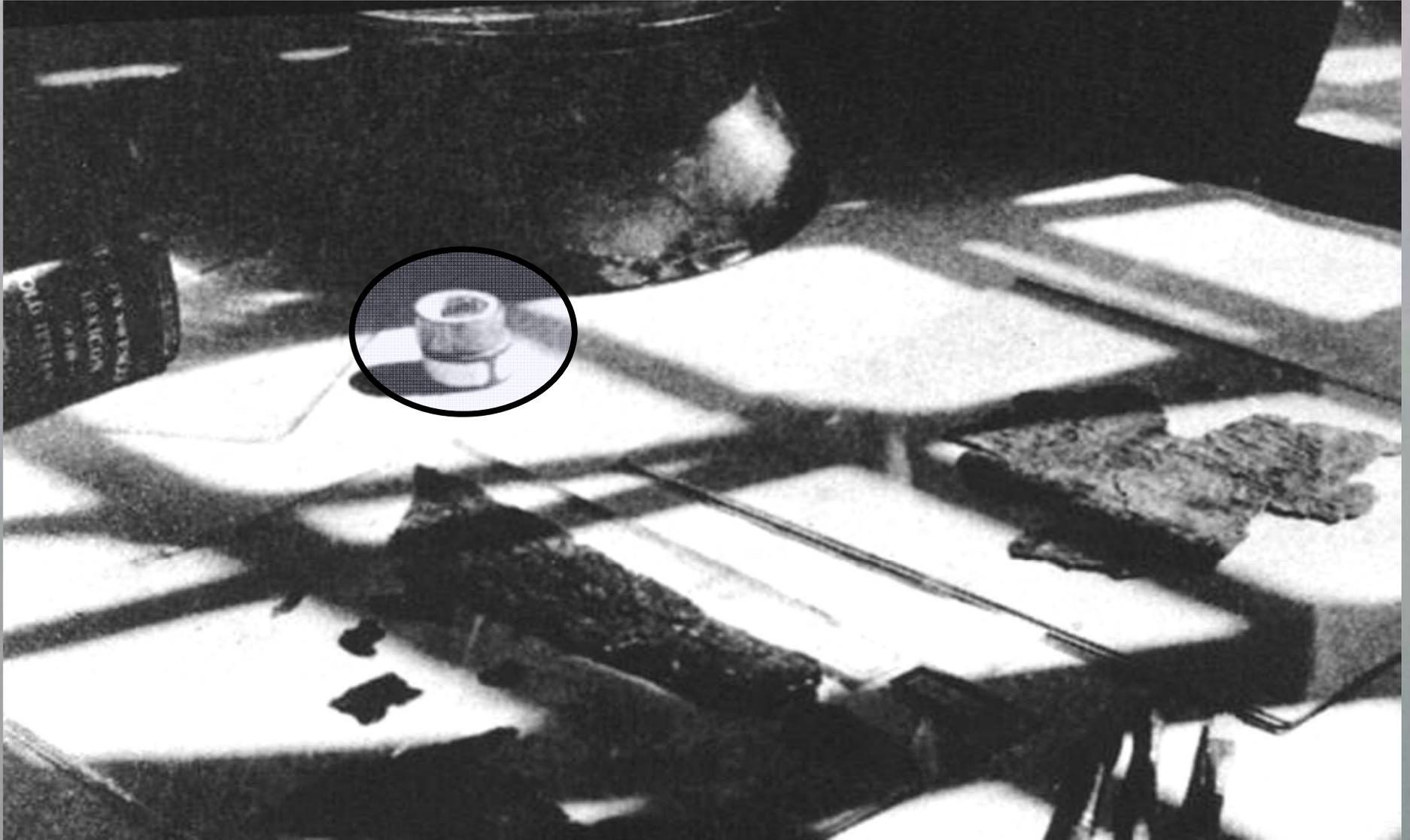
*INFRA-RED PHOTOGRAPHS WERE FIRST TAKEN IN THE 1950'S*



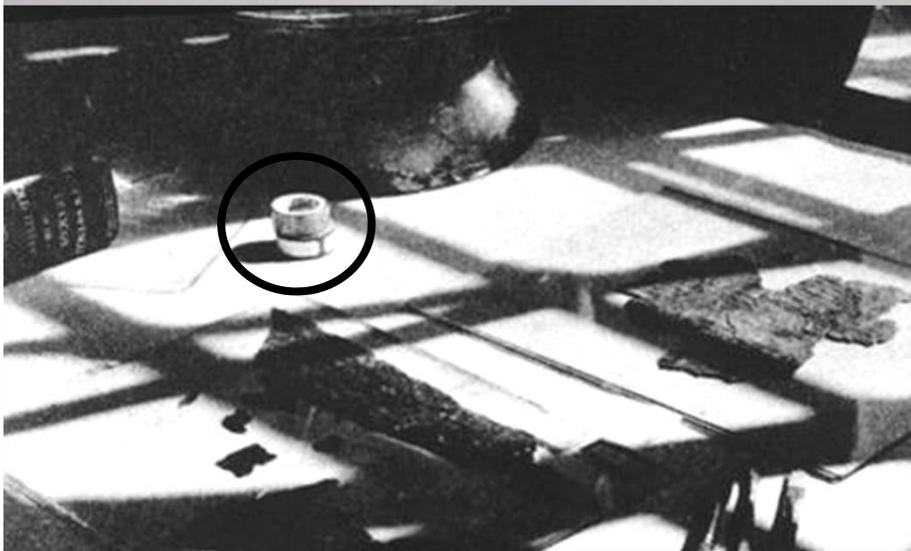
*THE SCHOLARS  
IN THE 50'S*



