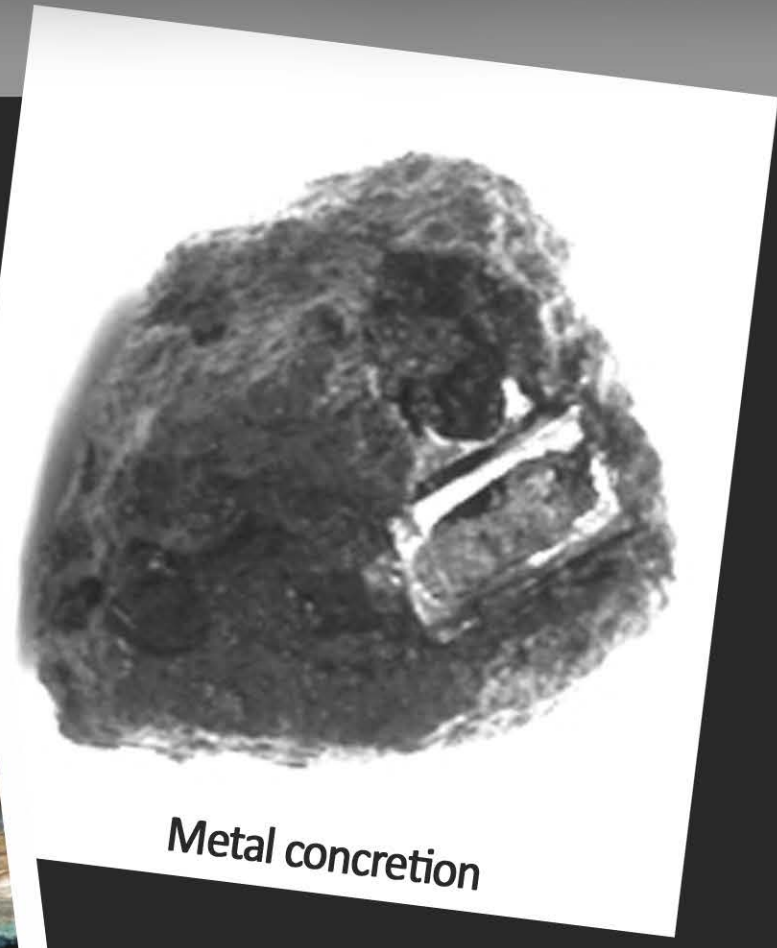


# Micro X-ray Computed Tomography for Identification of a Pseudomorph from the Elizabeth and Mary Shipwreck

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## Introduction

A 17th century British ship, the Elizabeth and Mary, was sent to capture Quebec during the Sir William Philips expedition. The boat sank during its return voyage in 1690 near Baie-Trinité, Quebec, after an unsuccessful journey. Along with the ship, all of the artifacts present onboard sank and were left untouched for centuries until the 1995 excavation. Among the artifacts recovered from the shipwreck was a strange concretion of metal. Due to the inability of archeologists and conservators to identify the concretion, it earned the name of Bizarre or BIZ-object. When X-ray analysis was performed, a small but unidentifiable mechanism was revealed within the concretion. The aim of this research project was to retrieve the identity and function of the artifact through micro X-ray computed tomography.

## Experimental

The BIZ-Object is very small in dimensions (2.5 x 2.4 x 1.8 cm). It can be described as a pseudomorph. All the parts of the mechanism had corroded away leaving voids in a mass of corrosion products.

Micro X-ray tomography was chosen as the main tool for studying the artifact. A total of 1014 x-ray portal images were taken with a XRadia MicroXCT-400 3D X-ray microscope at Queen's University, department of mechanical engineering. A 3 dimensional volume was reconstructed and the results were studied with the Aviso7.0 computer program.

The resulting 3D model proved extremely helpful. The voids within the object were located and measured. Through manual segmentation, each void was color-coded. The shape of each piece was highlighted, and the connections between different pieces of the mechanism were clarified. When all the pieces were identified, a simplified 3D model was built with SketchUp, a basic 3D modeling program.

The resulting images were sent to specialists in different fields for identification. Historians, anthropologists, archivists, craftsmen and engineers were consulted and multiple theories on the subject were explored. By developing a deeper comprehension of the whole system, a new perspective was acquired. The segmentation was taken further, by searching for discrete components that had been overlooked the first time.

