

# *Performance of Showcases for Organic Archaeology*

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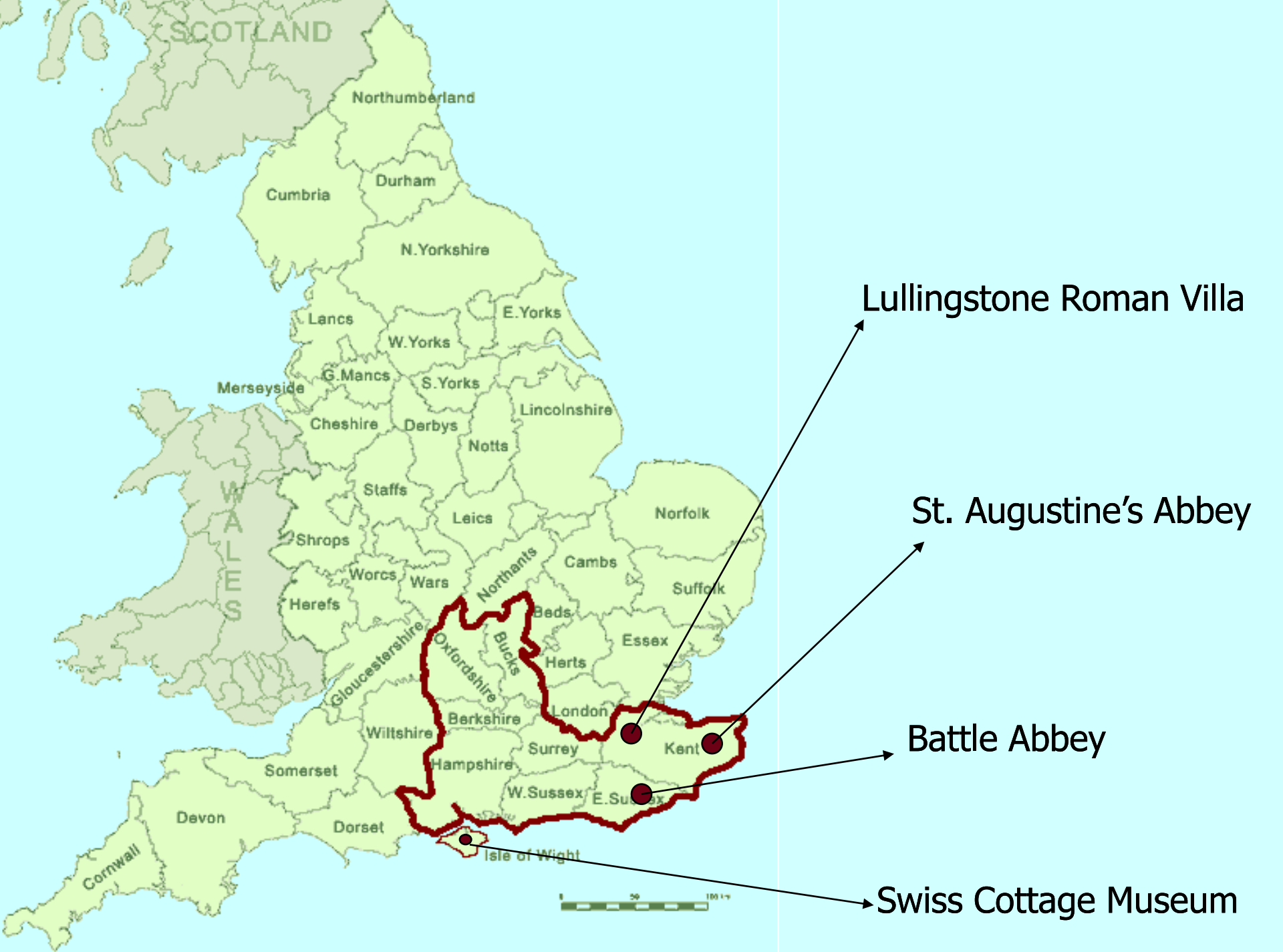
DG Educação e Cultura

Programa de Aprendizagem ao  
Longo da Vida

**U.** PORTO



ENGLISH HERITAGE



SCOTLAND

Northumberland

Cumbria

Durham

N.Yorkshire

Lancs

E.Yorks

W.Yorks

G.Mancs

S.Yorks

Merseyside

Cheshire

Derbys

Lincolnshire

Notts

Staffs

Leics

Norfolk

Shrops

Worcs

Wars

Northants

Cambs

Suffolk

Herefs

Gloucestershire

Oxfordshire

Bucks

Beds

Essex

Herts

London

Berkshire

Surrey

Kent

Somerset

Hampshire

W.Sussex

E.Sussex

Devon

Dorset

Isle of Wight

Cornwall

Lullingstone Roman Villa

St. Augustine's Abbey

Battle Abbey

Swiss Cottage Museum



# Battle Abbey



The exhibition room is located in the Great Gatehouse (room 2). This exhibition was created in 1995 to display some of the artefacts found on site during archaeological excavations. There are 3 showcases with organic materials.

# St. Augustine's Abbey



The exhibition room at St. Augustine's is not in the abbey but in a separate building open to the public since 2002. There are 3 showcases with organic materials found on site.

# Swiss Cottage Museum



This museum was built in 1862, in the Osborne House gardens. The museum collection is broad in its subject matter and there are 2 cases with archaeological organic materials.

# Lullingstone Roman Villa



The artefacts found *in situ* during archaeological excavations are displayed in the galleries (overlooking the fully excavated remains of the roman villa) which were completely recreated in 2008. Three showcases have been monitored.

# Exhibitions and Showcases

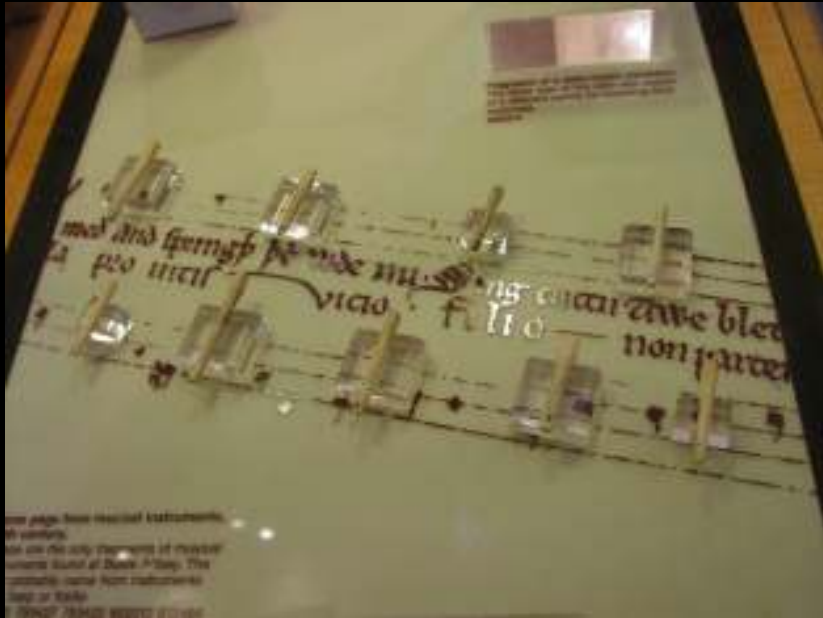
# Battle Abbey

-3 showcases have been monitored

-Main materials: wood and Perspex

-2 types of showcases (desktop and wall case)







The silica gel compartment of the “Abbot” case is located behind the display area and it has been monitored.



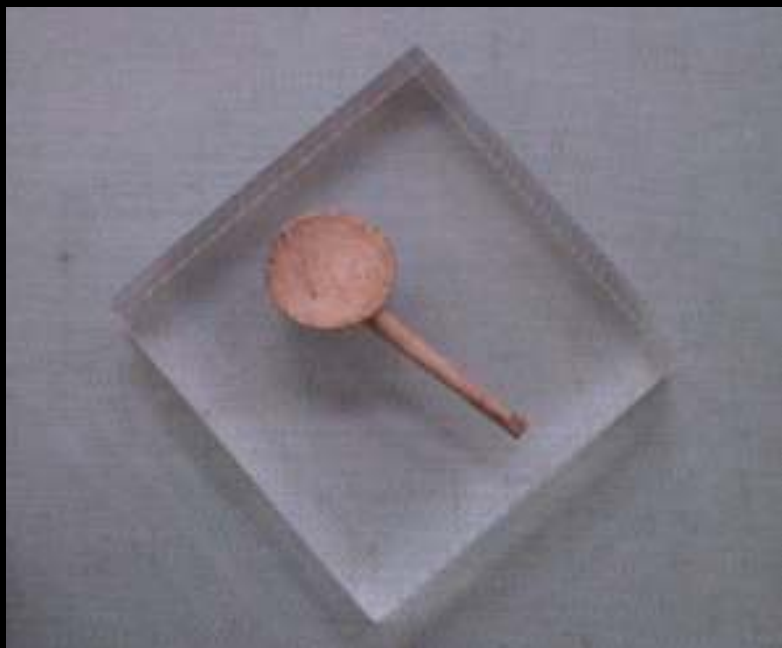
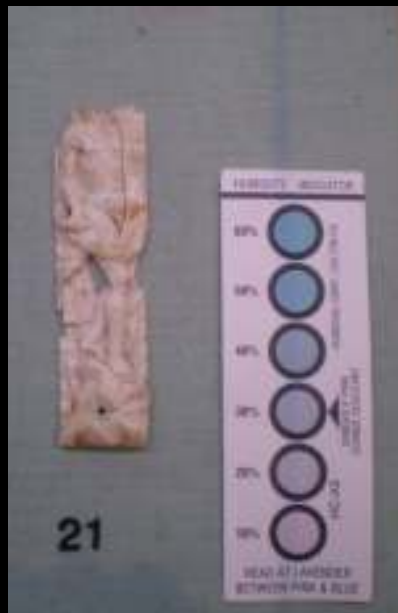
The silica gel compartment of the “Monastic Scribe” case is located beneath the display area and it has been monitored as well.



# St. Augustine's Abbey



- 3 showcases have been monitored
- Main materials: glass and chipboard



# Swiss Cottage Museum



-2 showcases have been monitored

-2 types of showcases

-Main materials: glass and wood





PARTS OF EGYPTIAN IVORY FLUTES.



