



# *Care and Use of Geological Collections*

Dr Emma Nicholls  
Deputy Keeper of Natural History  
Horniman Museum and Gardens

✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Outline

- What are geological collections?

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✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Outline

- What are geological collections?
- Care of collections
  - Handling
  - Conservation
    - Preventative Conservation / Collections storage
    - Remedial Conservation
  - Integrated Pest Management
  - ~~Hazards~~ Covered elsewhere by another speaker

## Outline

- What are geological collections?
- Care of collections
  - Handling
  - Conservation
    - Preventative Conservation / Collections storage
    - Remedial Conservation
  - Integrated Pest Management
  - ~~Hazards~~ Covered elsewhere by another speaker
- Use of collections
  - Display
  - Research

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## What are geological collections?




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# What are geological collections?

**Geology**

**Rocks**



**Minerals**




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[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Rocks are made up of various components/minerals


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# What are geological collections?



**Geology**  
**Rocks**



**Minerals**



**Palaeontology**  
**Fossils**



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)


Fossils come in a variety of forms, including body fossils, trace fossils, and even amber



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# What are geological collections?

**Geology**  
**Rocks**





**Earth Sciences**

**Minerals**



**Palaeontology**  
**Fossils**



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Traditionally, all of these have come under the umbrella term Earth Sciences




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# What are geological collections?

**Geology**

**Rocks**





**Minerals**



**Palaeontology**


**Fossils**

~~Earth Sciences~~

↓

**(some) Planetary Sciences**





enicholls@horniman.ac.uk  
@Dr\_EmmaNicholls



However geology also includes many planetary sciences, including those extra-terrestrial bodies that fall to earth as meteorites. So 'earth' is not really an adequate term


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# What are geological collections?

**Geology**  
**Rocks** 

**Minerals** 

**Palaeontology**  
**Fossils**  

~~Earth Sciences~~  
↓  
(some) Planetary Sciences  
↓  
Geosciences 


[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

So now we tend to use 'geosciences', to cover all bases


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# What are geological collections?



**Geology**  
**Rocks**



**Minerals**



**Palaeontology**  
**Fossils**




~~Earth Sciences~~

↓

(some) Planetary Sciences

↓

Geosciences  
&  
Natural Sciences



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

But frequently also fall under Natural Sciences!

## Care of Collections: Handling

**Rocks are not indestructible!!**

✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

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## Care of Collections: Handling

### Rocks are not indestructible!!

- Mechanical damage





[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Mica schist (schist means 'to split') is an example of a rock type that is very fissile, and prone to mechanical damage

## Care of Collections: Handling

### **Rocks are not indestructible!!**



- Mechanical damage
- Environmental fluctuations can cause splitting and cracking

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Care of Collections: Handling

### **Rocks are not indestructible!!**

- Mechanical damage
- Environmental fluctuations can cause splitting and cracking
- Pyrite decay can destroy material, such as fossils

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



## Care of Collections: Handling

Handling rocks, fossils, and minerals



✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



## Care of Collections: Handling

### Handling rocks, fossils, and minerals

- **Gloves- Almost always NOT necessary**



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Although you may want to wear nitrile gloves (or the like) for natural history specimens like taxidermy, it is mostly unnecessary in geological collections and most colleagues I have spoken to over the years actively discourage their use. Whilst gloves protect the human from dirt, residue, etc. they reduce tactility and, as demonstrated by ample anecdotal evidence from collections across the world, can cause breakages. As skin oil can't damage minerals, it's not worth the risk of wearing them to handle geological specimens. However hands should be both clean and lotion free, and you should wash your hands before and after handling rocks and fossils.



## Care of Collections: Handling

### Handling rocks, fossils, and minerals

- **Gloves- Almost always NOT necessary**







 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Obviously there are exceptions, such as if a specimen is hazardous. For specimens exhibiting pyrite decay you should wear PPE. In some cases, such as radioactive rocks and fossils, or asbestiform minerals, full PPE should be worn. More on that in Paolo's talk!



