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Micro-Computed Tomography in a Museum Environment

F Ahmed and D Sykes

The Natural History Museum, Cromwell Road, London, SW7 5BD, United Kingdom

From time to time, new techniques arise and revolutionise the way in which conservators, researchers and curators operate within a museum environment. One such technique introduced to the Natural History Museum (NHM) in London has created phenomenal interest, leading to an exceptionally high demand. The NHM purchased a Micro-computed Tomography (Micro-CT) system in 2008. Originally the purchase was driven by a large-scale human remains project but it soon began to show its capability as a technique in other areas of science. Till date almost 4,000 3D data sets have been collected. This non-destructive, non-invasive and exceptionally informative technique has become a powerful tool in aiding the understanding of museum specimens. This study examines how Micro-CT can contribute to projects in a range of scientific areas by showcasing its versatility as a technique, and explores ways to share such a large source of information-rich, unique data.

Micro-CT, as a technique, has enabled research into important environmental and biodiversity issues, and one such example, at the NHM, is an investigation into the effects of pesticides on bee brain morphology (Figure 1g). This project enabled technique development through staining protocols and provided an in-depth morphological assessment of bee brains. High profile projects such as Tissint (Martian meteorite), whereby Micro-CT was used to investigate voids [1] provides valuable information for the researcher and curator (Figure 2). It also produces readily understandable, visual information that allows the public to easily understand the kind of science carried out in a museum environment (Figure 1). Conversely other projects such as, imaging a Pterosaur skull for conservators, can provide a wealth of information for conservation purposes. In this case, investigating preparation techniques also provided data for researchers exploring evolutionary processes, by studying regions such as the brain case.

The CT suite at the NHM has facilitated over 110 projects in 2012 resulting in an incredible amount of data being produced. Recently, virtual collections have become a much more appealing concept for the museum environment. Micro-CT derived data can aid in producing a library of virtual collections to avoid sending out specimens outside the museum reducing damage or contamination to collections. This type of data can enable researchers to work simultaneously on the same collection at the same time in different location, making collaborations more productive. The data can be shared in various formats; raw data, mesh data, embedded models in pdf documents, numerical data, rendered images or standard 2D projections. The scope to share data in such a way opens new avenues for research and takes data sharing into the future of science.

Micro-CT data has also been carving the way in Taxonomy and providing an additional perspective on traditional 2D histology [2]. Researchers have been able to analyse data using 3D morphometrics and landmarks; to process density information; and obtain quantitative measurements. The combination of quantitative, qualitative and visual results most certainly enables scientists to get a better grasp of the object or specimen in concern. The acquisition of a Micro-CT system at the NHM has allowed researchers, conservators and curators to increase their knowledge in their field of interest. Whether it's creating virtual collections, staining deep-sea fauna for soft tissue investigations, examining dinosaur bones or exploring

voids in Martian meteorites, Micro-CT seems to be able to offer unique insights to everyone in the museum environment.

[1] C. Smith and F. Ahmed. Microtomography of the Tissint Meteorite. MetSoc, 2012, Cairns
[2] S. Faulwetter *et al*., Zoo Keys 263 (2013) p.1-45
[3] The authors would like to thank all the researchers and scientists who carried out CT imaging at the NHM in 2012

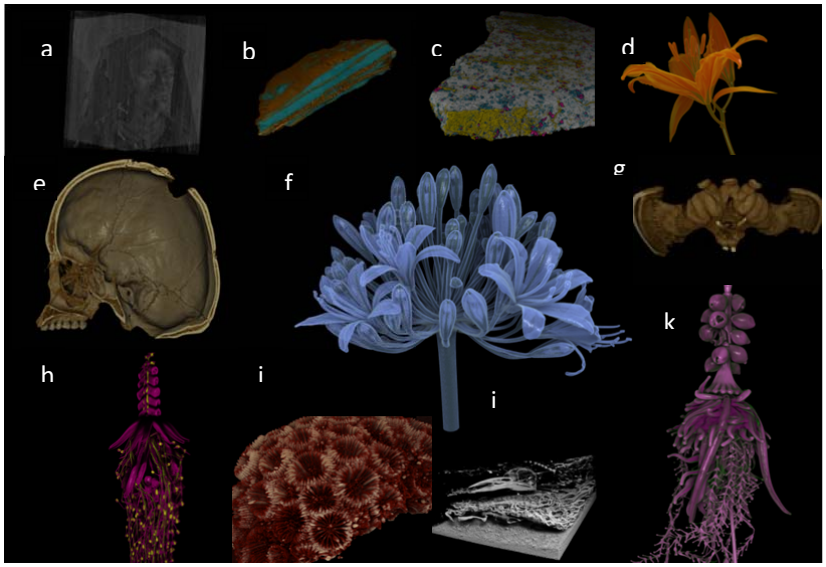

Figure 1. Rendered images showing the range of specimens imaged at the NHM; a) 15th century painting of Catherine of Aragon on a wood panel b) Native copper (South coast of England) c) Meteorite d) Lily flower e) Nubian skull f) Agapantha flower g) Bee brain h) Blaschka glass model of *Physophora Hydrostatica* i) a sample of coral polyps j) Bird skull of an unknown species found in a herbarium book (Sloane's collection) k) Blaschka glass model of *Physophora Myzonema*

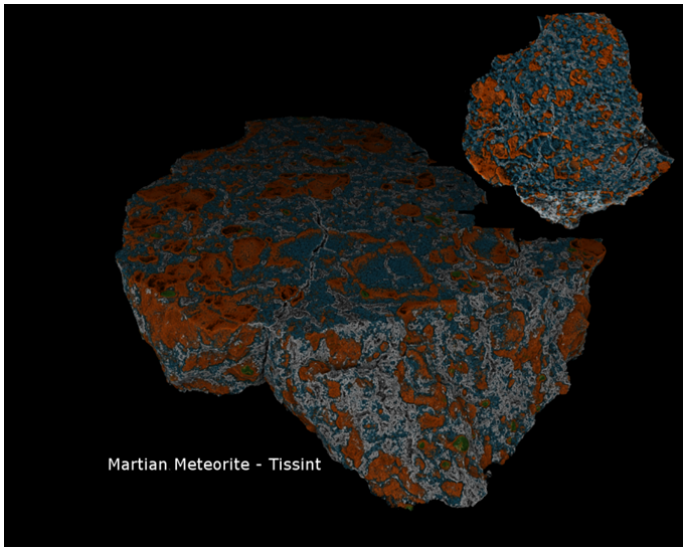

Figure 2. A 3D image of different phases of mineral present in the Martian meteorite Tissint

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