INSCRIBED WOODEN BASE.  
[About B.C. 1600]



THE EXHIBITS OF  
WERE BROUGHT TO  
BY J. R. PHIPPS  
(BURK OF COME)

# Lullingstone Roman Villa

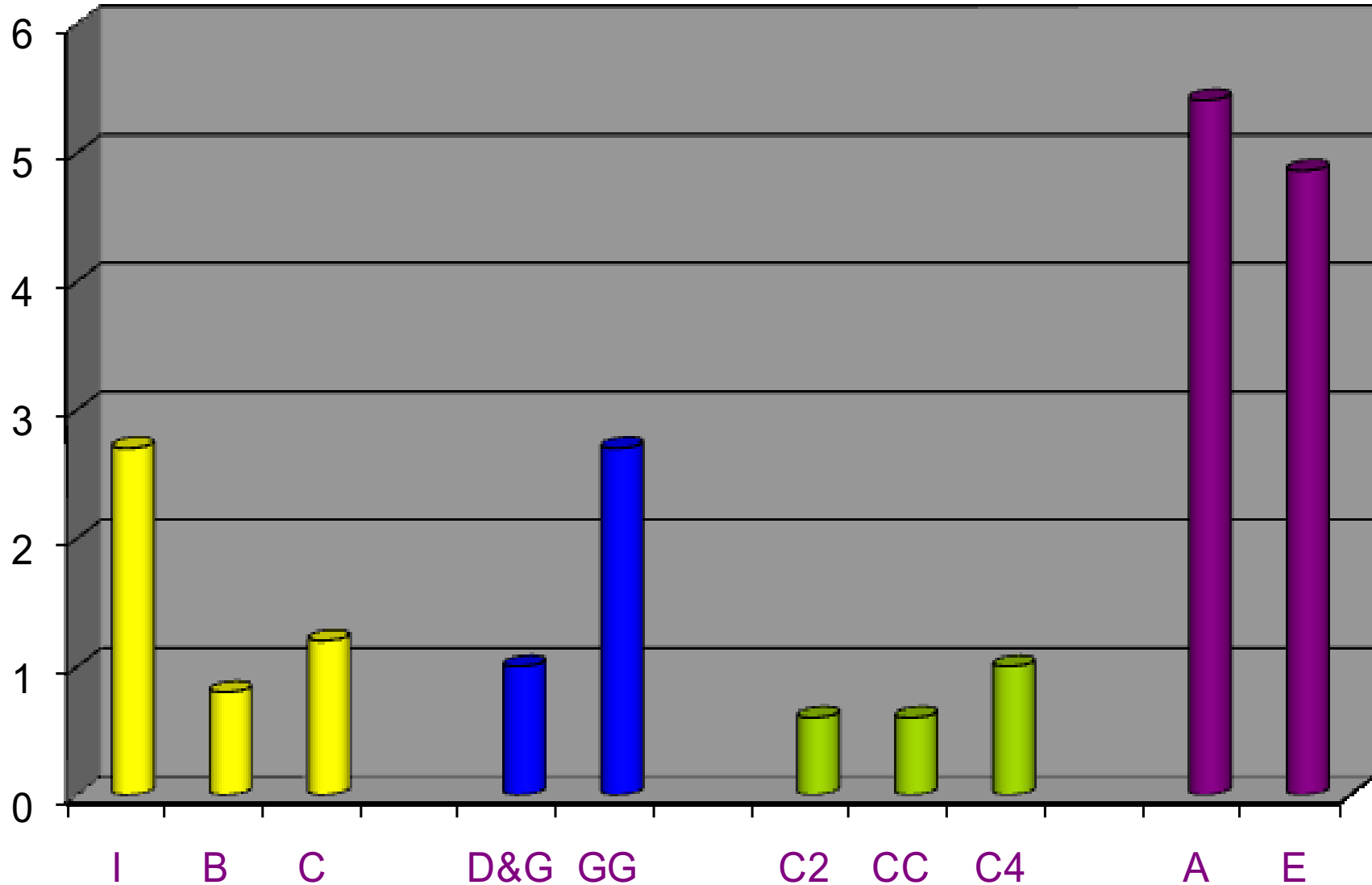


- 3 showcases monitored
- Main materials: metal and glass (with a gas assist system to open)



# Air Exchange Rates

# AER (day<sup>-1</sup>)



■ Battle Abbey ■ Lullingstone ■ St. Augustine's ■ Swiss Cottage Museum

[I=Ivory (Abbot case); B=Bone Pegs (Precentor Case); C=Cooper Case (Monastic Scribe)].



**2,7 day<sup>-1</sup>**

**1,2 day<sup>-1</sup>**



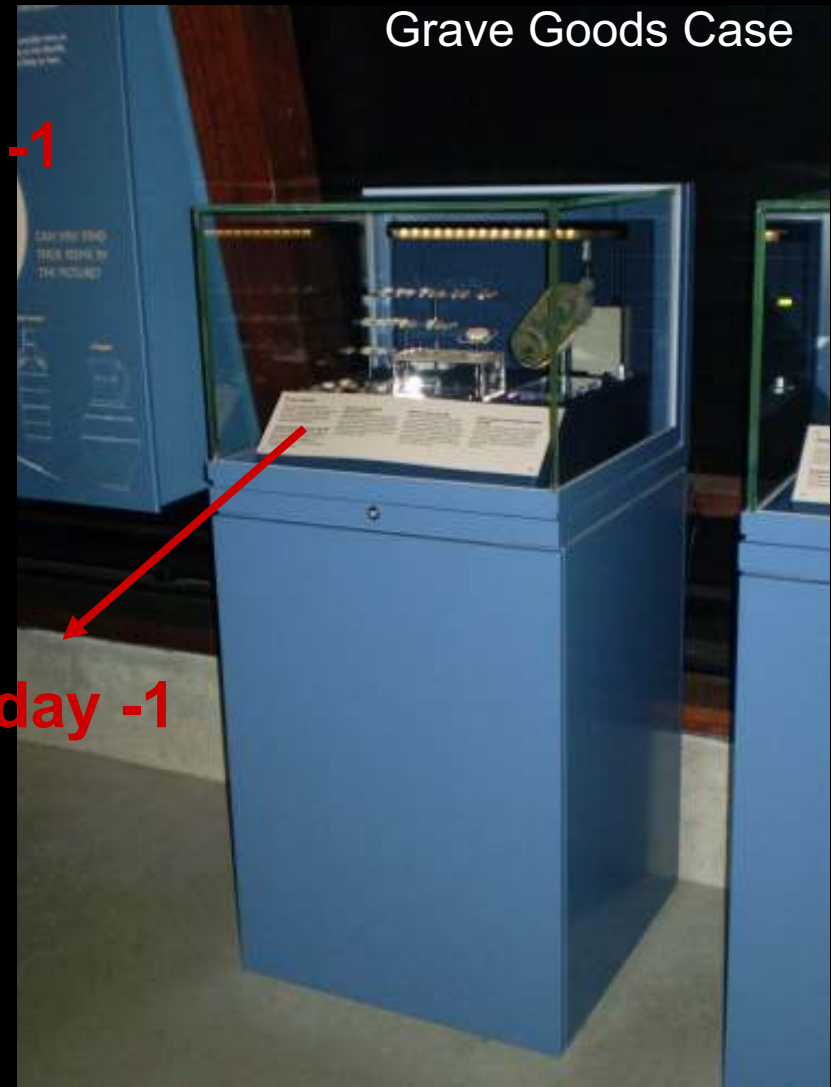
The desktop case is the most air tight, because the weight of the Perspex lid pressurizes the seals and makes it less leaky.

On the other hand, the effect of the gravity makes the wall case leakier by pushing it down from the seals.

Dog & Goose Case



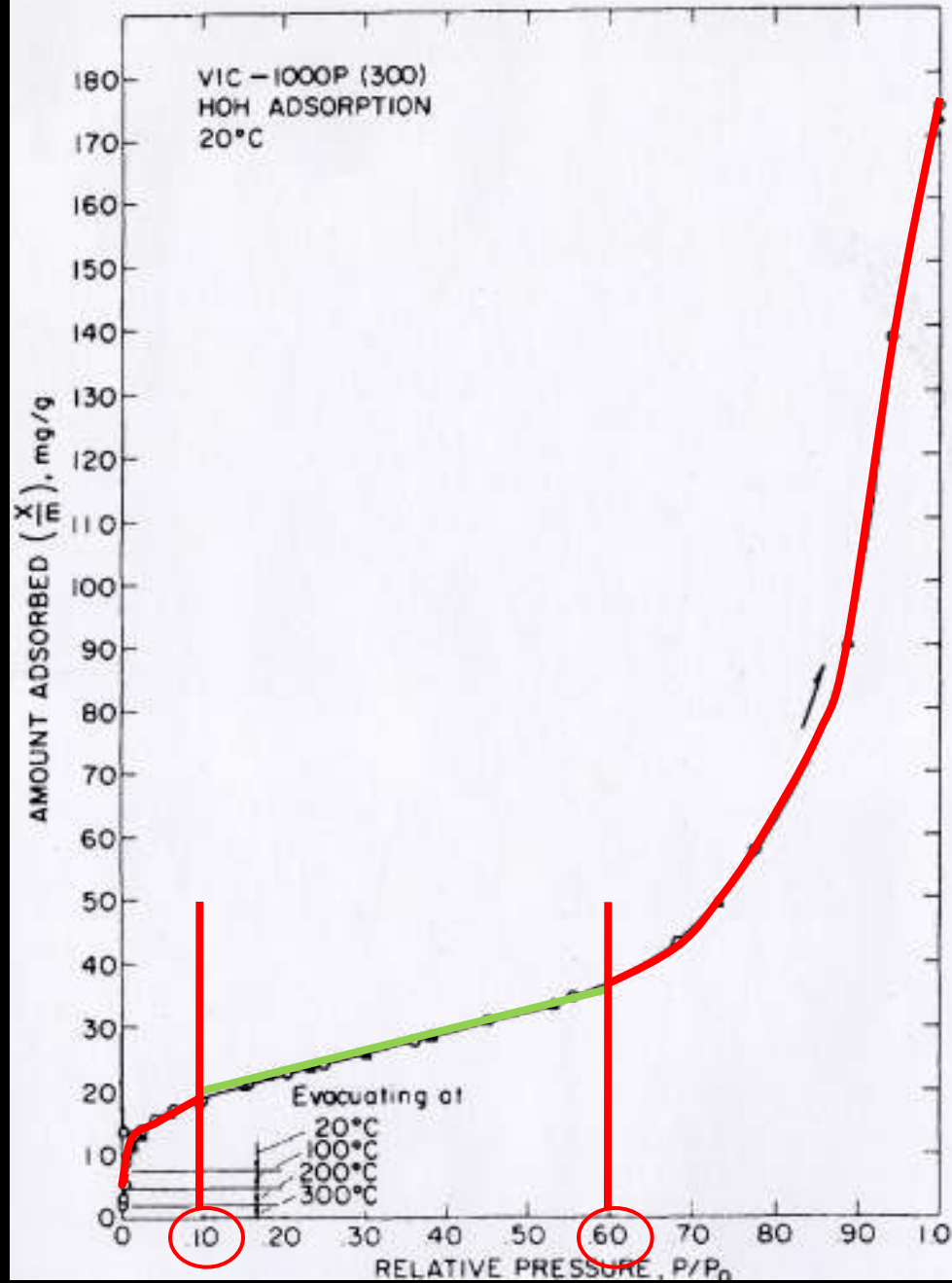
Grave Goods Case



- Smaller cases are, usually, leakier because they have more seals to volume ratio.
- The "Grave Goods" case has vertical and horizontal seals (see next slide), and the vertical ones do not seal as well as the others.
- This kind of cases with a gas assist system may have problems with balancing/harmonizing the pressure between the two sides of the case. This difference will make it more leaky.



