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3D modeling of Seals and Seal impressions excavated at Kanmer

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1. Objectives

i. Application of digital technology in Archaeology
ii. Digital archives of archaeological artifacts

Digital technology have been widely employed in archaeology.
This presentation aims to discuss about the advantages of using 3D models in the analysis of small artifacts from an excavation. 3D modeling is the process of making a representation of any kind of 3D objects using computer and software.
We tried to scanning the Harappan seals and sealing excavated at Kanmer, Kachchh, Gujarat, India. We report the results of scanning and modeling of small artifacts and discuss about the merits and demerits of utilizing 3D models in Archaeology.

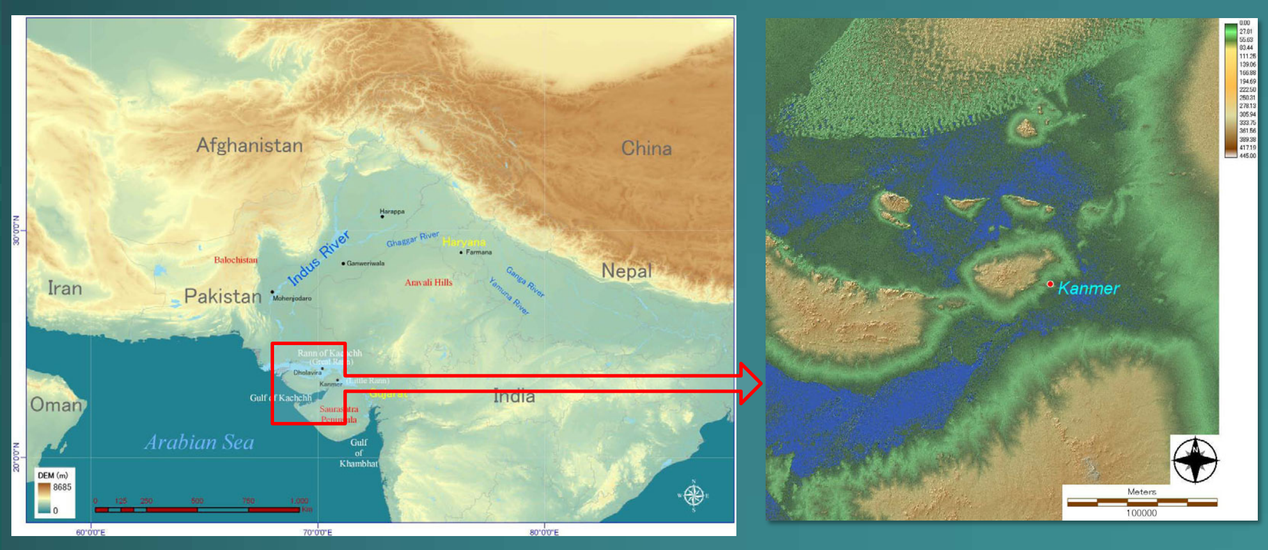


Fig.1 Location of Kanmer site (DEM)

2. Methodology

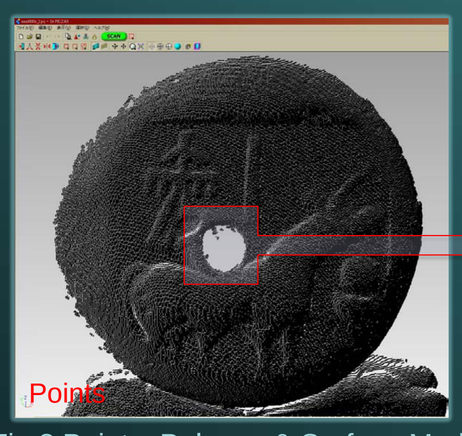
i. Use a “3D Laser Scanner”
Collecting 3 dimensional points data using “3D Laser Scanner”
ii. 「XYZ」Text data → Polygon meshes
iii. Create “3D Models”
“Geomagic Studio” ; Transforms 3D scan data and polygon meshes into accurate 3D digital models.