*IN THE 1950'S PRESSURE SENSITIVE TAPE WAS JUST INVENTED*



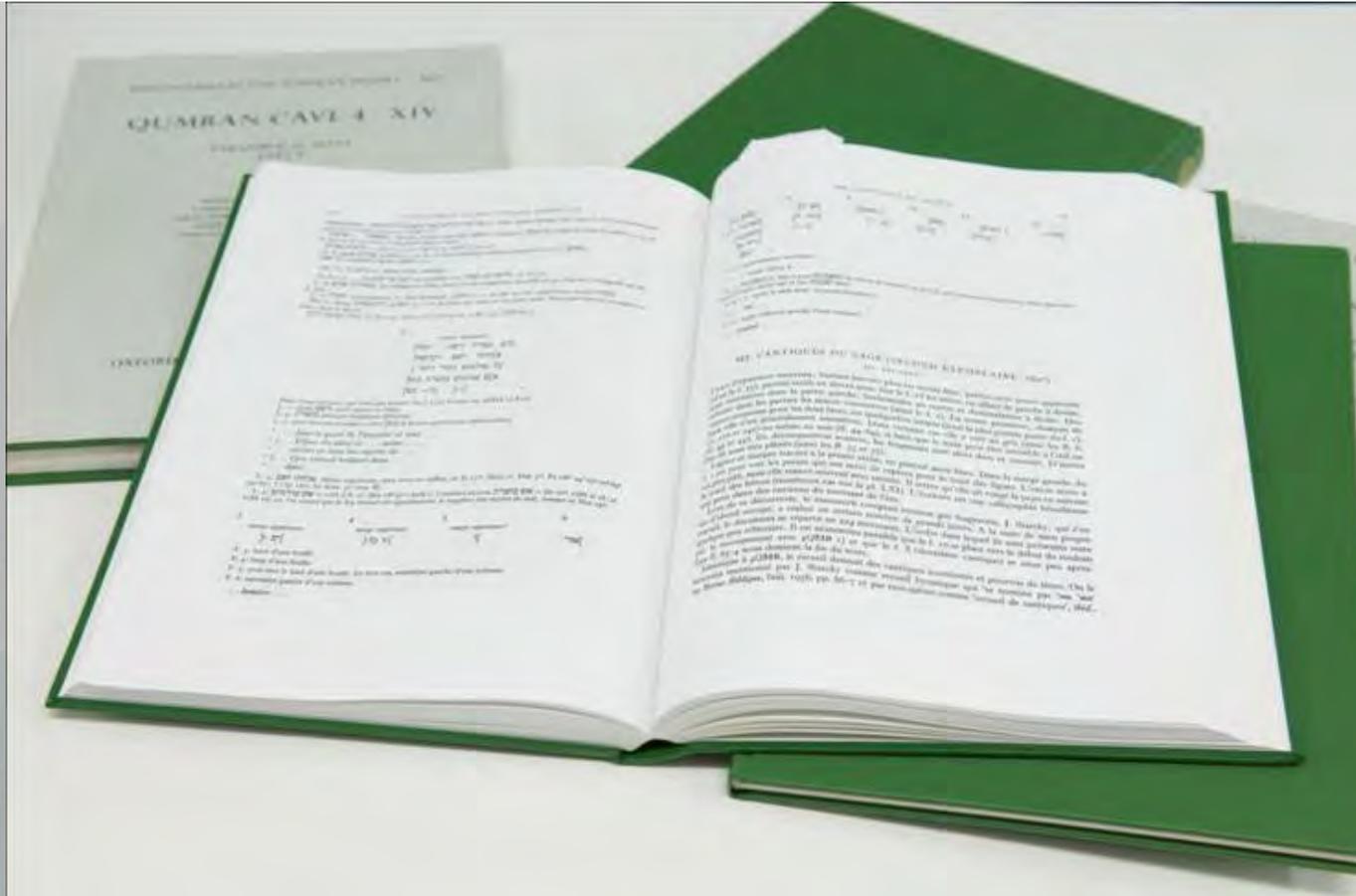
*In the 1950's pressure sensitive tape was just invented*