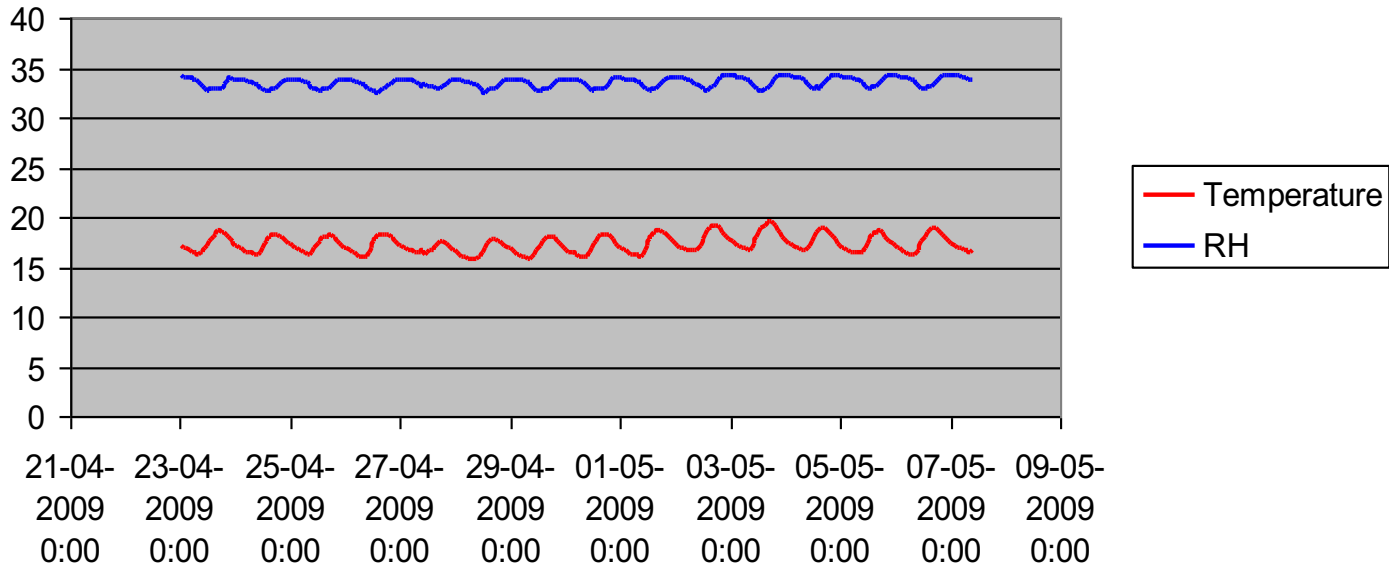
Temperature  
Relative Humidity



Rootare, Hillar & Craig, Robert, "Vapor Phase Adsorption of Water and Hydroxyapatite", *Journal of Dental Research*,

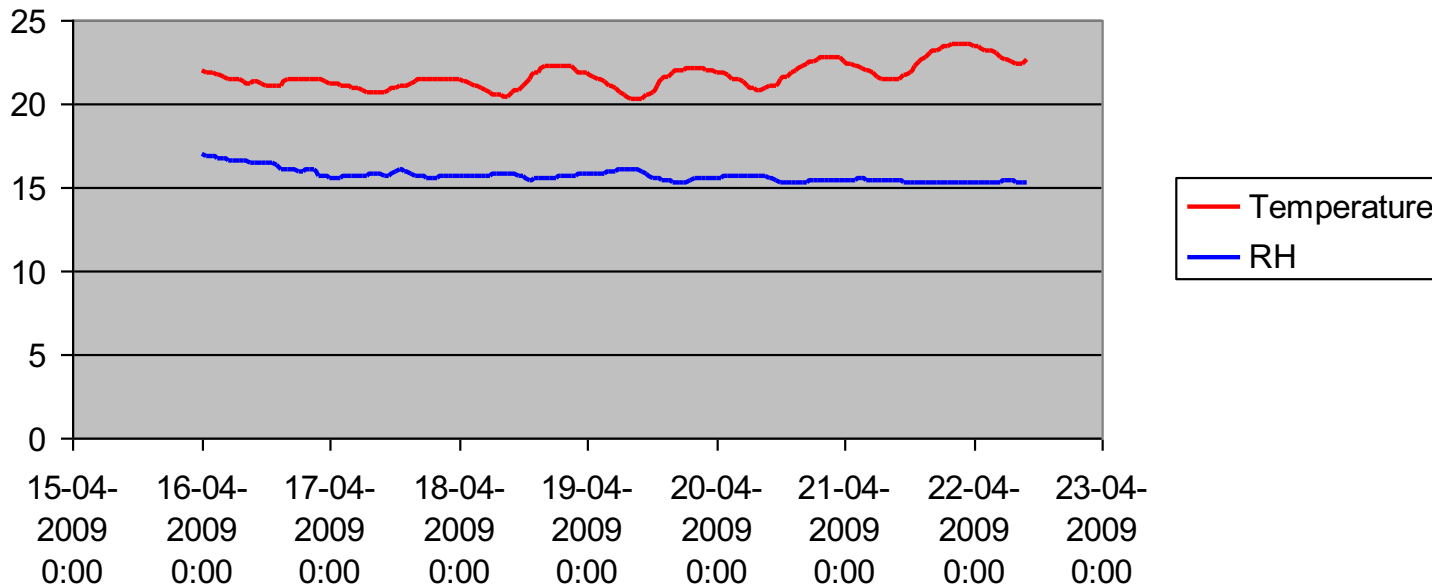


### "Copper Case" - Battle Abbey

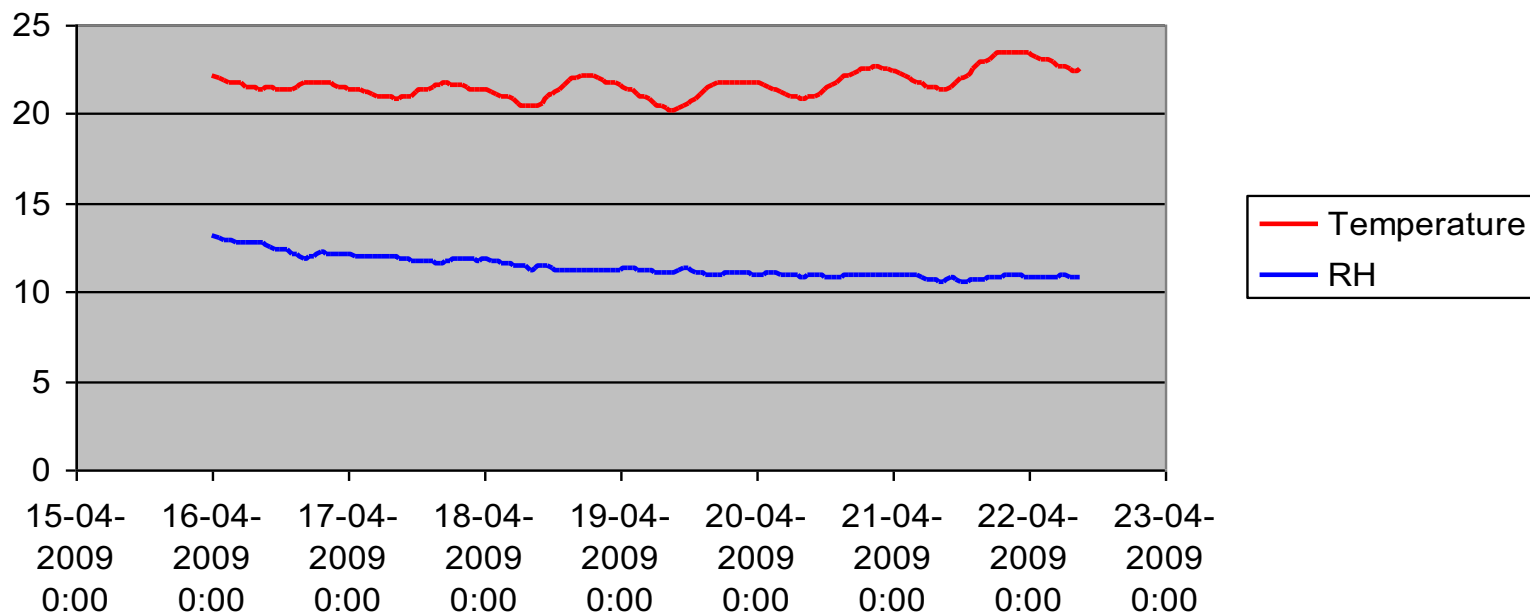


RH conditions within 3 showcases (see next slide) with archaeological metals and organic materials displayed.

### Case 2 - St. Augustine's Abbey



### Case 4 - St. Augustine's Abbey



# Organic Materials at Low RH



At the present time the bone prickers do not show any visible damage that may have been caused by this constant low RH. Photographs of the artefacts taken 5 years ago by David Thickett, have been compared with photographs taken in 2009 (during this project).

The conclusion is that the bone prickers do not show further damage.

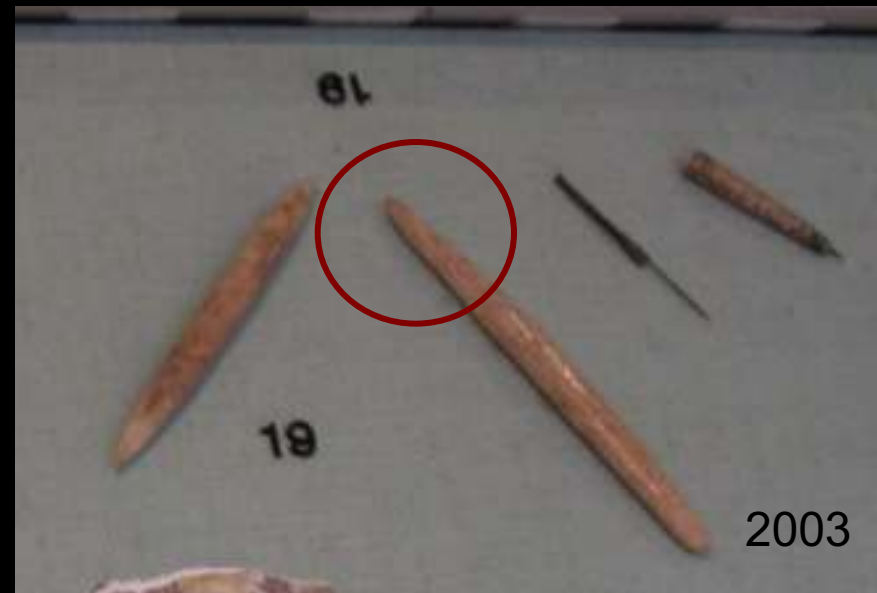


# Organic Materials at Low RH



At St. Augustine's Abbey (case 4), the bone materials are much more curved at the present time.

