3D X-Ray Microscopy on Cultural Heritage Artifacts

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ABSTRACT

3D X-ray computed tomography (CT) has been recently used in the fields of archaeology and cultural heritage since it is a non-invasive illustration technique, capable of providing a plethora of information about the inner structure of the object under study. Moreover, the method can distinguish internal density variations of the studied object [1,2]. Depending on the material and the dimensions of the object to be analysed, different approaches can be implemented [3].

FUNCTIONS

X-ray micro computed tomography (mCT) can reveal the internal structure of several types of objects by exploiting differences in their Xray absorption. It can provide information about the objects' relative composition and density without extracting any samples or causing any damage; reveal invisible defects, cracks or damage; show if there are any inclusions and if the object is a single piece or made of different parts joined together; and uncover methods of construction and even disclose possible repairs or even additions.

Fig.1: *3D X-Ray microscope (XRM) SKYSCAN 1275, Bruker* (Object size: 96mm diameter, 120mm height) *[7]*

DIFFERENT STRUCTURES AND MATERIALS

- ✓ Wood
- ✓ Ceramics
- ✓ Metals and Alloys
- ✓ Composites

Fig.2*:Roman Cupid statue: a) Overall front, b) 3D rendering of the exterior reveals areas of thin bronze in lower back, extensive porosity and repair, c) Interior of head with filled core bubbles. Note neck join (arrow), possibly due to metallurgical work, d) CT section of upper legs showing variable wall thickness and shape. The square feature at lower right is a repaired chaplet hole. Round features are modern pins [5].*

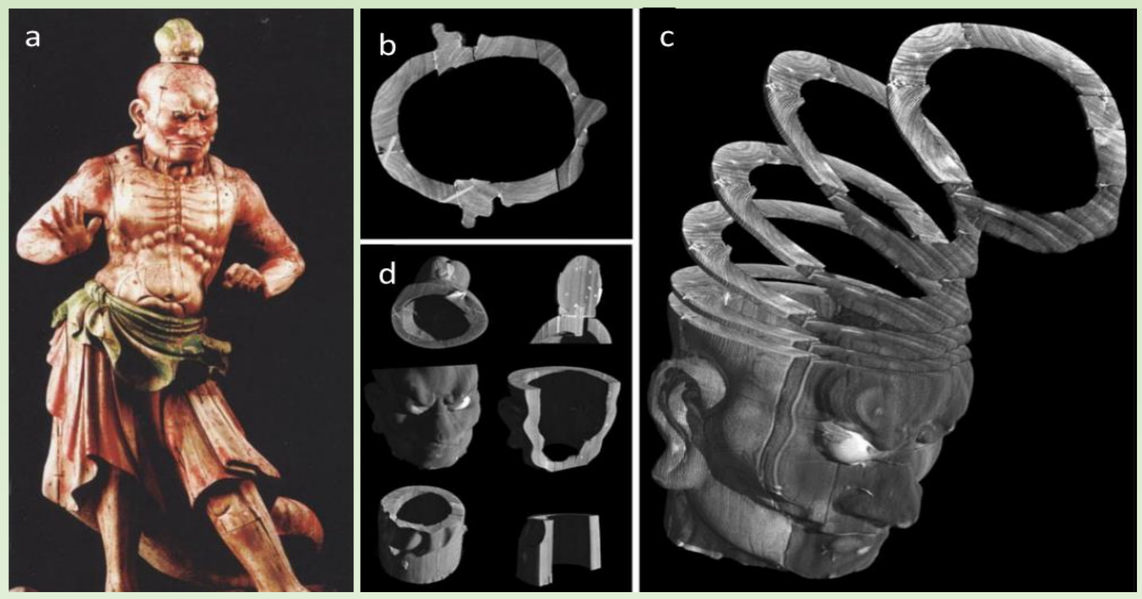

Fig.4*: Japanese statue of Kongo Rikishi: a) Overall view, b) Slice of statue's head showing the presence of bamboo wooden pins, c) 3D tomographic reconstruction of the head with virtual cuts, d) 3D rendering, highlighting the process of volume reconstruction based on the superimposing of many slices [7].*

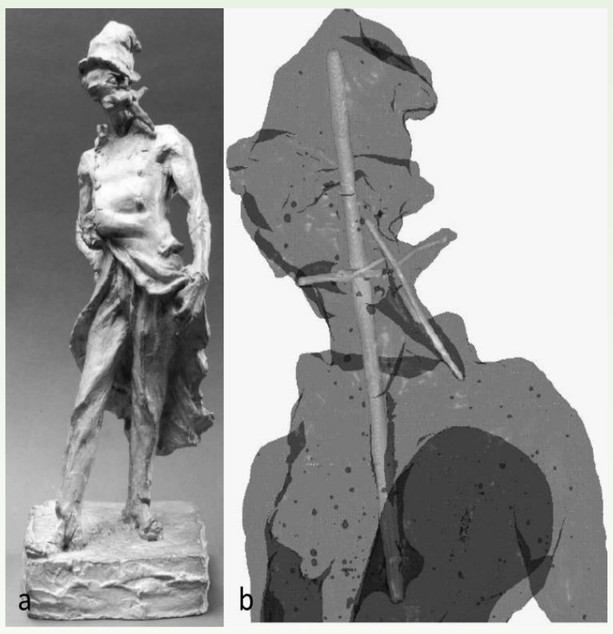

Fig.3: *Honoré Daumier's "Ratapoil", 1851, plaster, in private collection Geneva, height: 44,8 cm: a) Overall view, b) Isosurface image. The plaster surface is half transparent on this image, to make the inner iron armature within the head and torso visible [6].*

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