**In the 1960's British Museum  
Leather Dressing was applied**



**In the 1970's Rice Paper  
and Perspex Glue was used**



## *DISCOVERIES IN THE JUDEAN DESERT – DJD*



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# IAA DSS CONSERVATION LAB



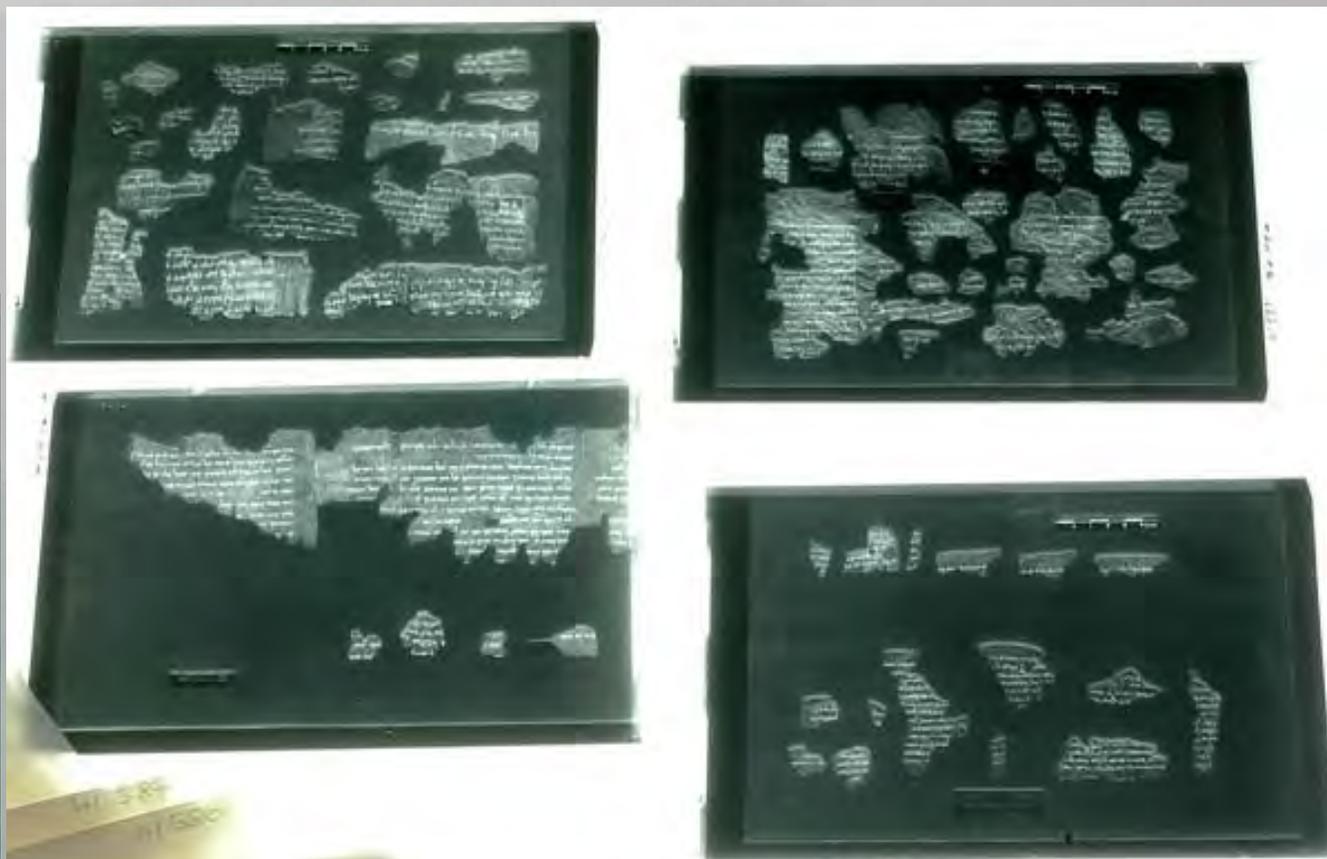
# THE CLIMATE CONTROLLED STOREROOM



**RH 48- 50%**

**Temp 20°C**

## *INFRA-RED NEGATIVES OF THE 1950's*



**Today stored in a  
climate controlled  
storeroom**

# CONDITION ASSESSMENT



# THE DAMAGES



**Delamination**



**Residue of tape adhesives**



**Ink Corrosion**



**Gelatinization**





# PROPER STORAGE



# TREATMENT PROCEDURES - PARCHMENT SCROLLS



**Temporary strengthening of the recto**



**carrier**

**Poultice**



**Vapor mini-chamber**



**PRESSURE SENSITIVE TAPE**

**residues**



# BEFORE AND AFTER TREATMENT

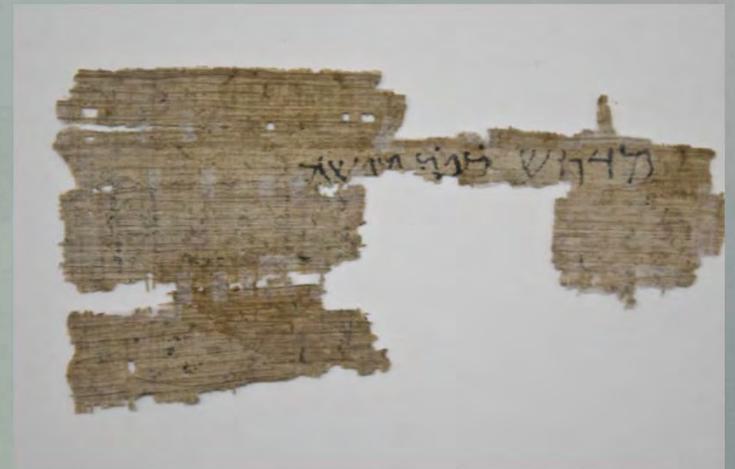
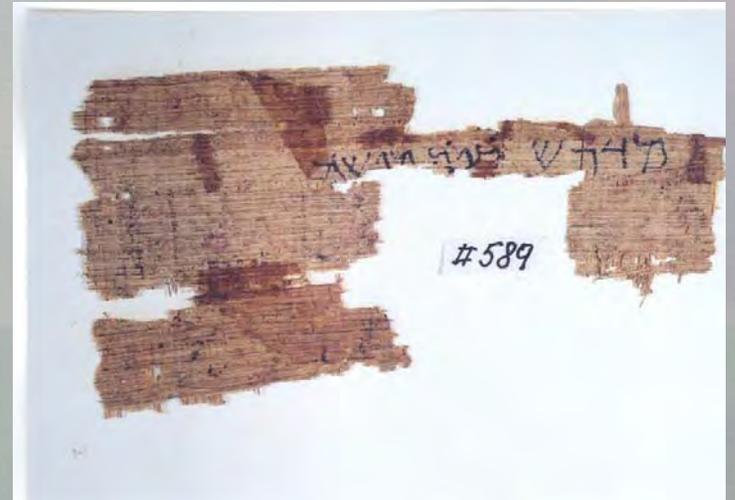


recto

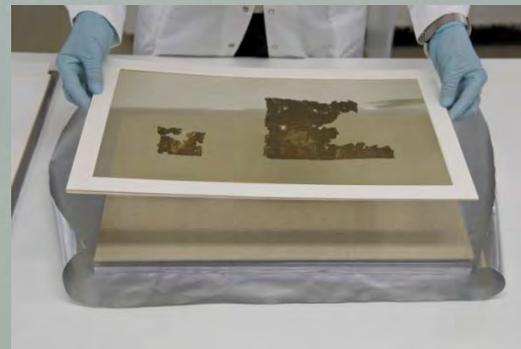
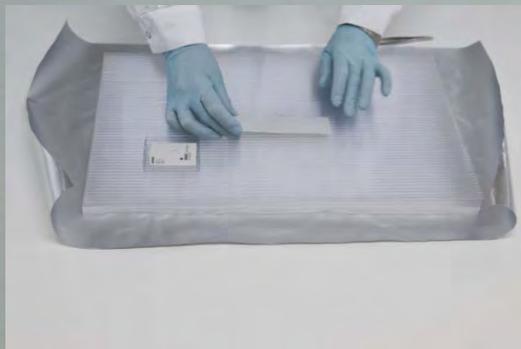


