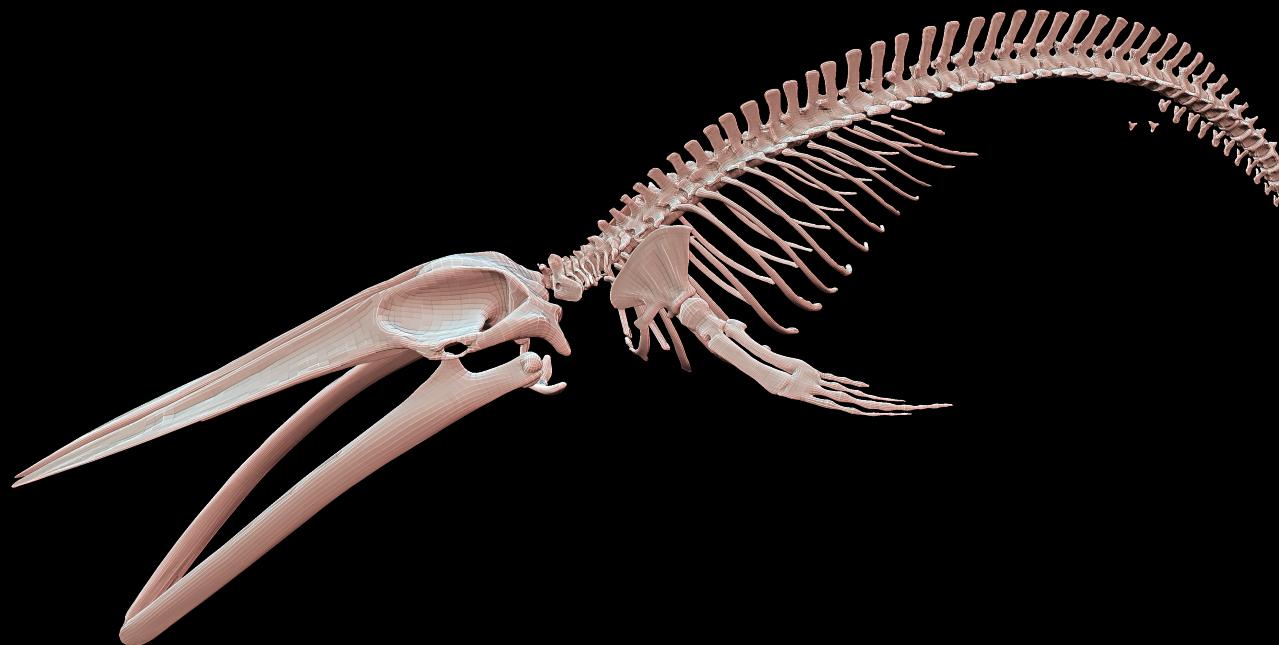


# Multi-scale 3D imaging at the Natural History Museum

Amy Scott-Murray





# Multi-scale 3D Imaging

Our imaging labs are part of the Museum's Core Research facilities

We're open to all NHM staff and students, external academic collaborators and commercial consultancy

# Multi-scale 3D Imaging

Our imaging labs are part of the Museum's Core Research facilities

We're open to all NHM staff and students, external academic collaborators and commercial consultancy

- Electron microscopy
- Light microscopy
- Confocal microscopy
- Micro-CT
- Focal variation microscopy
- Surface scanning
- EDX mapping
- Chemical analysis
- Sample preparation

# Multi-scale 3D Imaging

Our imaging labs are part of the Museum's Core Research facilities

We're open to all NHM staff and students, external academic collaborators and commercial consultancy

- Electron microscopy
- Light microscopy
- Confocal microscopy
- Micro-CT
- Focal variation microscopy
- Surface scanning
- EDX mapping
- Chemical analysis
- Sample preparation

# Multi-scale 3D Imaging

Our imaging labs are part of the Museum's Core Research facilities

We're open to all NHM staff and students, external academic collaborators and commercial consultancy

- Electron microscopy
- Confocal microscopy
- Micro-CT
- Focal variation microscopy
- Laser scanning
- Structured light scanning
- Photogrammetry