## Care of Collections: Handling

**Handling rocks, fossils, and minerals**

- **Gloves- Almost always NOT necessary**
- **Don't pick things up unless you have to**

[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



Both for your sake and that of the specimen

## Care of Collections: Handling

### Handling rocks, fossils, and minerals

- **Gloves- Almost always NOT necessary**
- **Don't pick things up unless you have to**
- **Don't take specimen away from, or lift high above, work surface**

## Care of Collections: Handling

### Handling rocks, fossils, and minerals

- **Gloves- Almost always NOT necessary**
- **Don't pick things up unless you have to**
- **Don't take specimen away from, or lift high above, work surface**
- **Use plastazote to protect both specimen and work surface**





[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

One sheet is enough, not all these!

## Care of Collections: Handling

### Handling rocks, fossils, and minerals

- **Gloves- Almost always NOT necessary**
- **Don't pick things up unless you have to**
- **Don't take specimen away from, or lift high above, work surface**
- **Use plastazote to protect both specimen and work surface**
- **Keep all labels with specimen/box**

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



Separating labels from the specimens, or mixing them up with other specimens could result in a loss of data and thus a decrease in the scientific value of the specimen



## Care of Collections: Handling

### Handling rocks, fossils, and minerals

- **Gloves- Almost always NOT necessary**
- **Don't pick things up unless you have to**
- **Don't take specimen away from, or lift high above, work surface**
- **Use plastazote to protect both specimen and work surface**
- **Keep all labels with specimen/box**
- **Make sure you put it back in the right place!**

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

It can take curators (or other collections management staff) years to come across a specimen that has been put back in the wrong place.



Another type of manual handling to consider is moving something from one place to another. Manual handling is mostly common sense, geology comes with some obvious risks- rocks can be heavy! There will (or should be!) a risk assessment for your collection. Ensure it is kept up to date.



Aside from the overall risk assessment for your collection, you need to think about everything that you do, before you do it, to ensure safe working for you and those around you. This involves:

**Plan out the task**

- Holding loads away from the body
- Twisting
- Stooping
- Reaching upwards
- Carrying long distances
- Strenuous pulling or pushing
- Unpredictable movement of loads
- Repetitive handling
- Insufficient rest or recovery
- Team handling



# Care of Collections: Handling

## Moving geological collections

### Risk assessment:


- Plan out the task
- Examine the specific load




[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

### Examine the specific load

- Is it heavy?
- Bulky / unwieldy?
- Unstable / unpredictable? Rocks are rarely cubes so have a habit of moving about if not stored properly (if it isn't stored properly, this should be addressed first!)
- Intrinsically harmful (eg sharp)
- Geological hazards (radiation, asbestos, etc. Covered by Paolo's talk)




## Care of Collections: Handling

**Moving geological collections**

**Risk assessment:**

- Plan out the task
- Examine the specific load
- Consider the environment



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

### Consider the environment

- Constraints on posture
- Poor quality of floor (smooth surfaces are better for wheeling trolleys with specimens on)
- Variation in levels (take specimens on a trolley into the lift, don't carry things by hand up stairs)
- Hot, cold, humid conditions
- Strong air movements
- Poor lighting conditions
- Hazardous chemicals



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## Care of Collections: Handling

### Moving geological collections

**Risk assessment:**

- Plan out the task
- Examine the specific load
- Consider the environment
- Think about yourself/others



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

### Think about yourself/others

Physically able to carry out the task

Pregnant

Unable to carry out the task due to health problems

Wearing correct clothing (tie back long hair, take off lanyards or jewellery that can catch, avoid loose clothing)

Movement hindered by PPE

Is special info / training required

Don't be a hero, you can damage yourself for life!!



## Care of Collections: Conservation

Two kinds of conservation:

[✉ enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[🐦 @Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)





## Care of Collections: Conservation

**Two kinds of conservation:**

- Preventative conservation

**To stop things going wrong**

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Care of Collections: Conservation

### Two kinds of conservation:

- Preventative conservation

To stop things going wrong

- Remedial conservation

To fix things when they do go wrong



Preventative conservation comes down to the correct storage of geological and palaeontological material

## Care of Collections: Conservation/Storage

### Preventative conservation / Collections storage

- Temperature and humidity  
< 20°C and *ca.* 40 %RH (depends on your material)



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



The two main things you need to think about re preventing problems are temperature and humidity. Whilst there are guidelines for what these both should be, it is mostly important to maintain a steady environment. Fluctuations in these two things are what will cause you the most problems in the shortest time.