After a long period of research, the artifact was finally identified as a lock. Its operation mode was brought to light, and a physical model of a 3:1 scale was build.

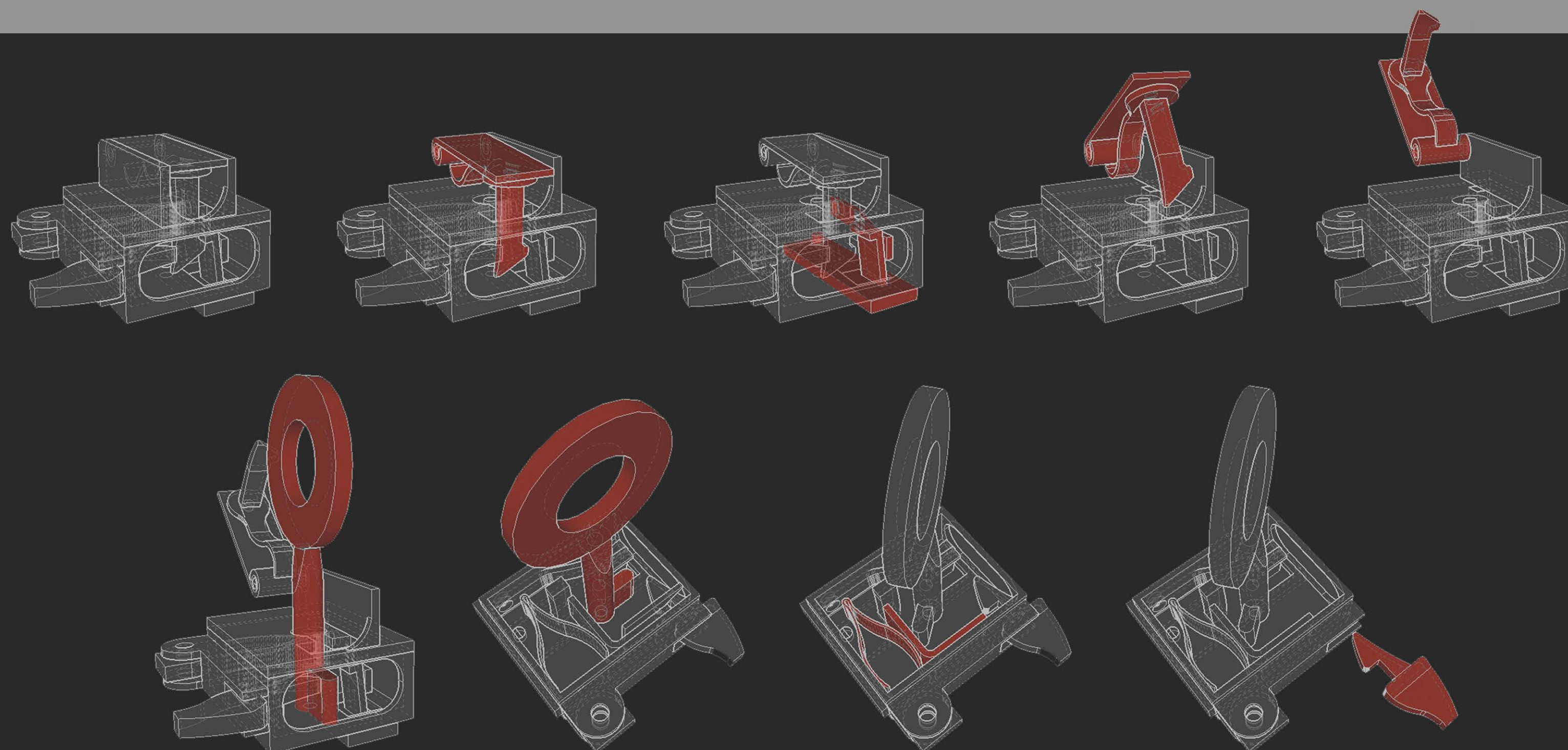


Photographs

X-ray images

Segmentation

3D reconstruction



## Conclusion

The complex pseudomorph from the Elizabeth and Mary shipwreck was studied and identified with micro X-ray computed tomography, a precise, non-destructive imaging technique for the study of complex artifacts. This new method of analysis can be achieved with basic knowledge of specific computer programs. Collaborations with experts on various fields proved to be a tremendous asset to the research.

## Acknowledgements

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