verso

# PAPYRUS SCROLLS



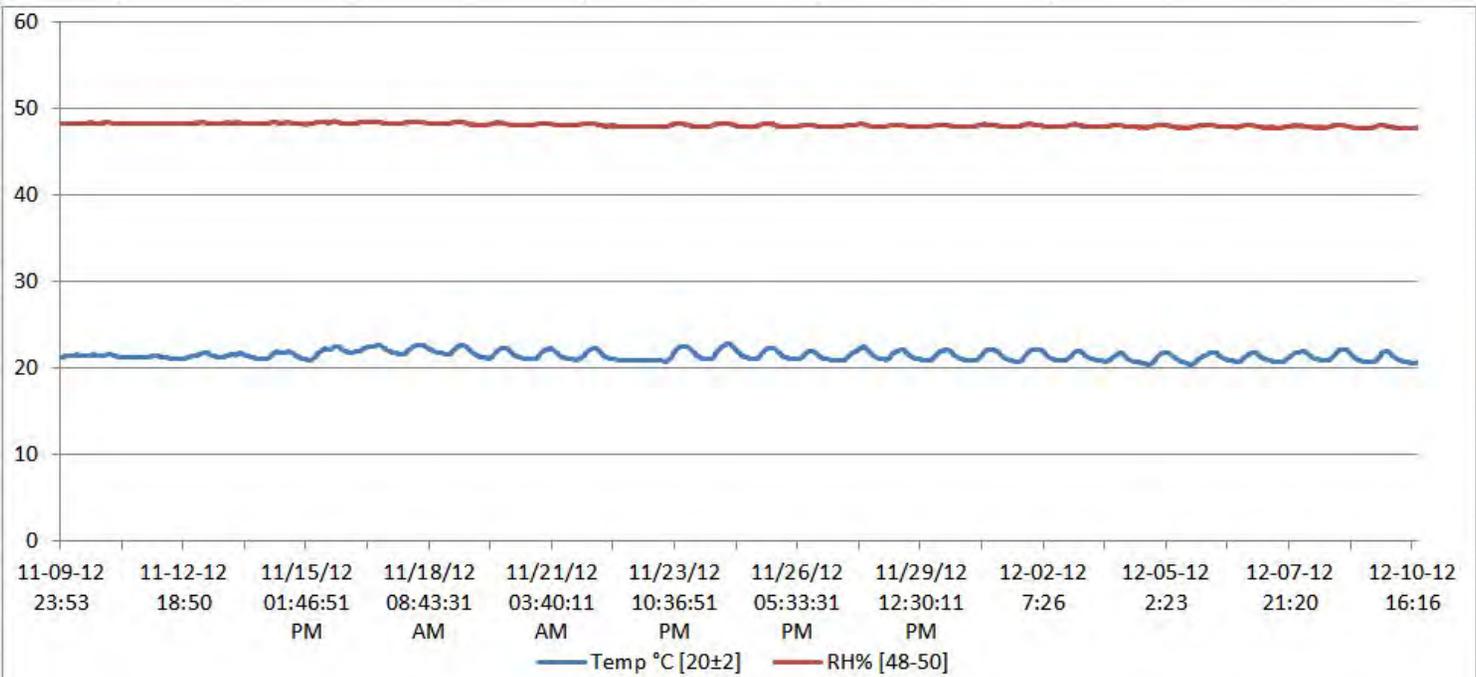
# PREPARATION FOR EXHIBITION – SEWING AND MOUNTING



# CONDITIONS OF DISPLAY

## CALCULATING LIGHTING LEVEL BY NO. OF HOURS/WEEK

<b>Days</b>	<b>75</b>	
<b>Hours</b>	per day	per week day/week
		<b>57</b> <b>7</b>
result:	<b>8.14</b>	<b>57</b>
total hours	610.714	
lighting level	calculated	allowed
	<b>24.6</b>	15,000
lighting on/off	<b>36.8</b>	
		light    break
	<b>30</b>	<b>15</b> seconds