# Multi-scale 3D Imaging

## Photogrammetry: Lyme Regis ammonite pavement

Photogrammetry

Structured light  
scanning

Laser scanning

Focal variation  
microscopy

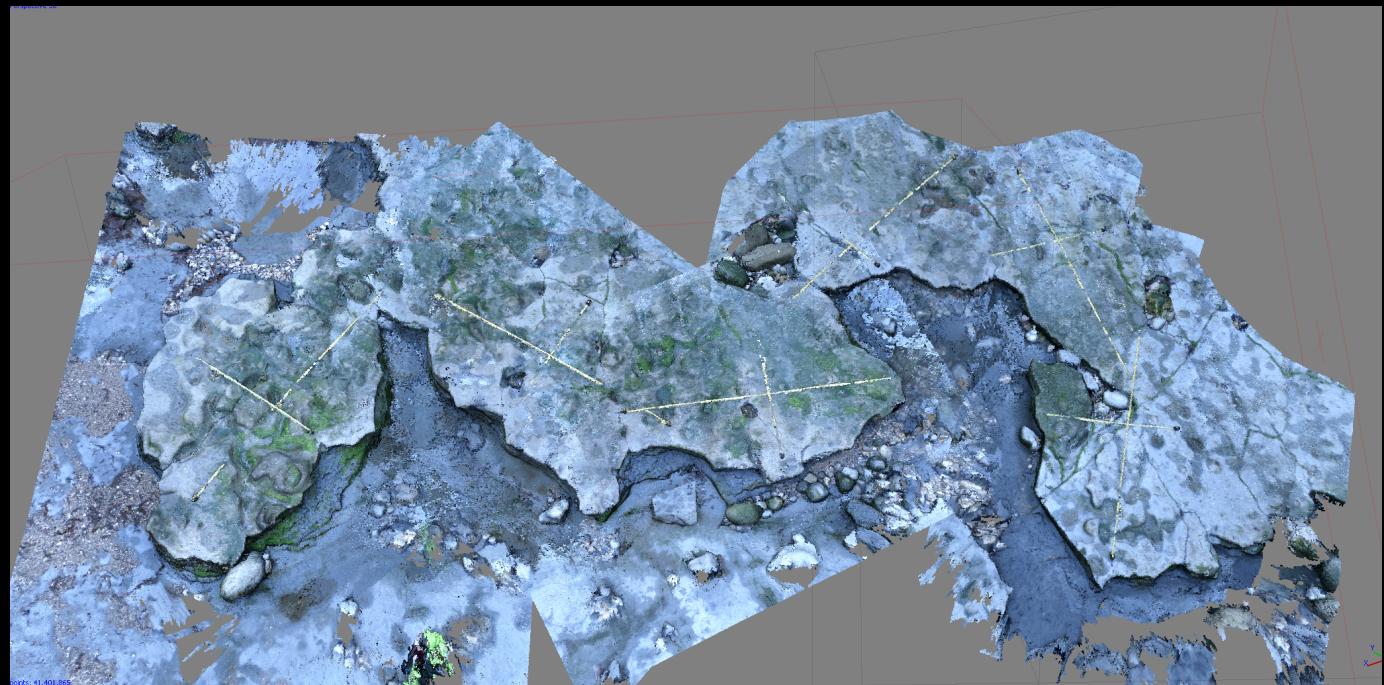
Micro-CT

Confocal  
microscopy

Electron  
microscopy

~40m across, 1600 photos

Year-long time series. Accuracy: ~1cm



# Multi-scale 3D Imaging

## Structured light scanning

Photogrammetry

Structured light  
scanning

Laser scanning

Focal variation  
microscopy

Micro-CT

Confocal  
microscopy

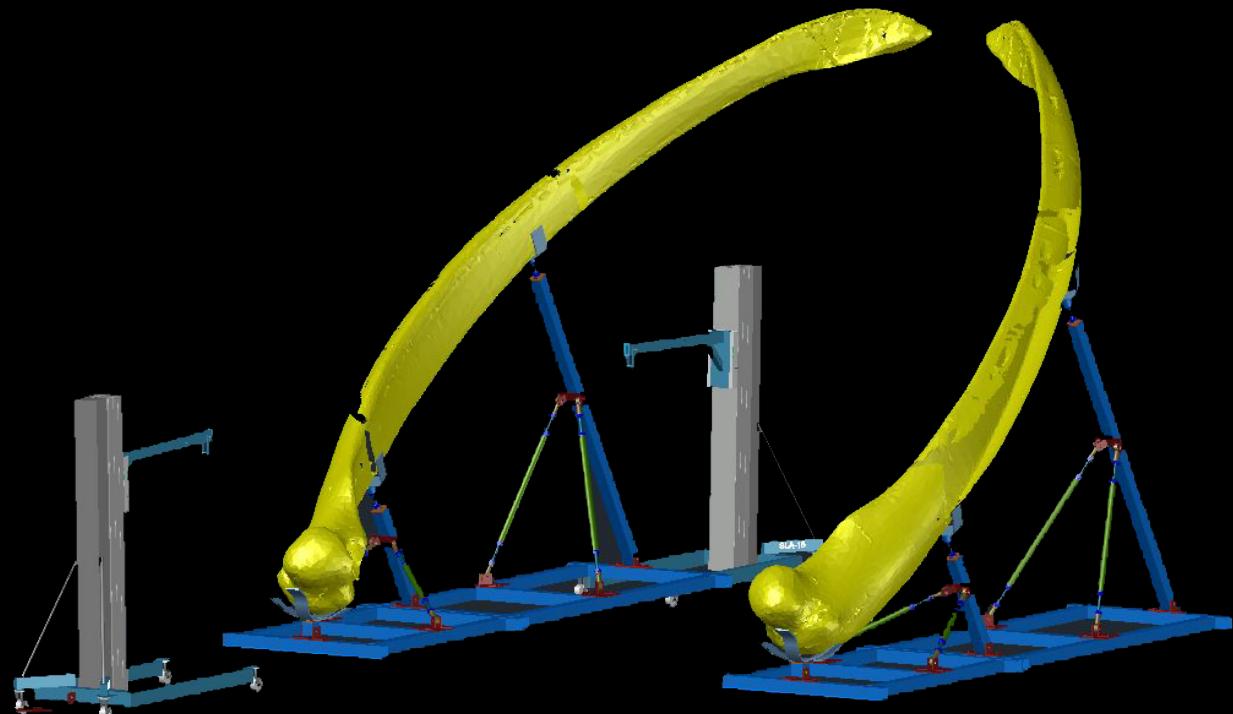
Electron  
microscopy

## Blue whale jawbones

~6m long

Accuracy:

~2mm



# Multi-scale 3D Imaging

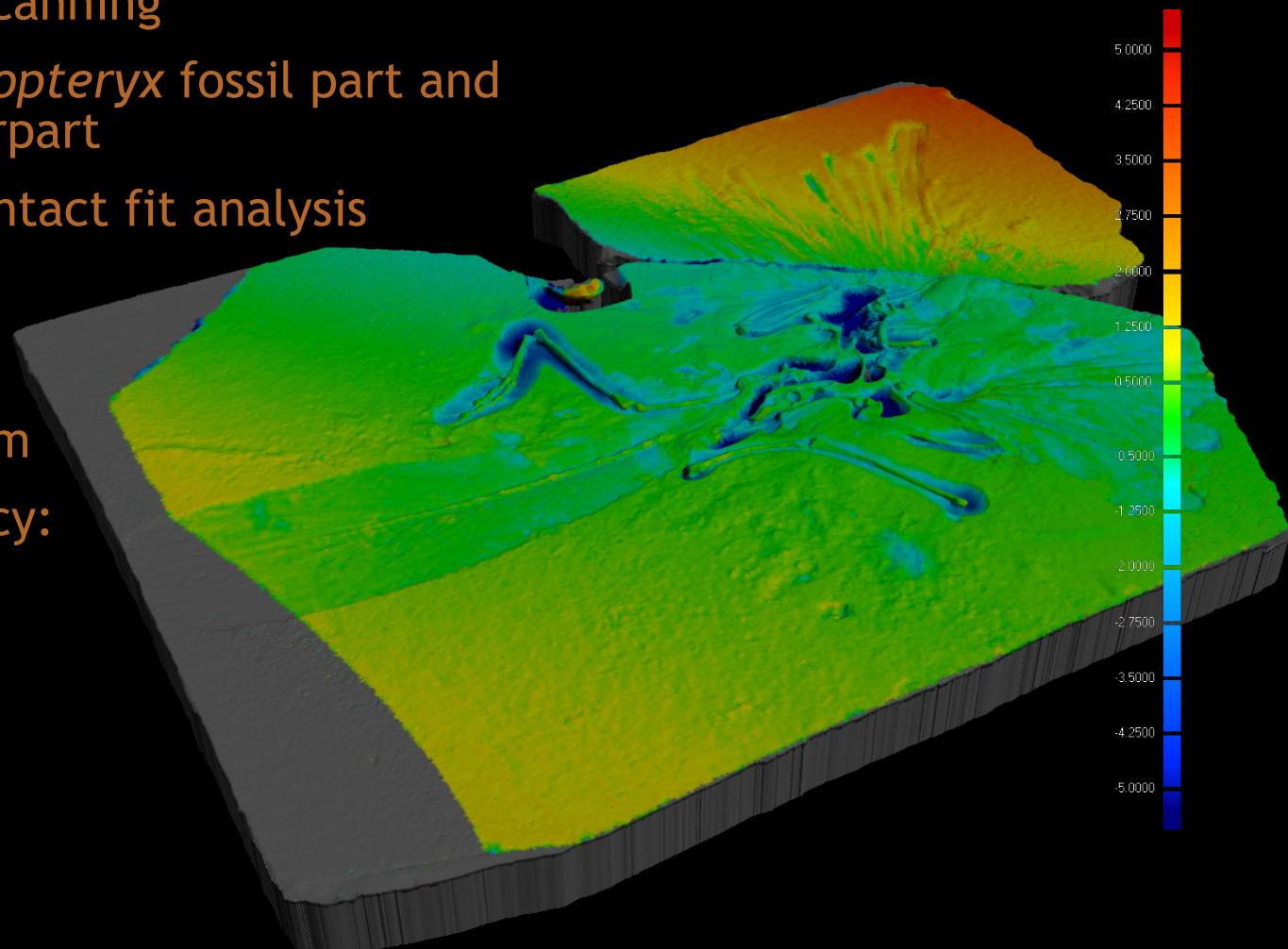
Laser scanning

*Archaeopteryx* fossil part and counterpart

Non-contact fit analysis

40x60cm

Accuracy:  
200  $\mu$ m



Photogrammetry

Structured light scanning

Laser scanning

Focal variation microscopy

Micro-CT

