Chapter IV-1

The Use of Medical Computed Tomography (CT) Imaging in the Study of Ceramic and Clay Archaeological Artifacts from the Ancient Near East

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Keywords: computed tomography, CT, radiographic technique, X-rays, archaeology, ceramics, clay artifacts, URIII period, envelopes, curved planes, non-destructive, ancient near east, Pottery Neolithic, Shaar Hagolan Culture, figurines, ceramic technology

Abstract

Computed Tomography Imaging (CT) is highly regarded as an efficient and relatively inexpensive medical diagnostic tool. It has not, however, come into its own in the study of clay and ceramic archaeological artifacts. Our studies demonstrate, however, that Medical CT is, in fact, a singularly powerful and efficient tool for in-depth radiological studies and analysis of a wide, range of archaeological finds. As the images obtained by the CT scans are digital, we have been able to manipulate them in many ways, thereby revealing new dimensions to non-destructive X-radiological studies of archaeological finds. By adapting various image post-processing techniques, developed for the CT as a medical diagnostic tool to our specific needs, we have been able to reduce research and development costs.

1. Introduction

In this paper we present the results of imaging studies we have conducted in Israel of clay and ceramic archaeological artifacts using Medical X-Ray Computed Tomography (CT).

Medical X-Ray Computed Tomography, commonly known in the medical profession as "CT", is a non-destructive radiographic technique. It is widely used by physicians as a diagnostic tool, as it is superior in many aspects to the imaging produced in a conventional radiograph.

M. Uda et al. (eds.), X-rays for Archaeology, 231–245.
We will describe the techniques we used and demonstrate how we adapted them for use on clay and ceramic archaeological material. Emphasis will be placed on the advantages that these techniques have over other radiological imaging techniques currently in use by archaeologists.

From a wide variety of studies that we have successfully completed, we chose two examples for this paper:

A. We present the results from our testing of UR III period tablets that had been sealed in clay envelopes. We will demonstrate how we used CT imaging, a totally non-destructive research tool, to view and actually read the inscriptions on the inner tablet without tampering with the outer envelope. Furthermore, we will show that the data we collected from these scans allowed us to understand the actual techniques used by the ancient scribes in forming these envelopes.

B. We also present results from our scanning of a figurine from the Pottery Neolithic period (sixth millennium BC) at the Shaar Hagolan site in the Jordan Valley of Israel. This site has revealed the earliest finds and largest collections of figurines formed from clay material in this region of the world. We will show how these scans revealed to us the ceramic technology the craftsmen used in its production.

2. Background

Computed Tomography (CT) is a popular non-destructive radiological technique. It was developed for, and is primarily used as a diagnostic tool in the field of medicine. CT scanners can be found in every modern medical facility in the world. More recently, however, CT was found to be an indispensable tool in other areas, e.g. industry, where complex pieces of machinery and even pipes are scanned.

Computed Tomography (CT) is proving to be a very practical diagnostic tool for archaeological studies:

1. The testing process is fast and non-destructive.
2. The data collected is digital and can be stored for future post-scanning processing.
3. The stored digital images can be printed, in fine detail, on film or paper.
4. A wide variety of post-scanning computer applications have been developed for the medical radiological community. We have succeeded in adapting some of these applications for use in our studies of archaeological material. Not having to develop new computer applications has drastically cut research costs.
5. The availability of CTs in almost every modern community makes it an ideal tool for archaeologists and conservationists. Research projects are invariably delayed by bureaucratic red tape when the shipping of artifacts to distant laboratories for testing requires official permission.

Some archaeologist and museum conservationists have already recognized the potential of CT. Projects have been published demonstrating the use of CT in the study of human and animal bone material (Anderson 1995, Davis 1997), Mummies