**"How long has he been working on the Dead Sea Scrolls?"**

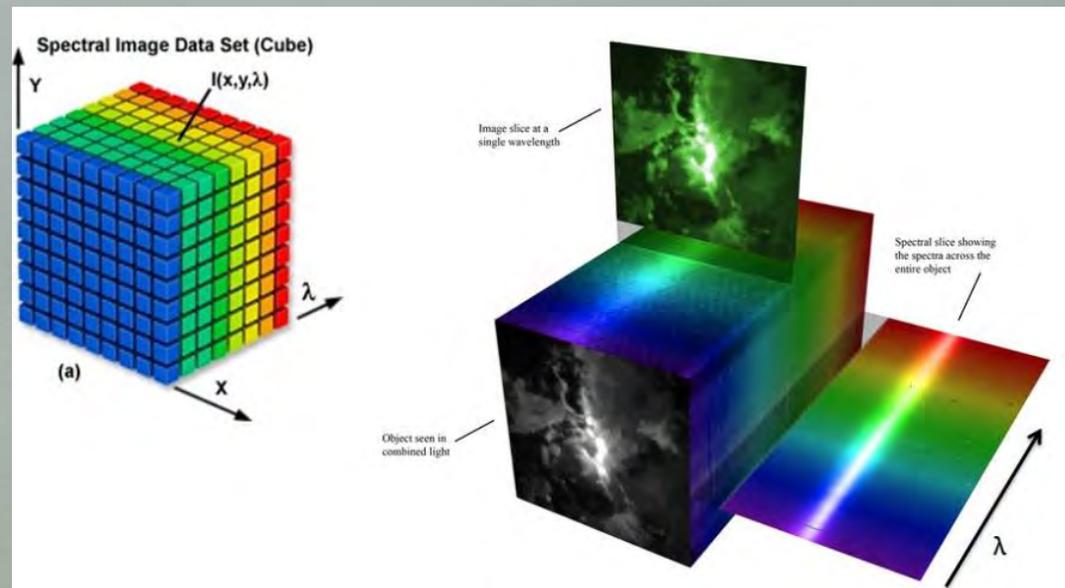
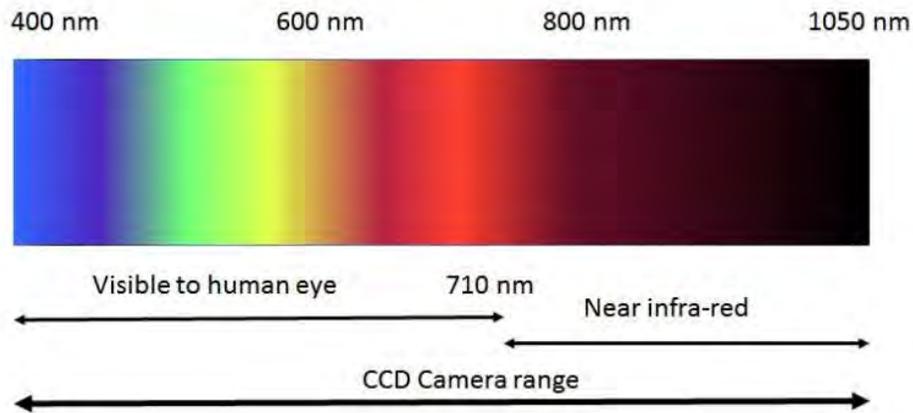
# PRESERVATION REVIEW COMMITTEE



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**Alessandro Bianchi, Head of the Italian team collaboration of the Ministero dei Beni Culturali, Roma, Italy**

# Spectral imaging

## Light Spectrum



**SPECTRAL IMAGING FIRST  
APPLIED IN MID 1990's**



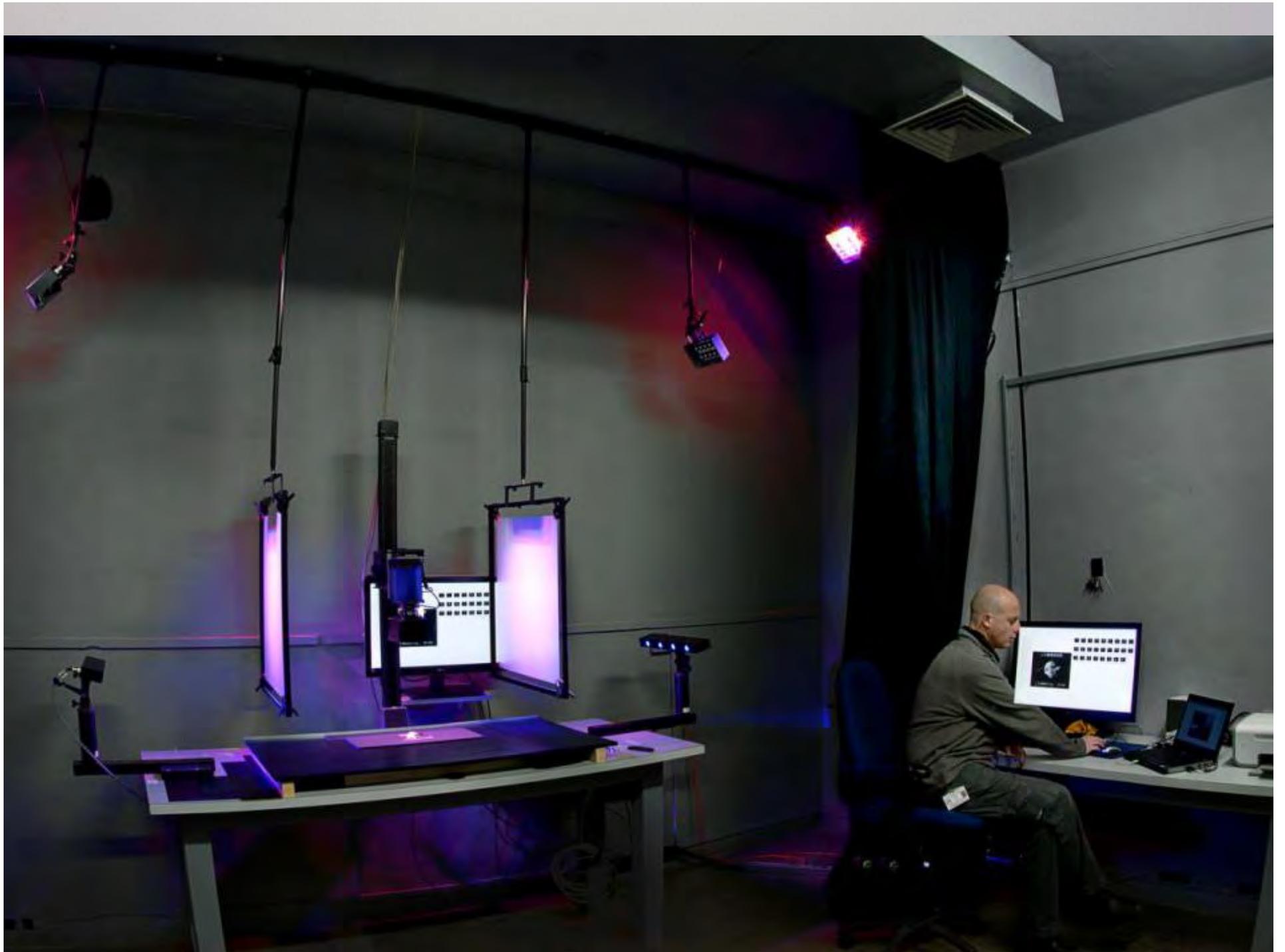
**Genesis Apocryphon  
1QapGen - cl.XIV**