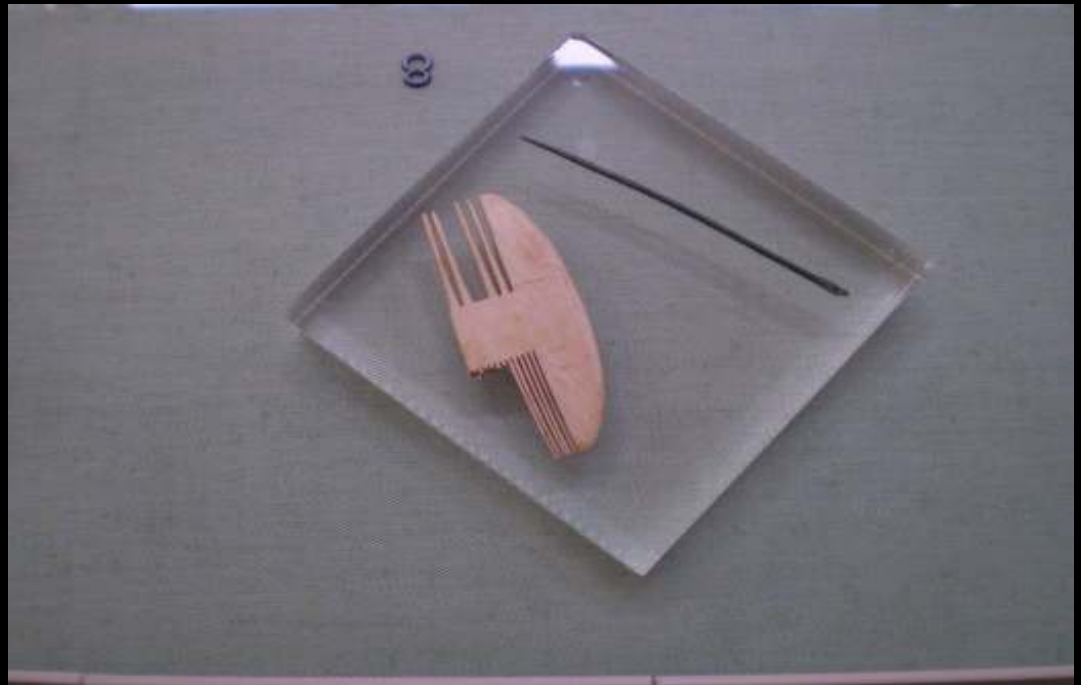
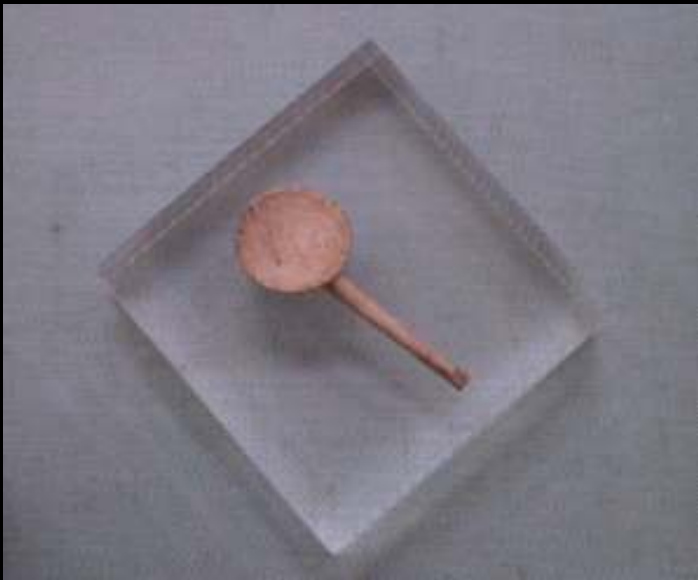
Again, if we compare the two photographs from 2003 and 2009 (and although they have not been taken in the same angle) it is visible that the two bone prickers are now much more curved in the ends; 5 years ago, they didn't show any curvature.



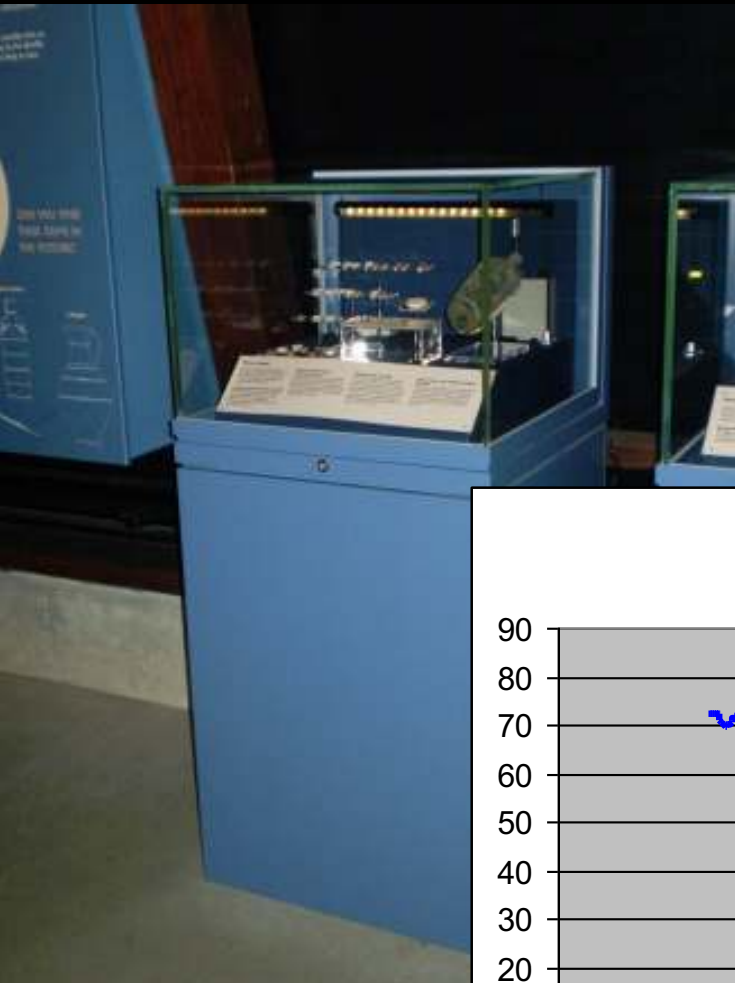
# Organic Materials at Low RH

On the other hand, there are two objects in the same case (case 4, St. Augustine's Abbey) that do not show any visible damage.

A double-sided comb made from a single piece of bone remains flat in its Perspex base (with no curving signs); and a bone spoon that does not show any visible damage either.

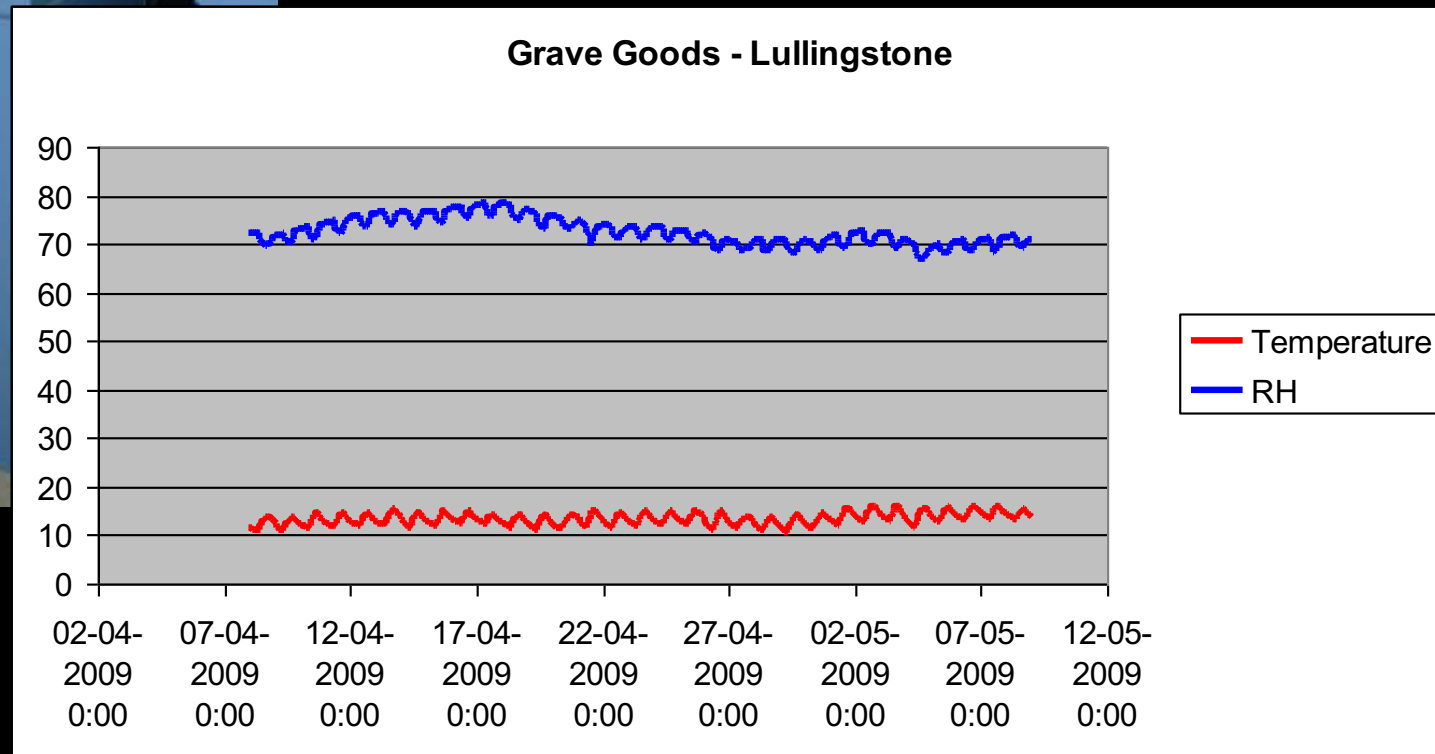


# Uncontrolled Environment and High RH



Among the 11 display cases that we have been monitoring, 5 have their RH above the recommended limits for organic materials.

