A broader view of the archaeological space

ITRAX™ Core scanner (X-ray microfluorescence, microradiography) and CT-scan (tomography)

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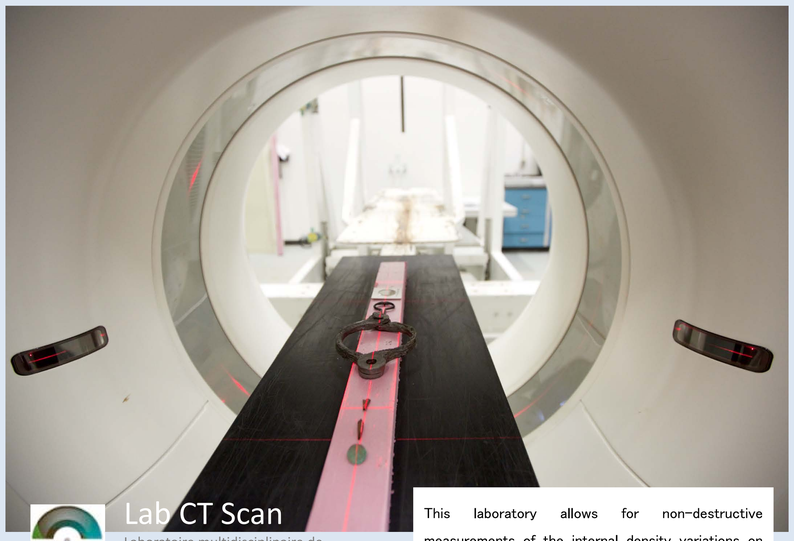
Conclusion

The INRS CT Scan Lab presents numerous and various applications in Archaeology providing high resolution and non-destructive analysis. It allows the study of the chaînes opératoires and chemical and physical characterization of archaeological deposits (sediments) and archaeological collection including bio-anthropology, zooarcheology and dendrochronology elements.

Presentation



Lab CT Scan

Laboratoire multidisciplinaire de tomodensitométrie
Pour les ressources naturelles et le génie civil

This laboratory allows for non-destructive measurements of the internal density variations on static body (internal structure, porosity, etc.) or dynamic phenomena, mainly hydrodynamic (experiment in 4D).

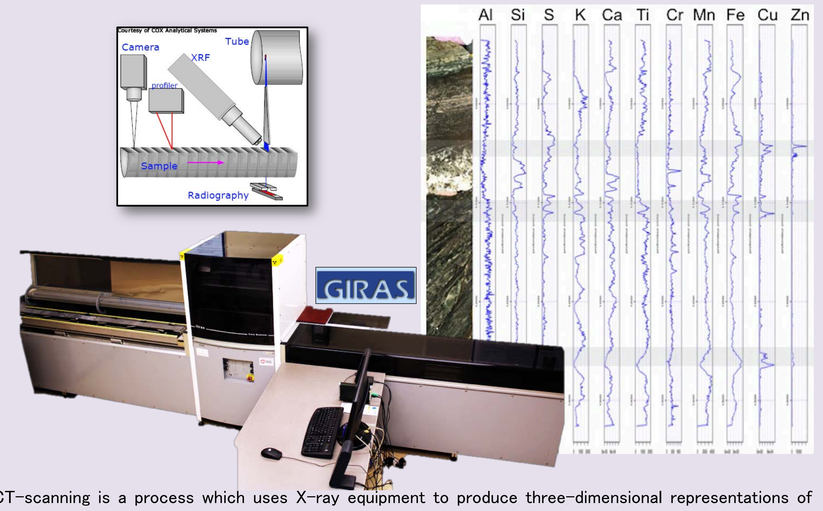
It is the only facility of its kind in a Canadian university.

The issue

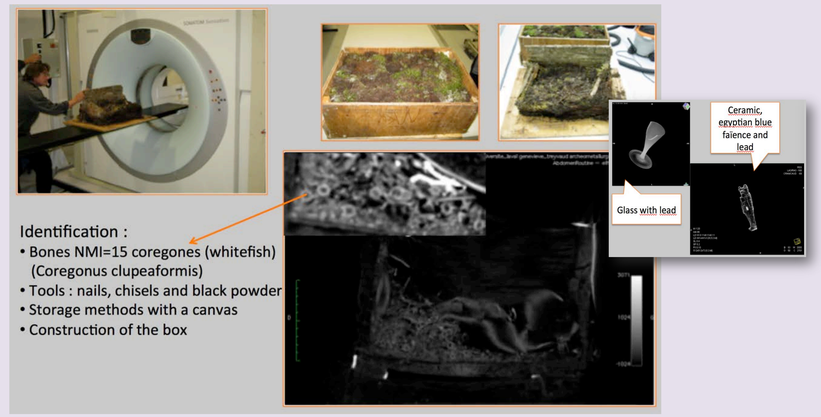
Archaeologist faces multiple pressing questions while being in the field or in laboratory. What is the composition of the different soil layers and what are their laterals extent? What modifications have been made by human occupation? Is it possible to measure, identify and characterize this archeological space in order to evaluate the potential of the archaeological site? What are the materials that make up the archaeological material, how it has been built and what is its preservation status?