## Care of Collections: Conservation/Storage

### Preventative conservation / Collections storage

- Temperature and humidity  
    < 20°C and *ca.* 40 %RH (depends on your material)
- Acid free tissue and conservation grade boxes- Reduces mechanical damage



 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



Cotton wool and the like are bad news for collections. Conservation grade, or acid free, boxes and tissues should be used instead. Specimens can be nestled in a puff of acid freed tissue to ensure they don't roll around which would risk mechanical damage

## Care of Collections: Conservation/Storage

### Preventative conservation / Collections storage

- Temperature and humidity  
    < 20°C and *ca.* 40 %RH (depends on your material)
- Acid free tissue and conservation grade boxes
- To bag or not to bag



 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

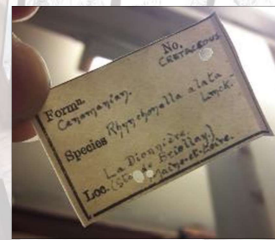
Bags are something you may receive conflicting advice about, but it just comes down to the type of lithologies you have. For the most part, bags are entirely unnecessary and in some cases, it can cause a microenvironment that will actually harm specimens. However, there are the odd occasions where particular material requires a very stable environment and constant monitoring, in which case a sealed bag is necessary... more on pyrite decay shortly. Another exception for bags is where (like the Bennett Collection at the Horniman Museum), you have a lot of small specimens held in close quarters with the potential for loose labels to get mixed up. In this case, you can use bags to keep labels in, with the added benefit of keeping pests (for the most part) out. If you bag specimens for these reasons, make sure you punch the bag with holes to allow air flow.



## Care of Collections: Conservation/Storage

### Preventative conservation / Collections storage

- Temperature and humidity  
    < 20°C and *ca.* 40 %RH (depends on your material)
- Acid free tissue and conservation grade boxes
- To bag or not to bag
- Look out for pest problems (labels)



✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 🐦 @Dr\_EmmaNicholls

IPM (integrated pest management) is occasionally overlooked with regard to geological collections, but they are susceptible too and should be monitored carefully. Although rocks and fossils are not attractive to museum pests, the labels which contain valuable scientific data are. Particular collections at risk are those held in wooden drawers for eg (modern cabinets tend to be metal which greatly reduces the risk of pest outbreak), as they are 'edible'. This damage to a specimen label from an historical infestation of woodworm that left holes in the cabinets, drawers, boxes and labels, could have been minimised with bags. Pests **can** chew through bags, but it is an extra barrier and shown to decrease pest problems. Unless specifically necessary for a microenvironment, bags should always be hole-punched to allow air flow.





Remedial conservation is what we use to fix a problem that has already occurred.



The most common problem you will face re conservation issues in geological collections is pyrite decay, also known as pyrite disease and pyrite oxidation. Pyrite is a naturally occurring mineral that can be stable, such as in fools gold. It is only when it becomes unstable that it causes problems. If you leave it long enough without treatment it can obliterate a specimen, as shown here.

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## Care of Collections: Conservation

**Remedial conservation**

**Signs of pyrite decay:**

- Smell of sulphur



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Signs of pyrite decay...

## Care of Collections: Conservation

### Remedial conservation

#### Signs of pyrite decay:

- Smell of sulphur
- Loss of surface shine



## Care of Collections: Conservation

### Remedial conservation

#### Signs of pyrite decay:

- Smell of sulphur
- Loss of surface shine
- White/yellow powder/fluff



## Care of Collections: Conservation

### Remedial conservation

#### Signs of pyrite decay:

- Smell of sulphur
- Loss of surface shine
- White/yellow powder/fluff
- Acid burns



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Pyrite decay releases sulphuric acid which can burn through paper including specimen labels! Some lithologies are more prone to pyrite decay than others, and so to an extent problems can be predicted. For example the London Clay and the Gault Clay are both susceptible to pyrite decay and should be monitored carefully.