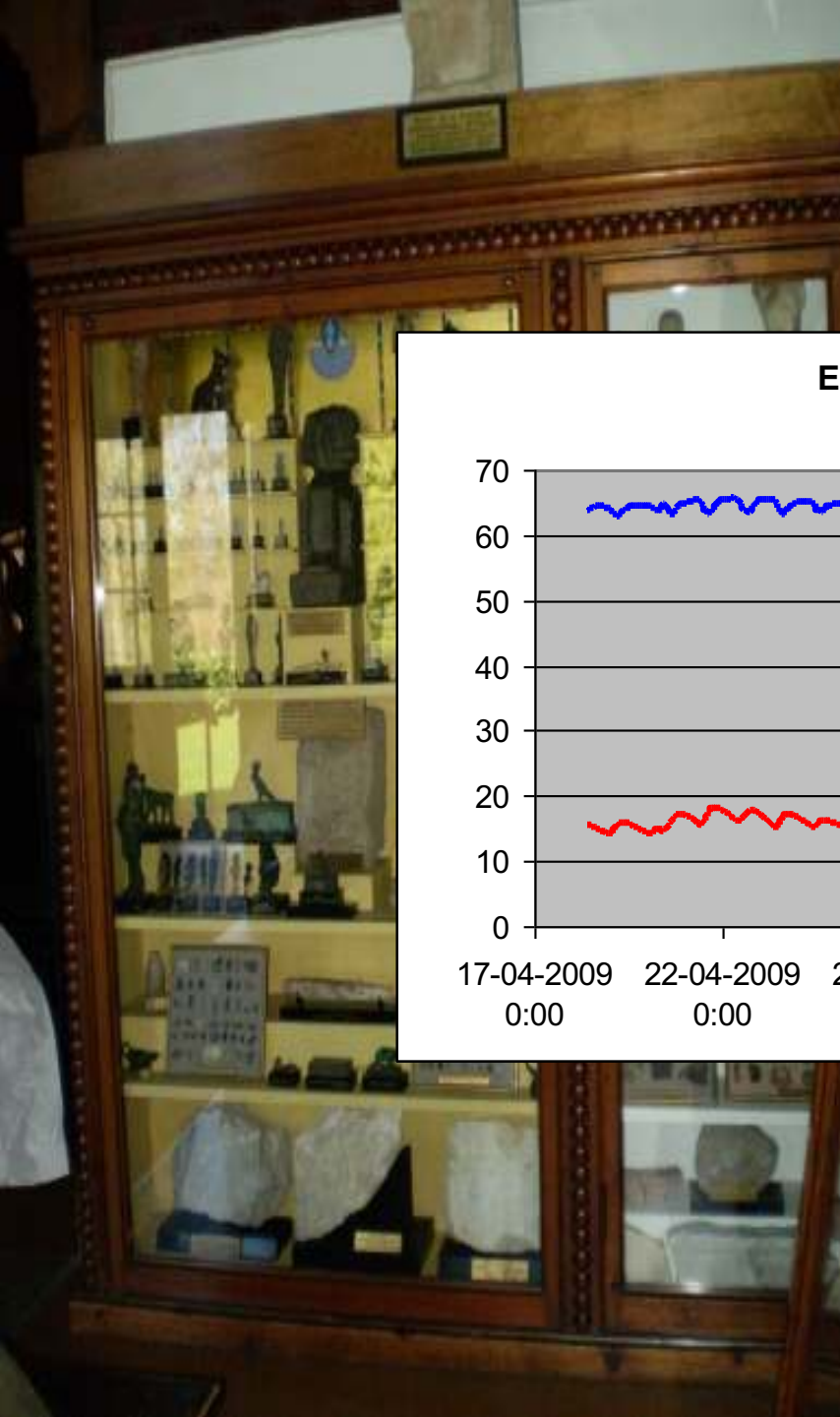
The Grave Goods case (Lullingstone) and the Egyptian case (Swiss Cottage Museum) are two examples of these conditions.



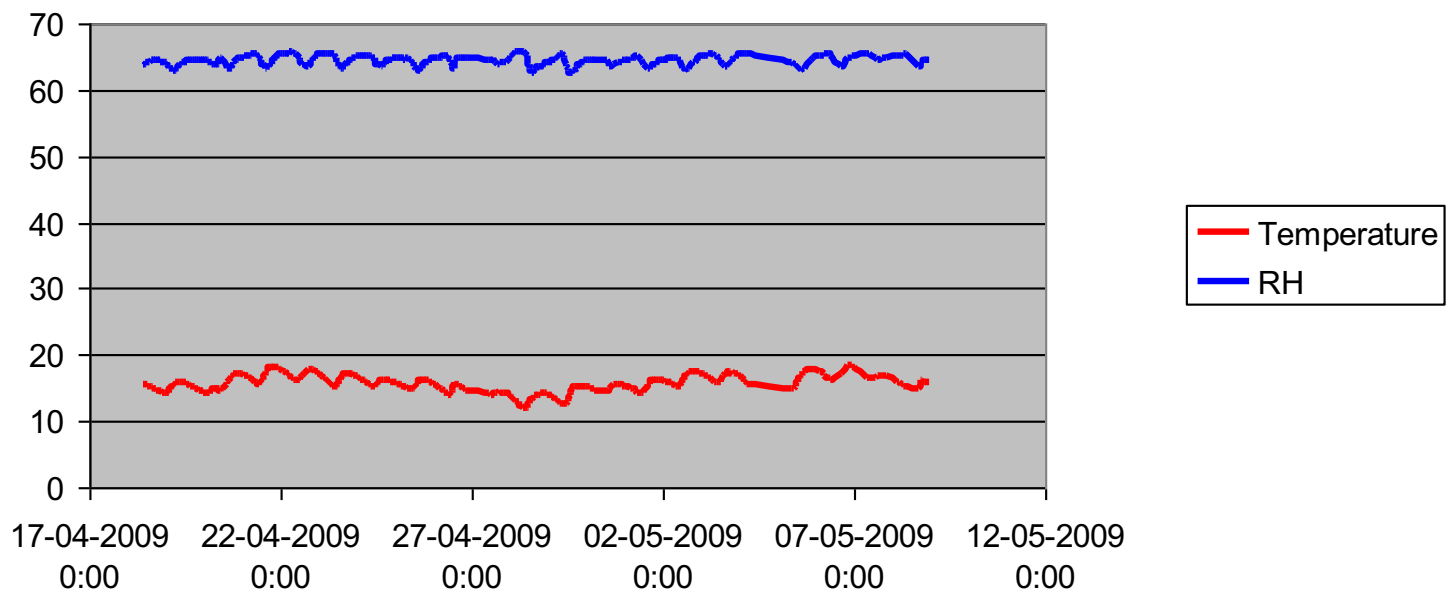


However, at the present time, the bone materials inside this display case show no visible damage (no mould, no expansion).

In fact, these objects have been stored and displayed in damp environments for many years and, maybe, they have reached their equilibrium at high RH. When discussing whether to buffer or not the internal RH with silica gel, care must be taken.



**Egyptian Case - Swiss Cottage Museum**





PARTS OF EGYPTIAN IVORY FLUTES.

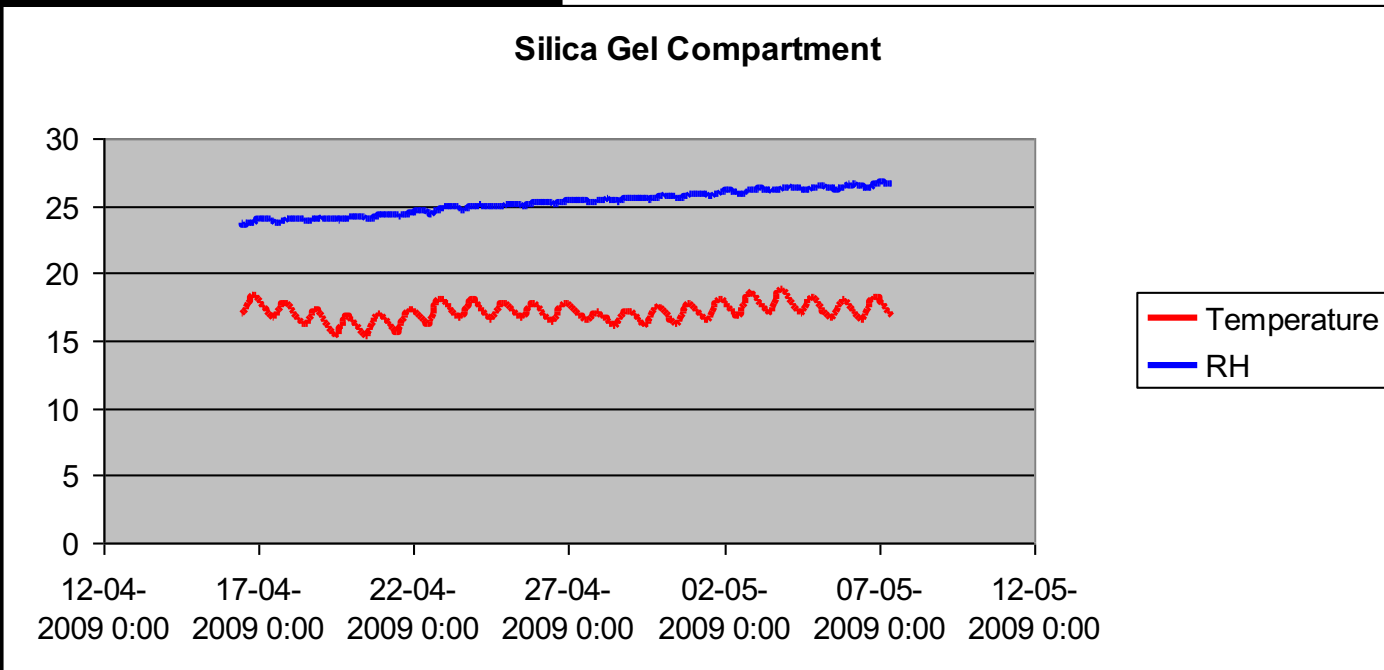
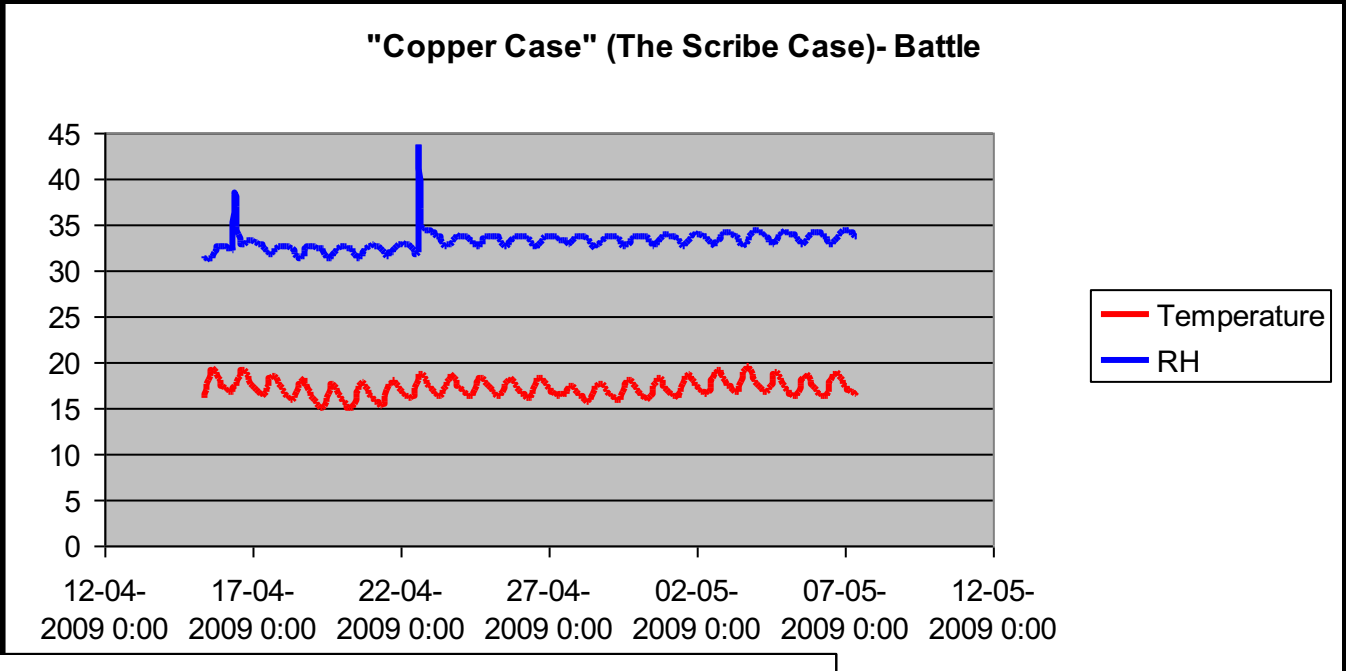


ALABASTRON.  
FROM THEBES. ABOUT 2000 B.C.

