

On-site Elemental Analysis of Art and Artifacts

Archaeological Site Survey, Identification, and Provenance with the Thermo Scientific NITON® XL3t and XL3p Portable XRF Analyzers – Simply Superior XRF



Introduction

With new advancements in technology, archaeometry – or the collection of quantitative data from archaeological samples – is quickly becoming one of the most trusted methods in archaeological study. Whether the task is reconnaissance survey, site mapping for excavation, restoration, or establishing provenance, quantitative chemical data has come to be the method most often sought out to accomplish these project goals. Performing quantitative analysis of archaeological samples, however, can pose a challenge on many fronts. Traditional laboratory techniques often require the destruction of the sample and always require time, not to mention high per-sample analysis costs. Limited budgets often mean that only a few of the hundreds of fragments discovered on-site are actually tested, with publication and reputation relying on a limited statistical sample. Given these limitations, the ability to obtain quantitative elemental data in the field, in real time, is invaluable to any archaeologist or art historian. Thermo Scientific NITON XL3 600 Series portable XRF (x-ray fluorescence) analyzers are the perfect tools for the job.



Nondestructive Thermo Scientific NITON analyzers safely unlock the elemental secrets of priceless artifacts and works of art.

The Thermo Scientific NITON Solution

As the longtime industry leader in portable XRF analysis, Thermo Fisher Scientific is uniquely capable of providing handheld nondestructive testing solutions for art and artifacts in the field, in the lab, or on the museum wall. Thermo Scientific NITON XL3 600 Series analyzers combine the most powerful (50 kV) miniaturized x-ray tubes ever used in handheld XRF instruments with multiple primary filters for optimal sample excitation, a high-performance thermoelectrically cooled detector, 80MHz real-time digital signal processing, and dual state-of-the-art embedded processors for computation, data storage, and communication. These essential tools have been engineered to take routine laboratory measurements into the field and change the fundamental way in which this field does research. With the ability to identify and quantify virtually any element from magnesium through uranium in any sample, the NITON XL3 600 Series is the only real option for portable archaeometric analysis. NITON XL3 analyzers are the first to integrate into a single, handheld device the analytical capabilities of a laboratory XRF instrument, offering:

- Fast, reliable, repeatable, nondestructive elemental analysis in a fully portable instrument, weighing less than 3 lbs (~1.3 kg)
- Accurate in-situ quantification of light elements (magnesium, aluminum, silicon, phosphorous, and sulfur) in soils and sediments with the optional Helium Purge Light Element Analysis Package
- An optional integrated color CCD camera and sample imaging system to visually identify, locate, specify, and save the image of the analysis area together with elemental analysis results
- A revolutionary small-spot x-ray area that allows users to isolate and analyze individual areas 3mm in diameter, several times smaller than can be isolated with conventional portable XRF analyzers

- Integrated Bluetooth™ and USB communications for direct data file transfer to user's PC or networked storage device, or for connection to a GPS receiver for real-time archaeological site mapping
- Built-in tilting color touch-screen display for easy viewing of results regardless of sample position.

From the Field to the Museum Wall

NITON XL3 600 Series analyzers can be used in the field as reconnaissance survey tools. By performing in-situ soil analysis at a sight of suspected historic human activity, the user can identify areas such as buried architectural features, hearth areas and fire pits, burial grounds and much more based on trend analysis of the elemental composition of the soil.¹ Pairing a systematic sampling grid with a Bluetooth-equipped GPS device makes the reconnaissance survey and mapping process faster and easier than ever with direct storage of latitude, longitude and elevation along with the reading results. The NITON XL3 telescoping Extend-a-Pole™ dramatically improves ergonomics and makes it possible to test the ground without ever bending down.

The NITON XL3 analyzer identifies components of pigments in paintings and glazes, thereby assisting conservators in the preservation and restoration of artifacts, as well as aiding in establishing provenance. By identifying elements without removing the paintings from the frame, or even the wall, curators are reassured that their pieces can be examined safely, without the potential for physical damage. NITON XL3 600 Series analyzers can also be used to measure metal alloy content to identify objects such as jewelry, silverware and weaponry, and establish provenance based on the elements and their concentrations. Authenticating pieces helps prevent counterfeits and fraud, and helps assure that a returned artifact is the same one that a museum loaned.

Who Uses NITON Analyzers?

NITON XL3 analyzers have been specifically engineered to provide superior archaeometric data, building upon previous generations of NITON analyzers already in use for archaeometric measurement.

The Hearst Castle in California houses the Nine Muses Sarcophagus, a 3rd Century sculptural masterpiece. Thermo Scientific NITON XRF analyzers were called in for the task of nondestructive analysis of the paints and pigments found on the sarcophagus surface. The entirety of the sarcophagus was at one time covered in copper colored paint, and remnants of it can still be found in place. As part of the restoration work undertaken



Revolutionize your reconnaissance survey methods – real-time results, GPS mapping, and chemical data to guide excavation.

by California Polytechnic University in San Luis Obispo, compositional analysis was performed on the various pigments in order to precisely match them for restoration.

The Smithsonian uses a NITON analyzer to analyze artifacts being repatriated to Native American Tribes in compliance with NAGPRA legislation.² Measuring the residual quantities of lead, arsenic and mercury (used to preserve artifacts) allows suitable precautions to be taken while handling them and appropriate clean-up to be performed before the items are repatriated.

The Bureau of Land Management and the Utah Geological Survey have evaluated the use of NITON XRF analyzers for dating petroglyphs. Dr. Farrel Lytle's work seems to indicate that by measuring the ratios of manganese and iron deposited by bacteria, it is possible to determine the age of a petroglyph.

Summary

Thermo Scientific NITON XL3 600 Series analyzers are the most advanced portable XRF instruments ever offered for art conservation and archaeometric analysis. Whatever the task, NITON analyzers provide quick, easy, nondestructive analysis of samples in either the lab or the field. Whether your project involves identification, restoration or dating, put the power of research in your hand with NITON XL3 analyzers, the ideal tools for in-situ chemical analysis of art and artifacts.

References

1. Dhaliwal, Muninder and Brackett, Claudia. The Use of X-ray Fluorescence (XRF) Technology to Aide Archaeological Investigations to Locate Evidence of Human Occupancy of Prehistoric Sites in Arizona. Stanislaus State University, CA. 2006.
2. Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001 et seq. [Nov. 16, 1990] (Final Regulations, 43 CFR 10 as amended and published in the Code of Federal Regulations October 1, 2003)

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AN44024_E0407B