## Care of Collections: Conservation

### Remedial conservation

#### Signs of pyrite decay:

- Smell of sulphur
- Loss of surface shine
- White/yellow powder/fluff
- Acid burns
- Expansion cracks



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Several expansion cracks can be seen in the brown ammonites in this image





## Care of Collections: Conservation

### Remedial conservation



**Volume 11, Issue 1**





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✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Pyrite decay cannot be reversed but it can be halted and the specimen stabilised. There are several great resources out there that you can tap into if needed. In 2019, the Geological Curators' Group released a special issue of their journal *Geological Curator* dedicated to pyrite oxidation. It is Volume 11, Issue 1, and I recommend having a look at some of the papers in there should you be interested. One thing it addresses is how to treat a specimen with pyrite decay, as illustrated by this image in the paper by Anna Fenlon and Lucia Petrera, which shows a micro environment created by heat sealing a plastic enclosure. The long plastic flap is to allow the specimens to be removed (for research, etc) by slicing along the top margin. The specimens can then be re-sealed inside by heat sealing the flap lower down, without the need to replace the entire plastic packaging- saving time and resources.

## Care of Collections: IPM

### What is Integrated Pest Management?

- Monitoring for pests
- Targeted treatment
- Modifying environment

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Care of Collections: IPM

### How to spot pests (inc Nat Hist colls)

- Frass
- Rolled textile
- Bald patches on taxidermy
- Holes in wood
- Skins, esp 'woolly bears'
- Bodies, live or otherwise

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## Care of Collections: IPM

**The most common pests (Nat Hist collections)**

- Clothes moth (*Tinea* and *Tineola*)



Case-bearing clothes moth. © Collections Trust



Webbing clothes moth. © Collections Trust

[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Pests are much more of an issue in natural history collections than geosciences collections...

## Care of Collections: IPM

### The most common pests (Nat Hist collections)

- Clothes moth (*Tinea* and *Tineola*)
- Carpet beetles (*Anthrenus*)



Case-bearing clothes moth. © Collections Trust



Webbing clothes moth. © Collections Trust



Varied carpet beetle. © Collections Trust



Guernsey carpet beetle. © Collections Trust

[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



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## Care of Collections: IPM

**The most common pests (Geo collections)**

- Furniture beetle/woodworm, *Anobium punctatum*
- Common booklouse, *Liposcelis bostrychophila*
- Carpet beetle larvae, *Anthrenus*



Furniture beetle/woodworm.  
© Collections Trust



Common booklouse.  
© Collections Trust



Carpet beetle larvae.  
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[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
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... however geosciences collections are NOT immune (contrary to popular belief!)

- Specimen labels tend to be paper
- Many historical specimen labels are coated in animal glue

- Cabinets and drawers may be wooden
- And although *Anthrenus* is never quoted as an issue in geological collections, I have found them in many!!





## Care of Collections: IPM

### Developing an IPM strategy

1. Inspection; Schedule of regular inspections
2. Preventive Action; Keep them out, deny them an environment
3. Identification; The main species and the damage they cause
4. Analysis; Visual inspection and trapping
5. Treatment Selection; Improve environment, carry out appropriate treatment- freezing, spraying, etc
6. Monitoring; Visual inspection and trapping
7. Documentation; Baselines

Pinniger, D. 2004. *Pest Management in Museums, Archives and Historic Houses*. Archetype Publications. 115pp

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Care of Collections: IPM

### How to monitor pests

- Blunder traps
- Pheromone traps
- Check them on a rota
- Add more traps in problem areas
- Document and check against baselines





[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Care of Collections: IPM

### How to deal with pests

- Freezing Nat Hist specimens:
  - 48 hours at -40 degrees centigrade
  - 72 hours at -30 degrees centigrade
  - 7 days at temperatures above these levels
- Do not freeze geo specimens!! But you may need to freeze drawers, labels, etc
- Double bag and seal carefully. Allow to defrost to room temperature before opening. Remove all traces of pests to make further outbreaks easier to spot
- Constrain
- External companies do a 'deep clean' spray
- Physical barriers; Close the doors, have door brushes, etc

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Guidelines

 [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Use of Collections: Display

Considerations:



✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

## Use of Collections: Display

### Considerations:

- Environment

## Use of Collections: Display

### Considerations:

- Environment
- Mounting (and transport)