INSCRIBED WOODEN BASE.  
[About B.C. 1600]

# Showcase and Silica Gel Compartment

T. and RH conditions within the display area and silica gel compartment of the "Monastic Scribe" case at Battle Abbey.



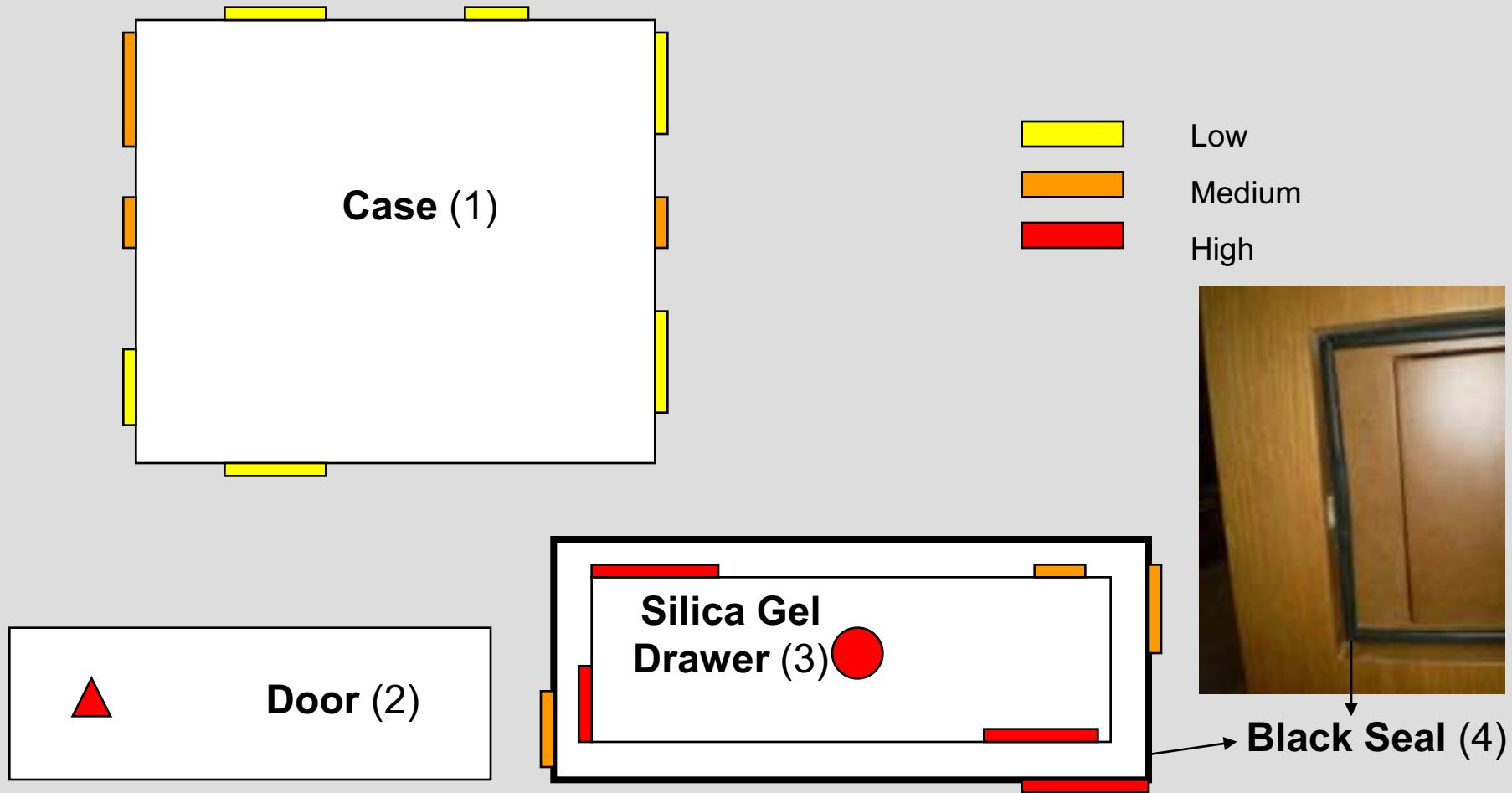
-The RH within the silica gel compartment is increasing faster

-The RH within the case is always more than 7% higher than the RH in the silica gel compartment.



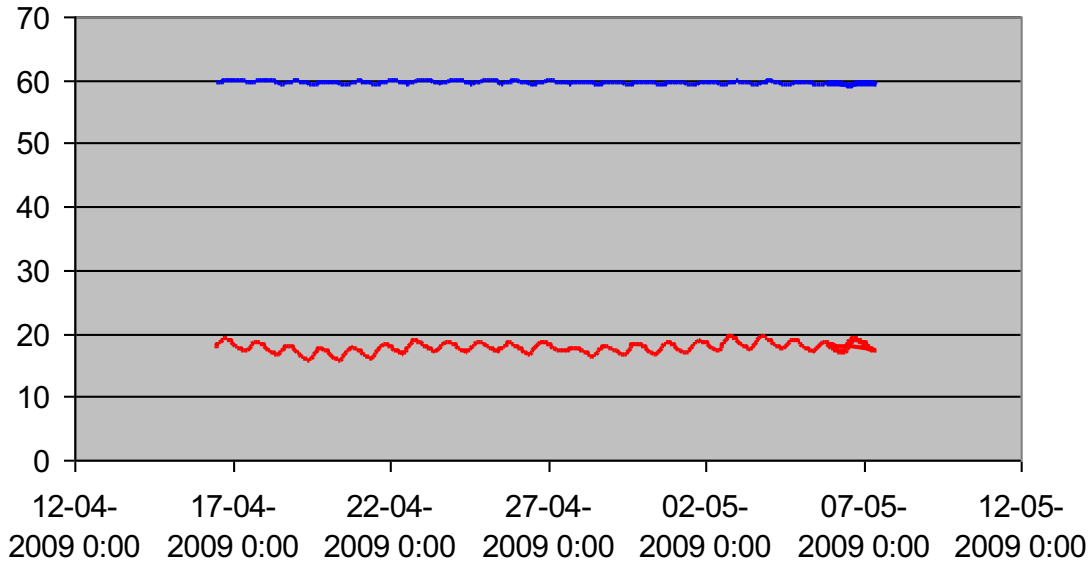
Running the Leak detector (Monastic Scribe case, Battle

# Leakage from Monastic Scribe case and silica gel compartment

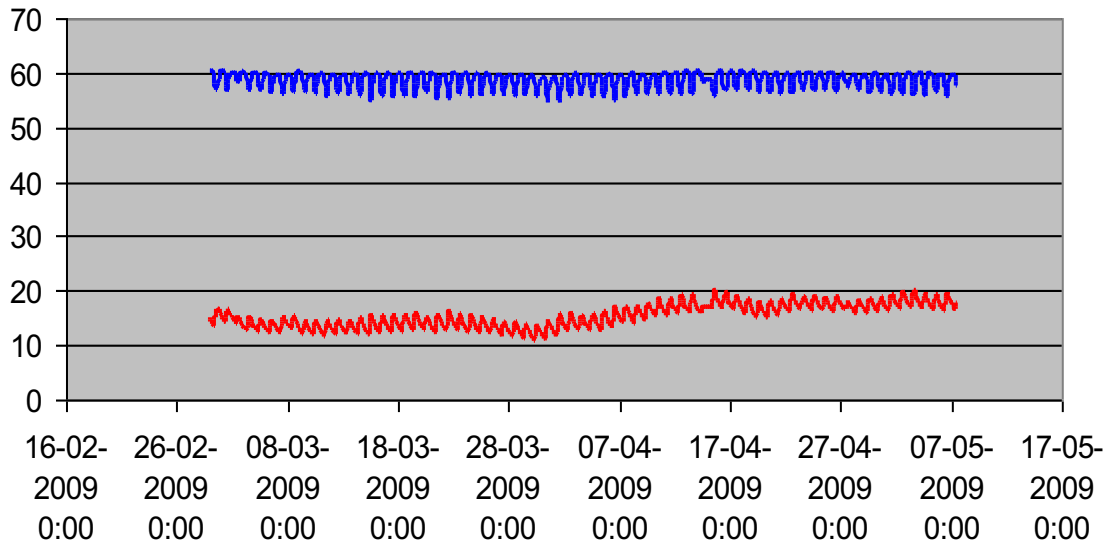


As we can see in the image above (representation of the leakage paths), the silica gel compartment (2,3 and 4) has much more leak zones than the display area (1). These “gaps” allow the air movement between the silica gel compartment and the outside of the showcase. Thus, the room conditions (with higher RH) are causing the RH of the silica gel compartment to increase faster than the RH inside the display volume.