Confocal microscopy

Electron microscopy

# Multi-scale 3D Imaging

Photogrammetry

Structured light  
scanning

Laser scanning

Focal variation  
microscopy

Micro-CT

Confocal  
microscopy

Electron  
microscopy

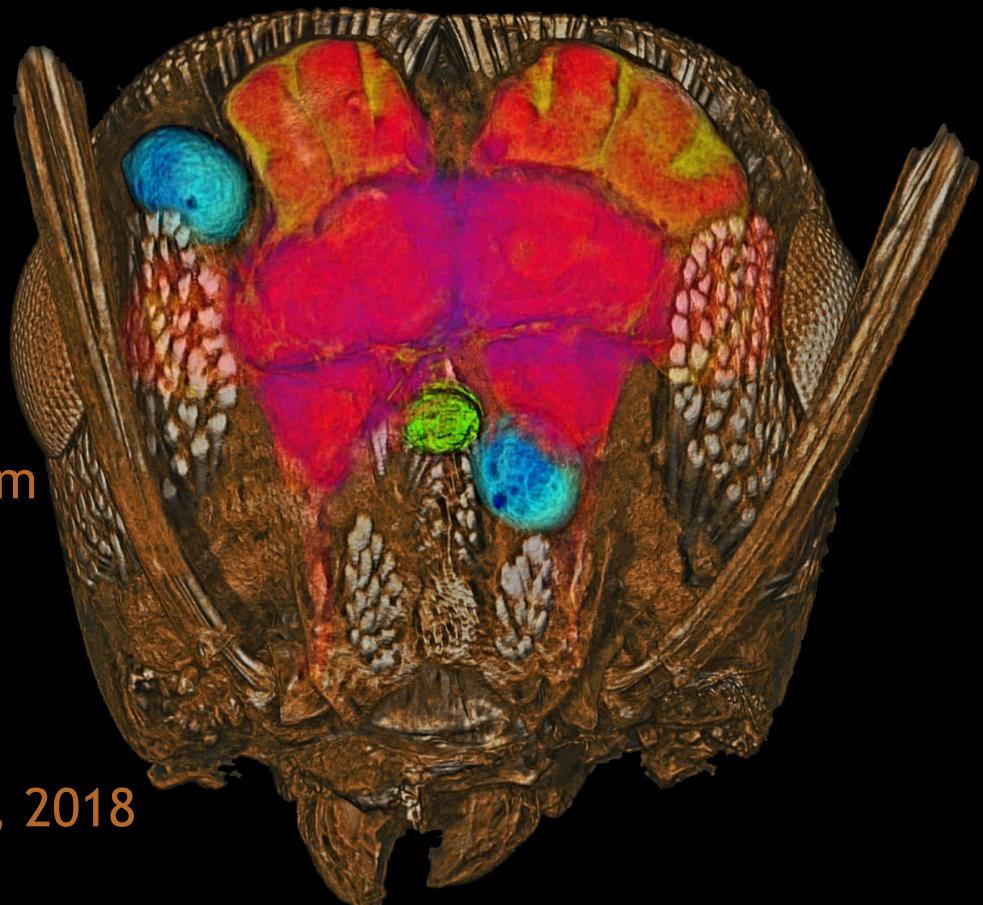
Micro-CT scanning (computed  
tomography)