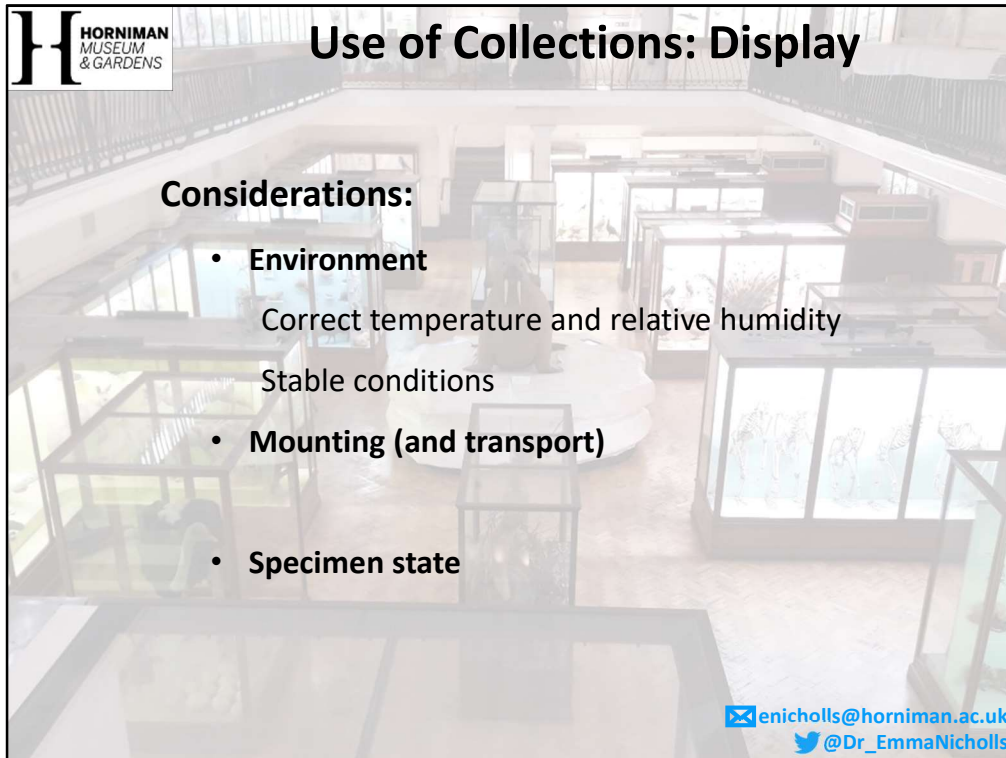
[✉ enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
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## Use of Collections: Display

### Considerations:

- Environment
- Mounting (and transport)
- Specimen state





Environment: We covered the importance of correct temperature and RH earlier, though again, mostly it just needs to be stable environmental conditions.






## Use of Collections: Display

### Mounting

**Considerations:**

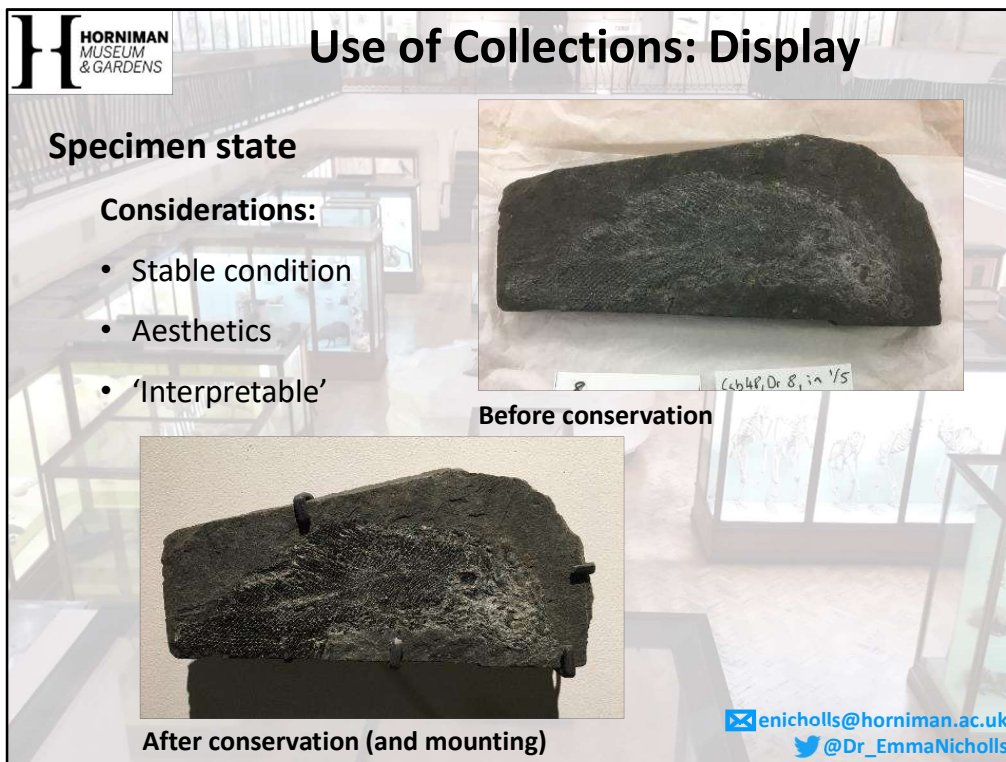
- Secure and stable
- Aesthetics
- Suitable materials
- No mechanical damage