Tools to get answers

The **ITRAX™ Core** scanner allows acquiring geochemical data and high-resolution radiographs from sediment without loss or destruction of material to be analysed. This instrument rapidly and continuously conducts the analysis of sediment samples, such as half cores or u-channels, allowing to retrieve geochemical profiles variations and to visualize the presence of archaeological material. The principle of operation is based on the simultaneous acquisition of microdensity (radiography) and microcompositional variations (XRF) using two separate X-ray detection systems. Moreover, colour information and magnetic susceptibility are provided through respectively a high resolution digital line-scanning camera and a magnetic susceptibility sensor incorporated in the system.



CT-scanning is a process which uses X-ray equipment to produce three-dimensional representations of components both externally and internally with a sub millimeter resolution. The characterization of materials with density index is then possible; to know which type of raw material, the sources of raw material, the materials preparation and the comparison between sites of raw materials used. Transverse images and 3D reconstruction can be produced as well as surveys and inventories of samples with core sampling and the stratigraphy and soils definition in relation to human occupation.



Example: Site ElFt-24 lac Arques « **La cache** » Storage and survival box on the Cree historical site

The answers obtained were about the content of the box, how they were placed as well as the manufacturing method for both the container and the objects inside. The final goal is then to produce a visual representation without altering the integrity of the box or its content. This research success has inspired a team of computer engineers to work with this data in the aim of placing this 3D model in virtual reality (VR) environment.

A new project now and for the future

INTROSPECT

The INTROSPECT project is a research collaboration between researchers in computer science and archeology made up of about fifteen people from France (the IRISA and CReAAH laboratories, Inrap and the company Image ET), Université Laval and INRS-ETE. It is supported financially by the French National Research Agency and the Fonds de Recherche Société et Culture du Québec for a period of 3 years.

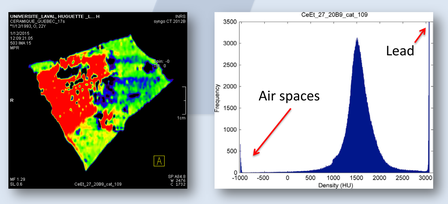
INTROSPECT aims to develop, for archaeologists, new uses and tools that facilitate access to new knowledge through interactive numerical introspection methods that combine computed tomography with 3D visualization technologies, such as Virtual Reality, tangible interactions and 3D printing. The scientific heart of the project is the systematization of the relationship between the artefact, the archaeological context, the digital object and the virtual reconstruction of the archaeological context that represents it and its tangible double resulting from the 3D impression. This axiomatization of its innovative methods makes it possible to enhance our research on our heritage and to make use of accessible digital means of dissemination. This approach breaks with traditional methods and applies to specific archaeological problems: these case studies will be examined in various archaeological contexts on both sides of the Atlantic. Quebec museums are also partners in the project to enhance our work with the general public.

INTROSPECT : Combining the tools and knowledge

Archaeology

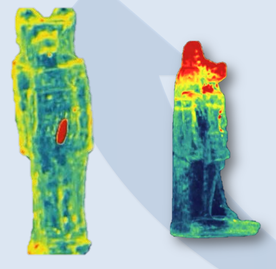
- Characterization of materials

Computed Tomography helps identify the different components and the porosity. Itrax will then give the chemical signature.



Ceramic shard with lead glaze

- Manufacturing methods



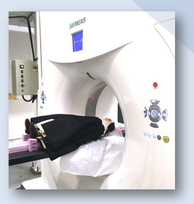
Example : Egyptian *oudja* found at Îlot des Palais, Quebec. Computed Tomography shows the technique used to manufacture these amulets. On the left, we can see in the center a piece of lead to add some weight and on the right, the inequality in the application of the glaze.

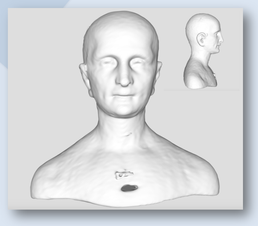
Multidisciplinary and international exchange of data

Technology Engineering

- 3D representation

CT-scan provides 3D images and movies. The details of those information can also be used to reproduce artifacts in 3D printing.





- Virtual reality and augmented reality

The 3D modeling can also be used in a virtual environment and the data of density provided gives a unique opportunity to increase realism.

Participants : ANR, Projet soutenu par le LIA RESO, Fonds de recherche Société et culture Québec, CReAAH UMR 6566 Centre de Recherche en Archéologie, Archéosciences, Histoire, UMR IRISA, Inria informatiques mathématiques, INSA RENNES, cnrs, UNIVERSITÉ LAVAL, UNIVERSITÉ DE RENNES 1, Inrap

Poster design : Marie-Anne Paradis