Ant brain, 2mm across

False colour

Smallest voxel size 40nm

From Martin-Vega et al, 2018



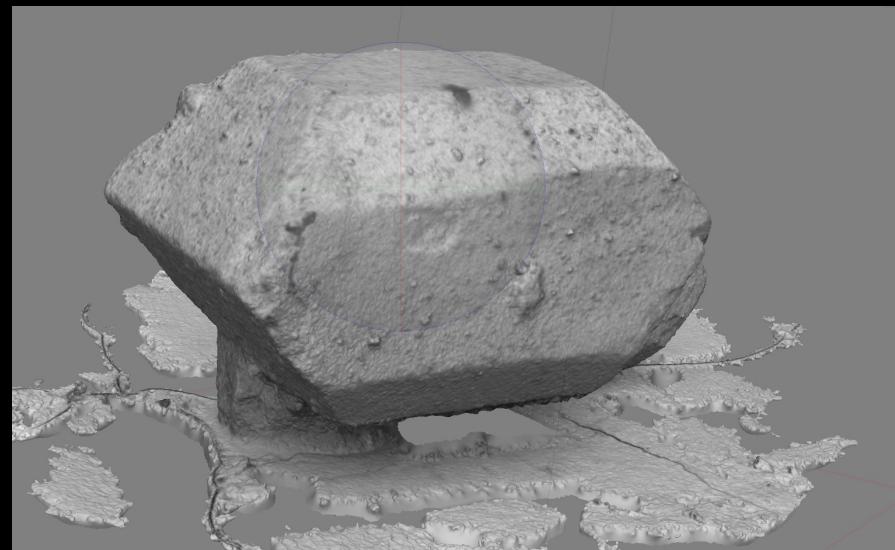
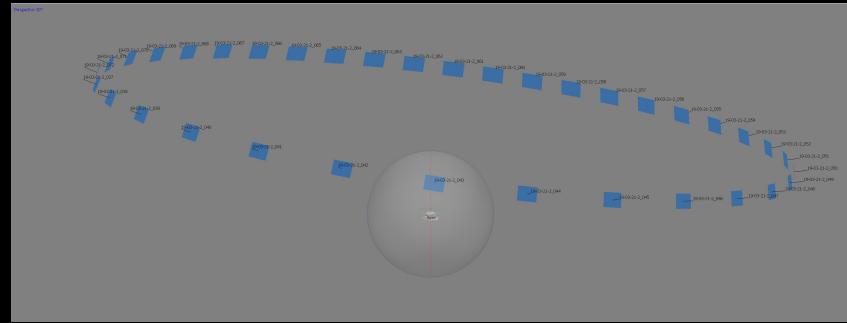
# Multi-scale 3D Imaging