**Silica Gel Compartment - Ivory Case**



**"Ivory Case" - Battle Abbey**

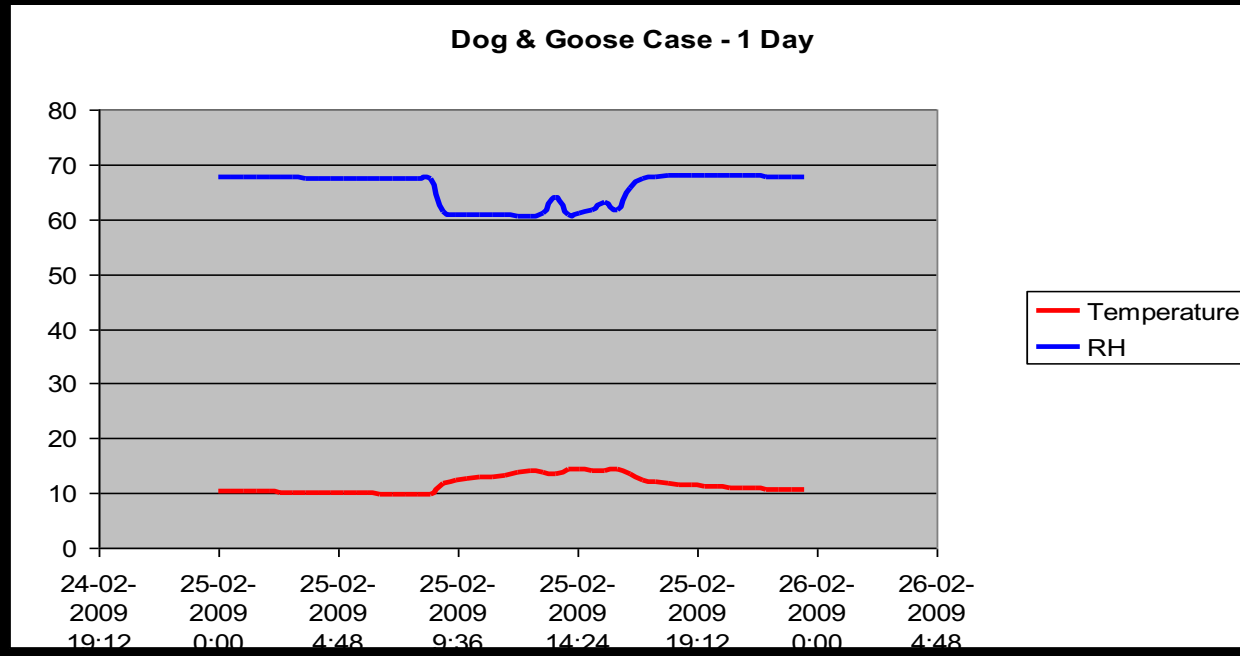
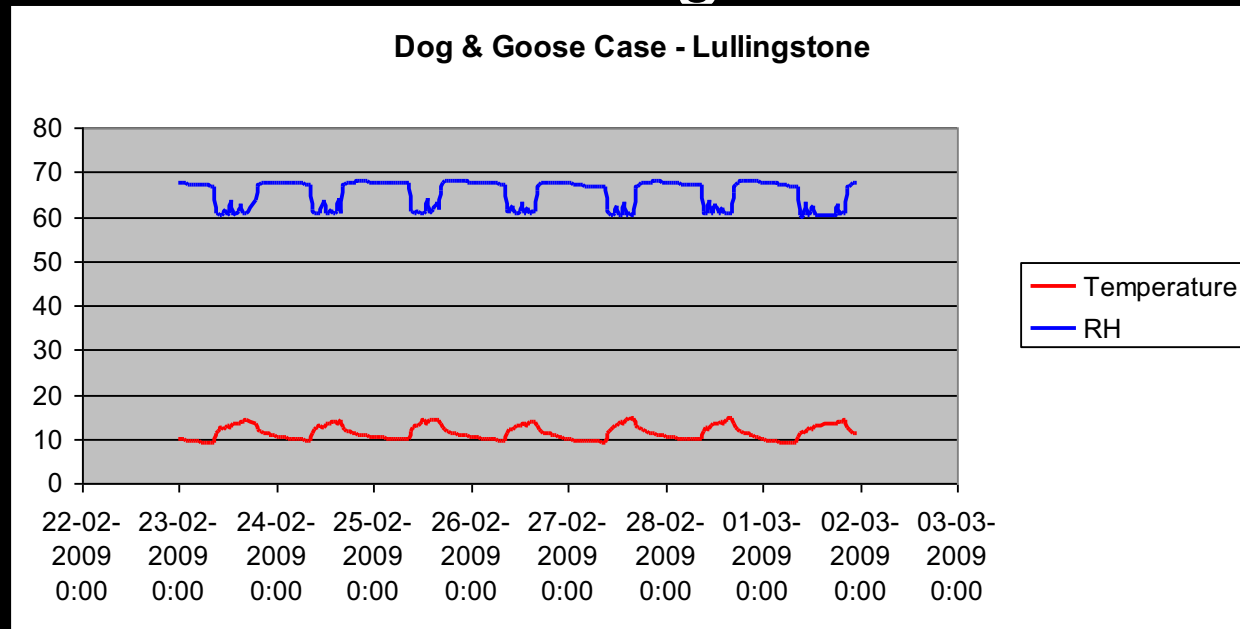


Abbot Case - the RH conditions of the silica gel compartment and the RH of the case itself are almost the same. The answer may be in the location of the silica gel tray.

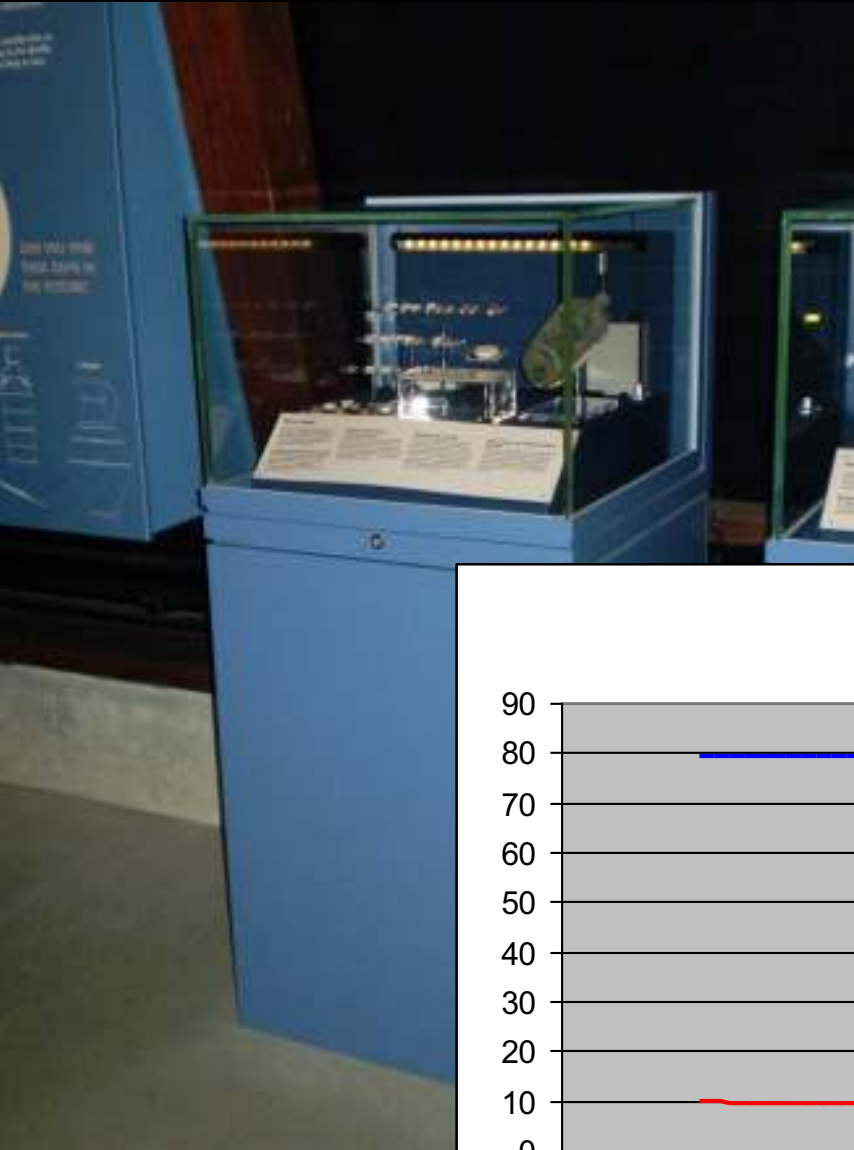
# Dog and Goose Case - Lullingstone



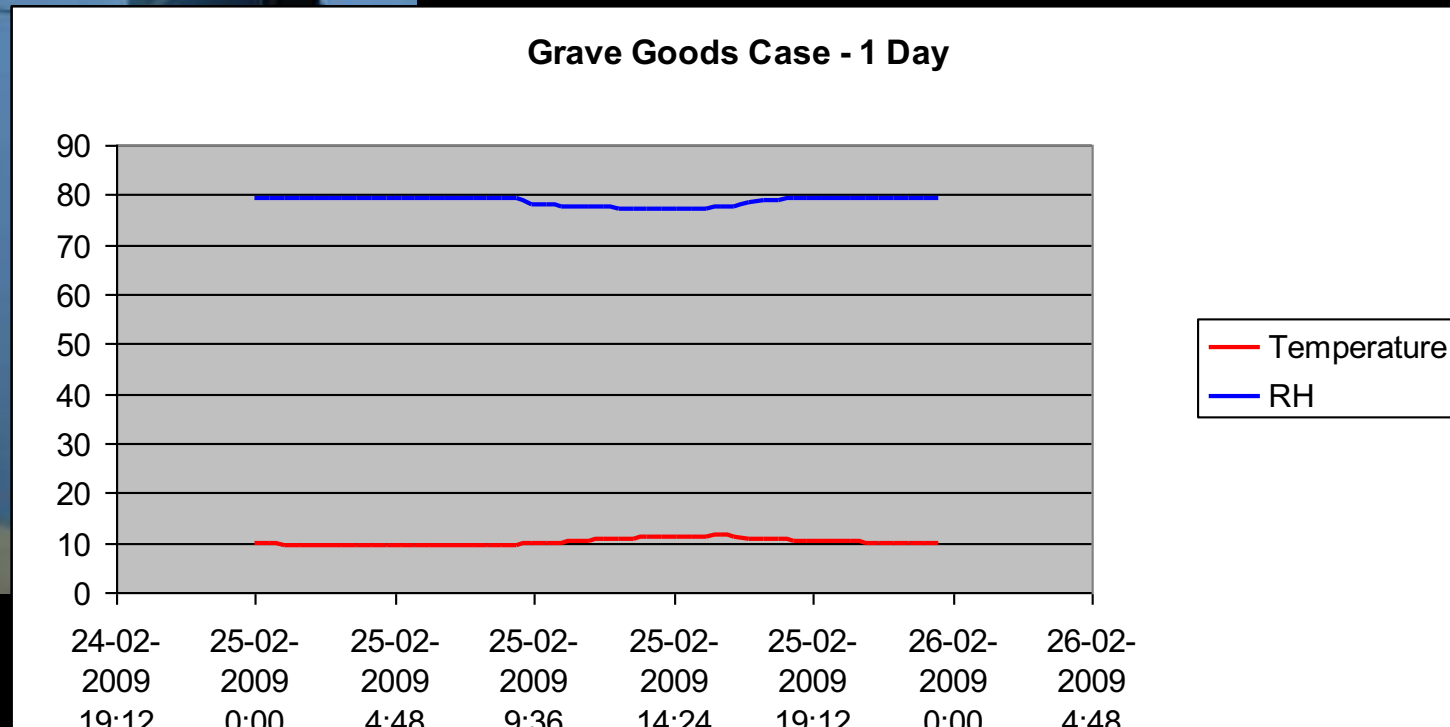
T and RH fluctuations within the Dog and Goose case, Lullingstone - daily cyclic humidity pattern with humidity changes of 7% regularly occurring.