## GOALS OF THE DIGITIZATION PROJECT AS DRAWN BY THE COMMITTEE OF EXPERTS IN 2007

- To digitally image the entire Dead Sea Scrolls corpus in high resolution: Color, Infra-Red and Multi Spectra in order to help sustain their conservation and preservation, while supporting and providing active conservation assessments, non-invasive testing and monitoring tools, and a better record and documentation of the scrolls physical state.
- To make the digital images and texts available and accessible via the internet to all.
- To support scholarship by creating and delivering the highest quality images of the DSS and to provide interactive tools within a supportive research framework including scholarly resources and other available data.

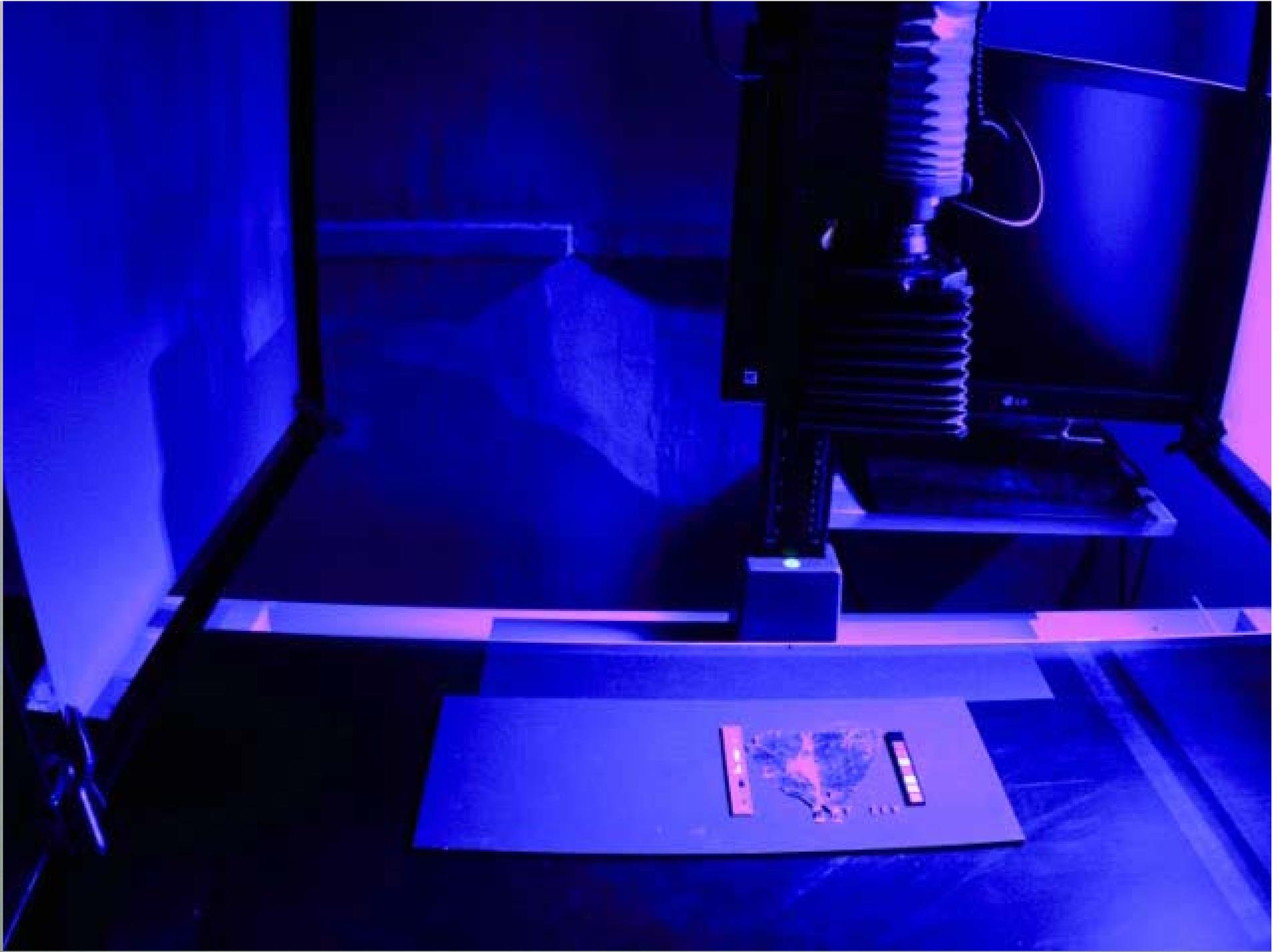
## SCANNING *PAM* & IAA NEGATIVES





## One system does it all - Creates the highest resolution images

- Highest optical quality broad band lens custom designed for the project
- High resolution 39 Mega Pixel monochrome camera
- Dedicated Led lights: 12 bands– 8 visible + 4 in the NIR for monitoring and scholarly work
- Calibrated with NIST traceable industry standards reproducible to < 1 % reflectance
- Color fidelity ~3 times more accurate than any color camera
- 28 exposures – 12 left and 12 right lighting + 4 raking lights – in the visible and NIR - per side
- Every fragment imaged both recto and verso
- Creating a file of 56 monochrome exposures per fragment,
- The system generates a 57<sup>th</sup> file of a very high fidelity color image that combines all visible bands for documentation and publication
- Resolution of files – 1215 PPI 1:1,
- Capture of 4 GB per fragment, divided into 57 files (28+28+1).