## Electron microscopy

No native 3d, but  
photogrammetry possible

Sugar crystal,  
length approx 2mm

Photogrammetry  
Structured light  
scanning  
Laser scanning  
Focal variation  
microscopy  
Micro-CT  
Confocal  
microscopy  
Electron  
microscopy



# Multi-scale 3D Imaging

## Electron microscopy

Photogrammetry

Structured light  
scanning

Laser scanning

Focal variation  
microscopy

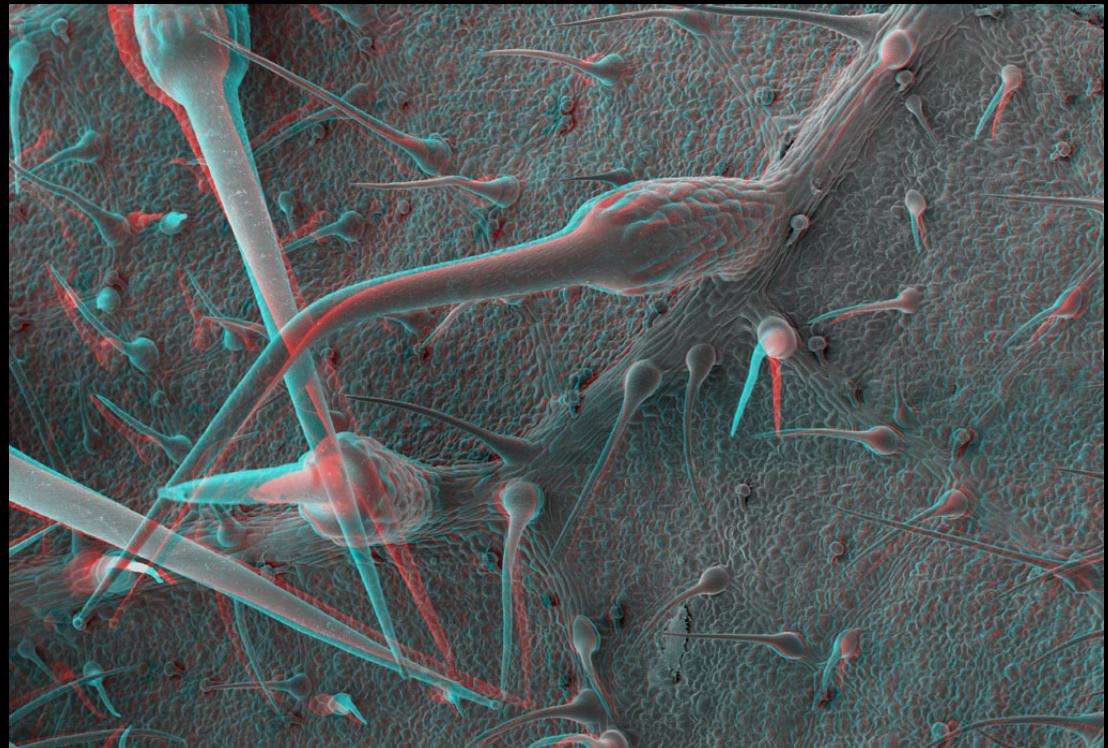
Micro-CT

Confocal  
microscopy

Electron  
microscopy

For the very  
smallest objects,  
use stereo!

Stinging nettle:  
Large hair width  
 $50\mu\text{m}$



# Multi-scale 3D imaging at the Natural History Museum

40 nettle hairs = one ant brain

# Multi-scale 3D imaging at the Natural History Museum

40 nettle hairs = one ant brain

200 ant brains = one *Archaeopteryx* fossil

# Multi-scale 3D imaging at the Natural History Museum

40 nettle hairs = one ant brain

200 ant brains = one *Archaeopteryx* fossil

100 *Archaeopteryx* fossils = one ammonite  
pavement

# Multi-scale 3D imaging at the Natural History Museum

40 nettle hairs = one ant brain

200 ant brains = one *Archaeopteryx* fossil

100 *Archaeopteryx* fossils = one ammonite  
pavement

800 000 nettle hairs = one ammonite pavement!

# Multi-scale 3D imaging at the Natural History Museum

Amy Scott-Murray

[a.scott-murray@nhm.ac.uk](mailto:a.scott-murray@nhm.ac.uk)

[sketchfab.com/NHM\\_imaging](http://sketchfab.com/NHM_imaging)