# Grave Goods – Lullingstone

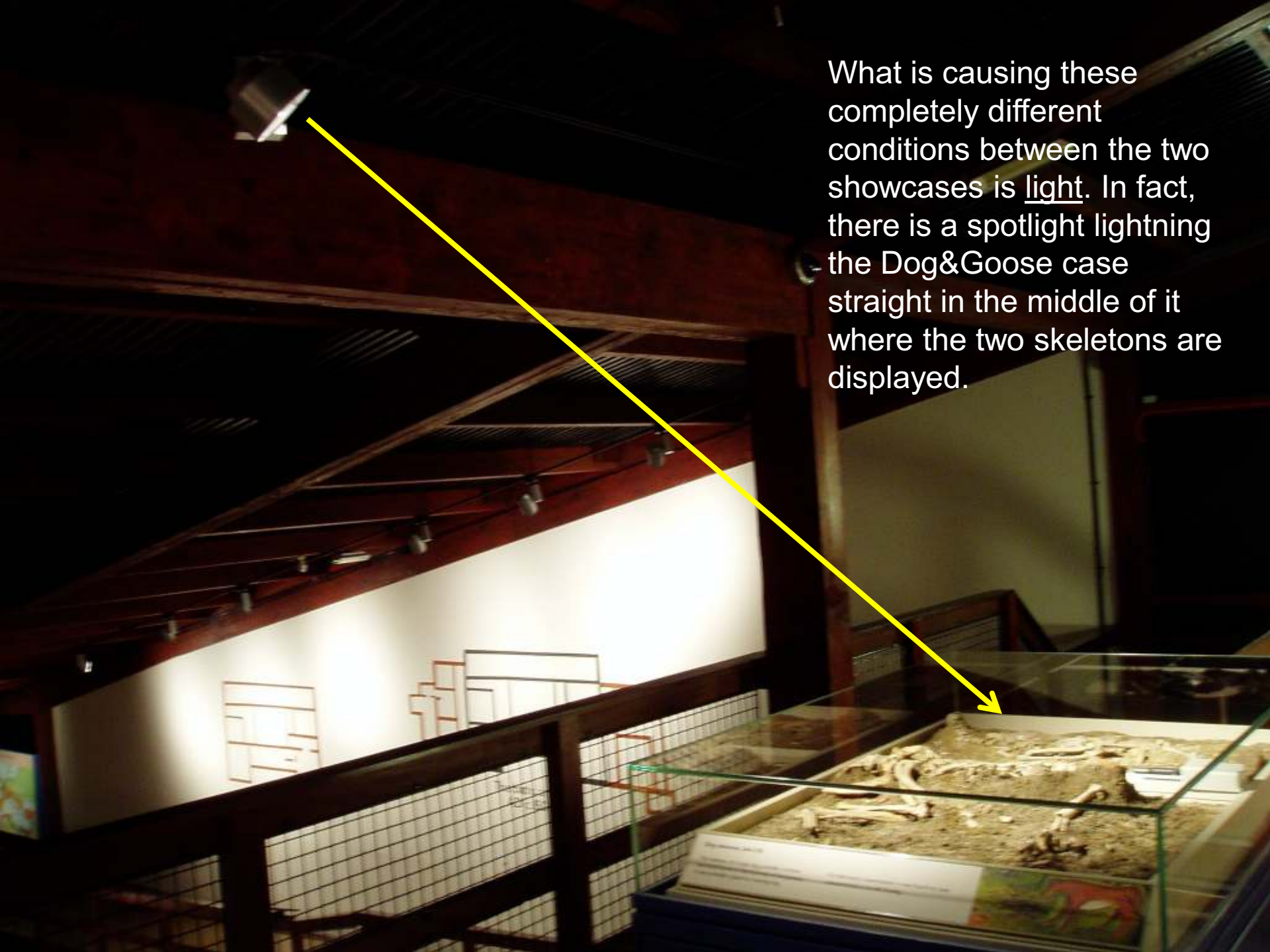


T and RH fluctuations within the Grave Goods case, Lullingstone – This showcase is located in the same exhibition, but the RH has minimal fluctuations of 2%.



Light

What is causing these completely different conditions between the two showcases is light. In fact, there is a spotlight lighting the Dog&Goose case straight in the middle of it where the two skeletons are displayed.





Light Levels\*: 2.469.600

Recommended: 100.000

Actually, the same type of spotlight is used to illuminate all the area with the remaining structures of the roman villa (hundreds of m<sup>2</sup>).

Not just the daily fluctuations of RH and T may cause damage to the objects. Light can also cause damage too. This spotlight should be replaced or at least repositioned/redirected as soon as possible.

\*Light levels falling on the centre of the case were checked using an **Elsec meter**. The annual luxhours were calculated from a punctual reading.

Light Levels

117.000

The L.E.D. bulbs used in the Grave Goods case are not a heat source and so, they are causing T and RH fluctuations within the case.



**Grave Goods**

These grave goods were found in the tomb of a man who lived in the 1st century AD. The objects include a glass gaming counter, a glass bottle, and several small objects.

**All glass gaming counters, AD 100**  
These were popular for the game of backgammon. This glass counter was found in a tomb in the 1st century AD.

**Plates of carved ivory, early 4th century**

These plates were found in the grave of a man who lived in the 4th century AD. The plates were made of ivory and were used for playing a game.

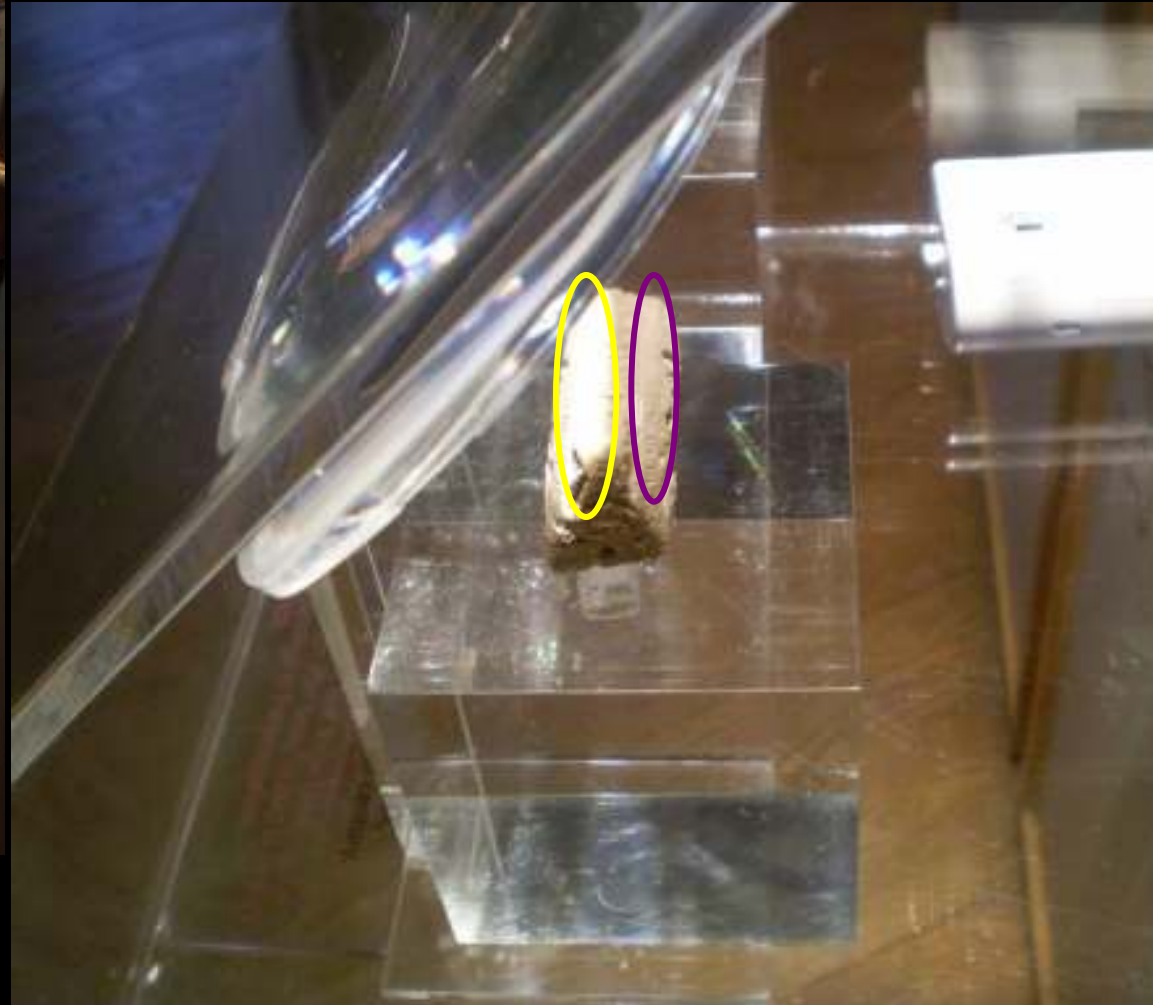
**Mosaic floor, AD 100**

The floor of the tomb was made of mosaic. The mosaic was made of small pieces of stone and was used for decoration.

**Glass bottle with dolphin handles, AD 100**

The bottle is decorated with dolphin handles and was used for storing wine. It is made of glass and has a stopper.

Lux-Hours/Year:  
6.081.600



The light levels measured at the Abbot case (Battle) are well above the recommended and it may be causing a chemical deterioration of ivory's internal structure, especially collagen. Besides, there is a massive difference between the two sides of the same object, which may cause, in the future, different colorations.

Not Exposed: **2.027.200**



However, at the present time, we can not see any visible damage in the object not even a difference in colour between both sides.



POLLUTION

# OZONE (O<sub>3</sub>)

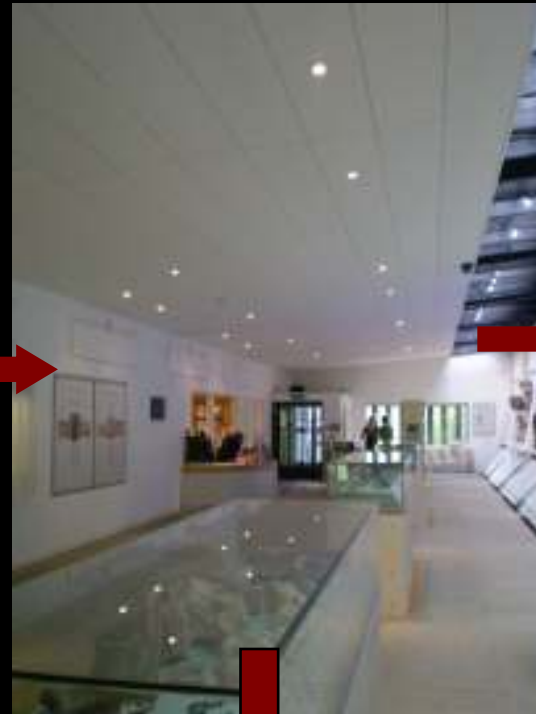


**Outside: 60 ppb**

**Room: 11.45 ppb**

**Perspex Showcase: 6.86 ppb**

# OZONE (O<sub>3</sub>)



Outside: 42.65 ppb

Room: 12.58 ppb

Glass Showcase: 4.92 ppb

# OZONE (O<sub>3</sub>)



“Copper Case”

- 8.01 ppb
- 1.2 day<sup>-1</sup>



“Ivory Case”

- 6.86 ppb
- 2.7 day<sup>-1</sup>

At Battle, no relation could be done between the AER and the better performance of display cases with regards to pollutant ingress.

However, the Perspex cases (Battle) are not as efficient as the glass cases (St. Augustine's Abbey) when providing protection against pollutants ingress.

# Conclusions

- Organic materials at low RH with no damage
- Differences between silica gel compartment and display area
- Light heating causing big RH fluctuations
- Pollution: glass cases seem to prevent the ingress of pollutants better than the Perspex cases
- Relation AER/Pollution
- Old Exhibitions: good control of RH fluctuations
- Recent Exhibitions: not as good as we expected

# Acknowledgements

- David Thickett and Emily Deacon
- EH's Collections Conservation Team
- EH's Staff on sites
- Universidade do Porto
- Prof. Paula Menino-Homem