## DEVELOPMENT OF A MONITORING METHODOLOGY

- Pixel by pixel comparison of two images of a fragment taken at identical parameters at different times
- Filtering out distracting “noise” - alignment errors, reflectance changes
- Testing and demonstrating development on aged modern parchment
- All modern samples are analyzed using various analytical techniques to distinguish between different sources of variations

20.11.2011



24.4.2012



# ARTIFICIAL AGING

## ANALYTICAL TECHNIQUES

Hyperspectral Imaging (HIS)

Environmental Scanning Electron Microscopy (ESEM)

Fourier Transform Infrared Spectroscopy (ATR-FTIR)

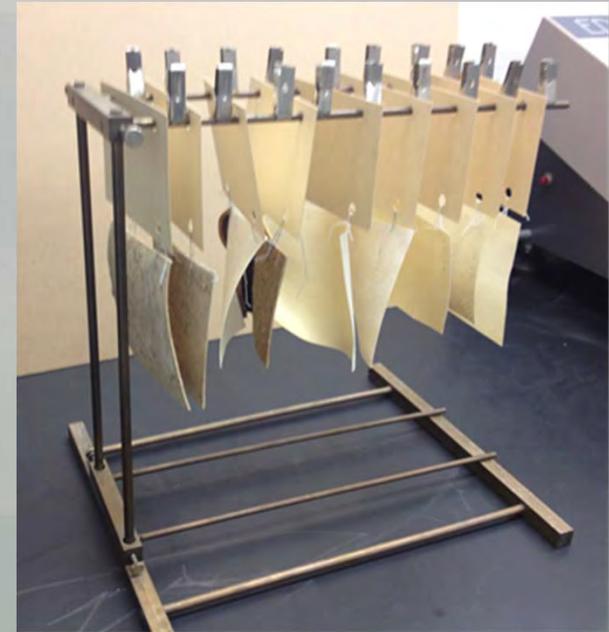
X-Ray Fluorescence (XRF)

Gas Chromatography Mass Spectrometry (GC-MS)

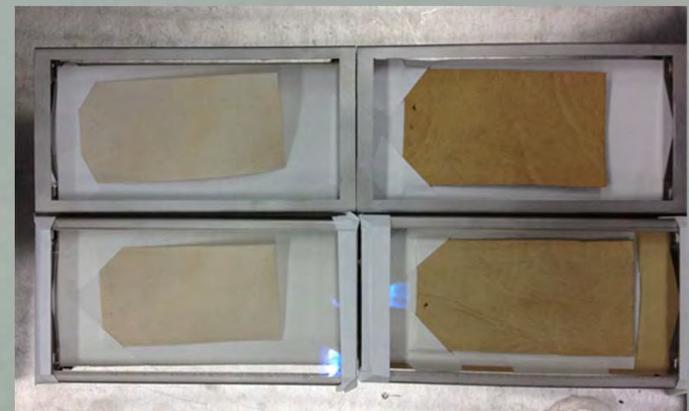
Raman Spectroscopy

Differential Scanning Calorimetry (DSC)

Thermal Gravimetric Analysis (TGA)