[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

In terms of mounting, you need to consider stability, vibrations, and anything that will cause mechanical damage. I remind you rocks and fossils aren't indestructible! You can see there is padding on the ammonite mount where the specimen touches the metal structure, this is a conservation grade felt that won't damage the ammonite.

Also consider the aesthetics of the mount, these mounts barely obscure the specimens from the front.



A conservator should carry out a condition check of the specimens before they are selected for display to check they are stable enough. The conservator can also give the specimen a spruce to enhance its aesthetics. The fossil fish in these images was treated by the Horniman's Conservator with a thin layer of wax over the scales. A process which

is completely reversible. The other thing you need to consider is how 'interpretable' they are. If it isn't obvious what something is, you need to think about how you're going to help people understand and connect with the specimen through your exhibit panel text.



As custodians of natural or geosciences collections, we have a moral obligation to facilitate their use for furthering science and education.



## Use of Collections: Research

How do researchers access collections?

✉ [enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
🐦 [@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)



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## Use of Collections: Research

### How do researchers access collections?

Documentation / Digitisation

- Online access ('Collections Online')
- Journal papers
- Conference presentations
- Physical access

[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Researchers can access collections in a number of ways; Online access, peer reviewed publications, conference presentations, etc... but it all starts with documentation and digitisation of the collections because if you don't know what you have in your collection, no one else will either.



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## Use of Collections: Research

### How do researchers access collections?

Documentation / Digitisation

- Online access ('Collections Online')
- Journal papers
- Conference presentations
- Physical access

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It isn't just a researcher's career and the wider scientific community that benefits from granting researchers access to collections, the more that is discovered about the rocks, fossil species, or particular specimens in your collection, the richer your collections database. It all starts with documentation, but it circles round and bleeds down again, with the enhanced knowledge and understanding of collections potentially improving every one of these steps each time, ultimately making the collections more valuable.



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• Attract more research

• Enhance public programming

[enicholls@horniman.ac.uk](mailto:enicholls@horniman.ac.uk)  
[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Improving the knowledge and understanding of your collections also has other benefits such as attracting more researchers to your museum/institution, or more internally-enhancing public programming such as exhibitions, etc



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## Use of Collections: Research

- Research requests are shades of grey and that's where the expertise of collections management staff comes in; knowing what to and what not to do (destructive sampling for eg.)
- However researchers also have a responsibility to respect that expertise, and to follow protocols specific to the collection they are visiting.
- The door between researchers and collections management staff (often not mutually exclusive roles) should open both ways every time someone goes through it.



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[@Dr\\_EmmaNicholls](https://twitter.com/Dr_EmmaNicholls)

Not every research request is black and white, there have to be shades of grey and that's where the expertise of curators and other collections management staff comes in.

## Advice Summary

### Ask for help and advice

- Internal colleagues (including cross-discipline staff)
- Colleagues in the museum/geosciences sector

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### Utilise Subject Specialist Networks

- Natural Sciences Collections Association, Geological Curators' Group, Palaeontological Association, etc

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### Access Resources

- Books
- Peer reviewed journals
- NatSCA blog <https://natsca.blog/>
- GCG blog <https://geocollnews.wordpress.com/>