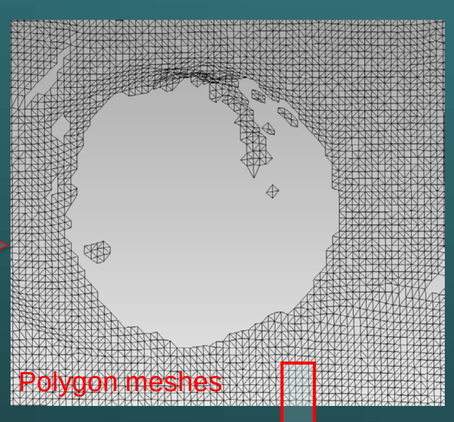
Roland “PICZA” LPX-1200

Scan Pitch (Minimum Interval in scanning) = **0.1mm × 0.1mm**

Setting a seal on turntable
Max Scanning Range (Turntable) :
Diameter “130mm”, Height “205.2mm”

Fig.2 “3D Laser Scanner”





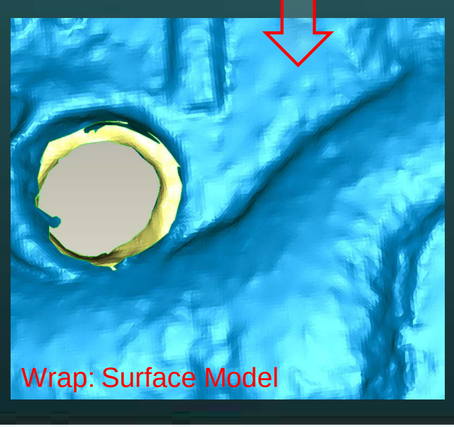


Fig.3 Points, Polygon & Surface Model

3D modeling is a process of developing a mathematical representation of any three-dimensional surface of object via specialized software. The product is called a 3D model. It can be displayed as a two-dimensional image from any direction through a process called 3D rendering or it can be used in a computer simulation of physical phenomena.

3. Results

Fig.4 Indus Seal (impression), from Kanmer

Needless to say, Drawing and Photographs are still important. But.....We have to develop new stages. The resulting digital 3D model, shown in the screen of the laptop, was used by a rapid prototyping machine to create a real resin replica of original object.

Seals
(impression)

Sealing
No. 1054 (Grid: SS30)

Fig.5 3D Models

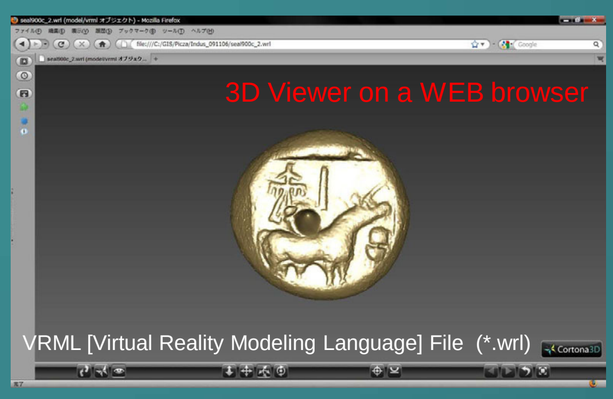


Fig.6 Exporting 3D Models; VRML format

VRML is a text file format where, e.g., vertices and edges for a 3D polygon can be specified along with the surface color, UV mapped textures, shininess, transparency, and so on.
URLs (Uniform Resource Locator) can be associated with graphical components so that a web browser might fetch a webpage or a new VRML file from the Internet when the user clicks on the specific graphical component.

4. Conclusion

i. Beyond Drawing and Photograph
- Various kinds of digital technologies have been applied to recording of results of excavations and surveys in the Indus Project. By means of 3D scanning, we could understand structures and artifacts or site formation more accurately than traditional methodology. These results will promote more detailed studies of Harappan civilization and cultures.

ii. Museum or Exhibition
- Creating a replicas of real objects by means of 3D scanning and 3D modeling.
- Exhibition of real artifacts in showcase: Display from one side of artifacts → 3D models on the computer: We can observe the artifacts from any direction.

iii. Cultural Heritage, Cultural properties
- Digital archive: Digitizing an intangible or tangible cultural properties (such as collections of Archaeology Museum, Art museum and Library etc.)
- We could display any structures and artifacts not only in Museum but also utilize via internet easily.

Our research is still in the primary stage now. This research is a first attempt of 3Dmodeling of Harappan seals and seal impressions. We believe that our research could contribute to progress of the Harappan archaeological studies.
The combined use of 3D scanning and 3D printing technologies allows the replication of real objects without the use of traditional plaster casting techniques, that in many cases can be too invasive for being performed on precious or delicate cultural heritage artifacts.