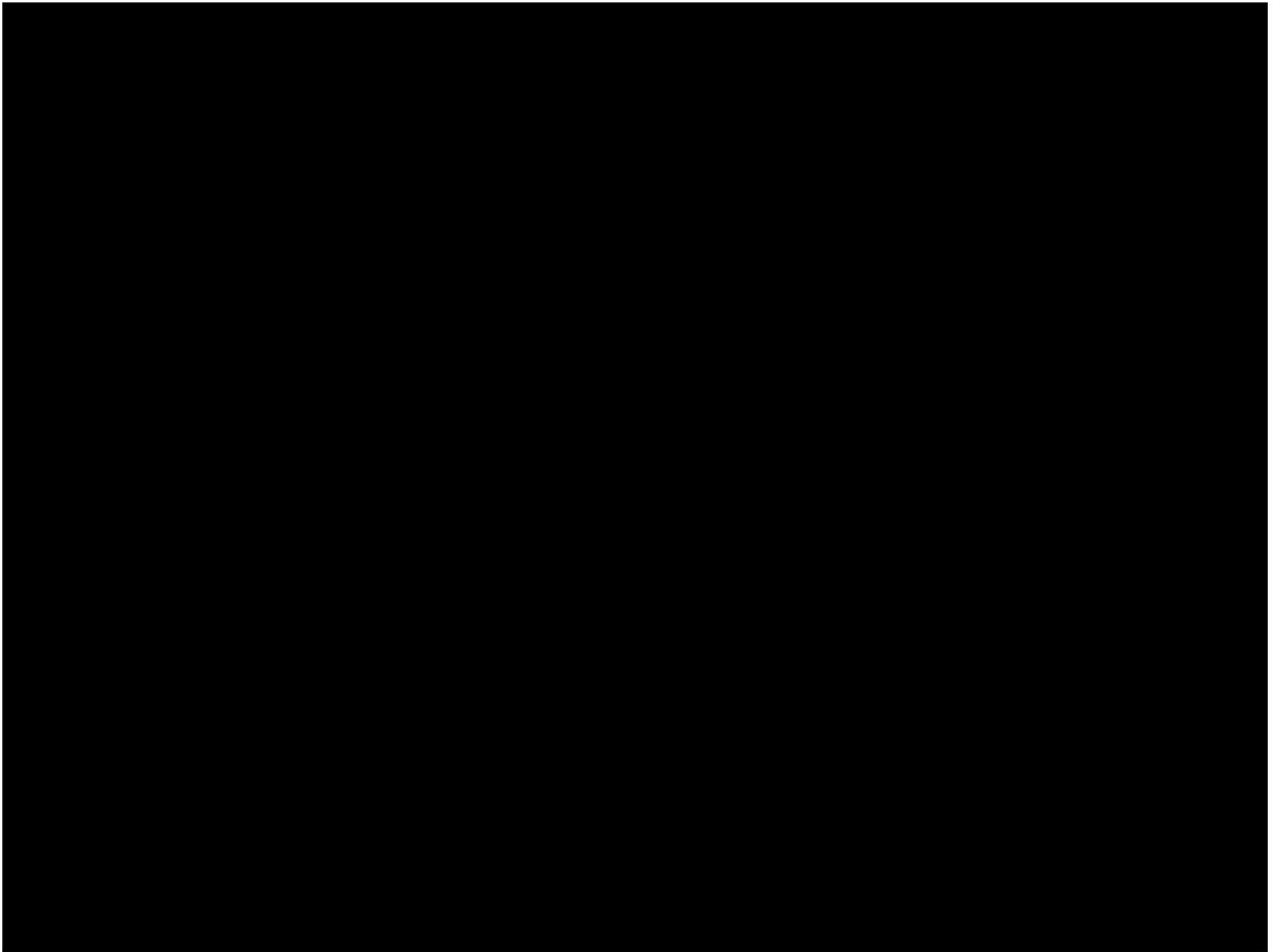


parchment samples used for the artificial ageing in the oven.



parchment samples used for the artificial ageing with light exposure.<sup>41</sup>





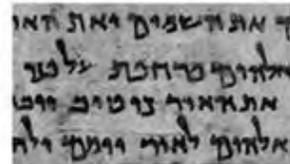
## Finally at Your Fingertips

Welcome to the **Leon Levy Dead Sea Scrolls Digital Library**. Cutting-edge technology brings the greatest archaeological discovery of the 20th century right before your eyes. You can now explore and examine these ancient written treasures, including the oldest biblical manuscripts in existence and thousands of unique fragments.

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### Historical Timeline

What were the historical events that affected the writers and readers of the Scrolls throughout history? >>

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*THANK YOU*

## Acknowledgements

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Arcady Mutter

Tamar Rabbi

Tanya Treiger

Shani Tzoref

Asia Vexler

Iris Yossifon

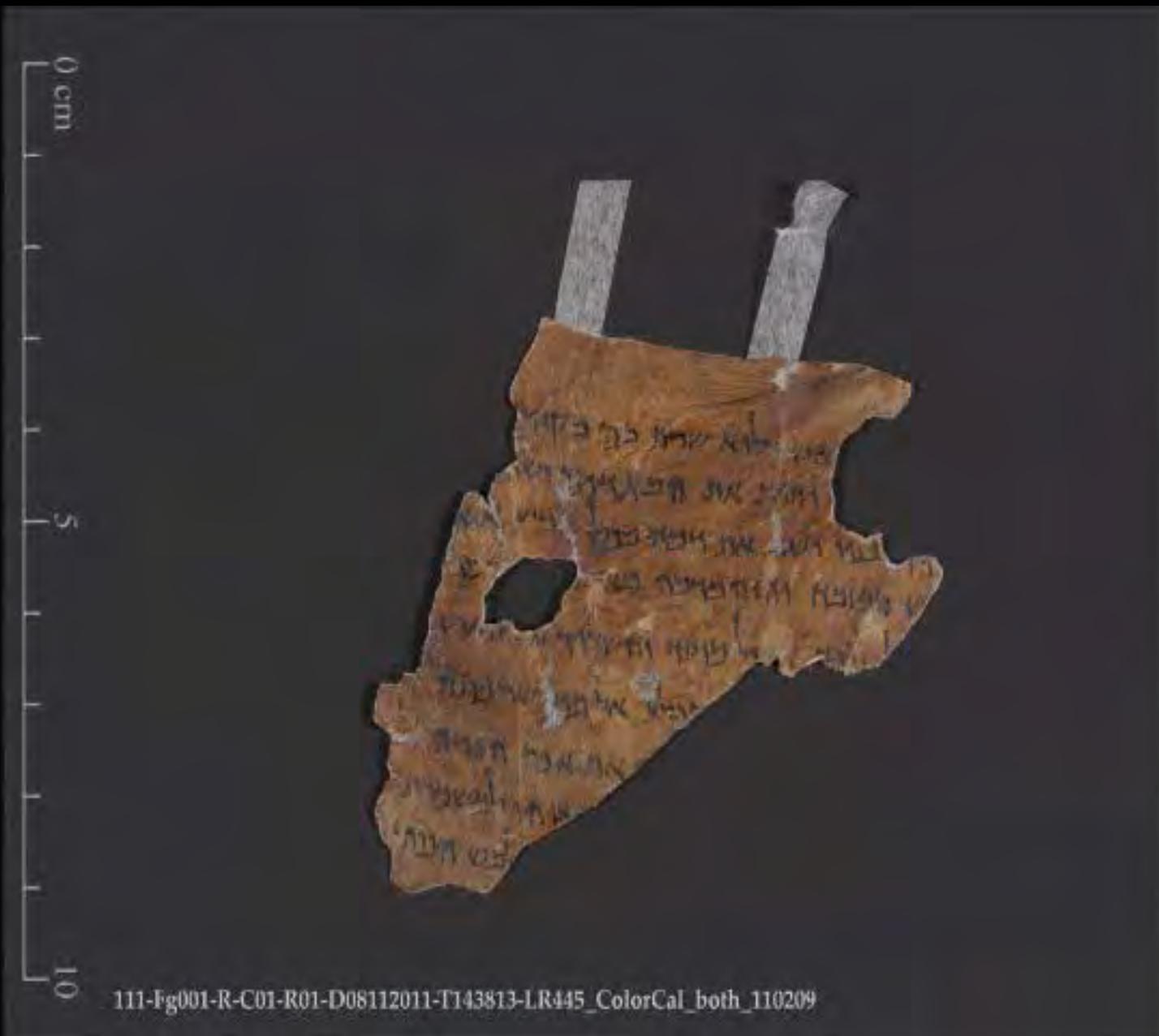
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Shai Halevi

Yair Medina

Tzila Sagiv



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