

## Mobile Analytical Solutions for Art Conservation and Archaeometry



- **Museum:** *an organization which collects, researches, interprets, preserves and displays natural objects & artifacts of artistic, cultural, or historical significance*

Scientists who discover, investigate and preserve our cultural heritage have a unique balance of creativity and scientific discipline along with a passionate regard for the samples they work with. They identify materials and fabrication, study contextual evidence, investigate degradation mechanisms, develop and assess treatments and innovate analytical techniques.



**Shanghai Museum**

Bruker has long been at the forefront of providing advanced analytical instrumentation for art conservation, archaeometry and research. Bruker instruments are used by skilled and knowledgeable scientists in leading museums, institutes and universities around the world to determine the material aspects of priceless and complex samples.

## Bruker Laboratory Technologies for Cultural Heritage Objects and Artifacts

### Elemental Analyzers

- Wavelength dispersive X-ray fluorescence (WD-XRF)
- Energy dispersive X-ray fluorescence (ED-XRF)
- Micro-X-ray fluorescence ( $\mu$ -XRF)

### Compound Analyzers

- X-ray diffraction (XRD)
- Raman spectroscopy
- Fourier transform infra-red spectroscopy (FT-IR)
- Matrix-assisted laser desorption/ionization mass spectrometry (MALDI-MS)
- Liquid chromatography-mass spectrometry (LC-MS)



**Krakow Museum**

- **Conservation scientist:** *an individual who applies analytical techniques for material, chemical, and technical aspects of cultural objects for preservation and restoration*



- **Archaeological scientist:** *an individual who applies analytical techniques for material aspects of objects and their surroundings to determine trade routes, cultural or commerce exchange, and manufacturing processes*



**Taiwan National Palace Museum**

Bruker provides portable non-destructive and non-contact spectroscopy solutions. These elemental and compound analyzers are taken to local museums and private collections, not just to large metropolitan ones. Archaeologists frequently take them to remote locations where they supplement previous knowledge of the site. Conservators and archaeologists research and assess the nature of constituent materials and subsequently applied materials with these powerful, but portable analytical tools.

Bruker's portable spectroscopy solutions are unique in their flexibility to investigate not only homogenous samples, but also complex, heterogeneous and non-uniform samples. They help identify, compare and quantify elements and compounds of sample materials in the context of their environment. This provides immediate information for dynamic scientific insight into the objects, artifacts and their surroundings.

- **Bruker:** *an organization manufacturing analytical instruments driven by scientists with the idea to always provide the best technological solution for each analytical task*

## Measure Elements and Compounds

- Qualitative & comparative
- Semi- and fully quantitative
- Elemental distribution maps

## Analyze Diverse Materials

- Architecture & furniture
- Adornments & sculpture
- Textiles, objects & tools
- Illustrations & manuscripts
- Base & preparation materials
- Pigments & coatings
- Binders, varnishes & preservatives

## Meet Multiple Project Objectives

- Research & interpret
- Determine original materials
- Authenticate origin or context
- Guide conservation & restoration



**Acropolis Museum**

- **Handheld XRF Elemental Analyzer:** The most agile XRF analyzer from Bruker simultaneously measures elements from sodium (Na) to uranium (U) at concentrations as low as parts-per-million to high percentage levels (depending on the element). Objects of any form – liquid, solid, powder, film – can be analyzed wherever they are located.

Bruker's two handheld XRF spectrometers, the TRACER 5™ and the S1 TITAN™, are for qualitative and semi-quantitative elemental analysis. They also perform quantitative analysis when utilizing calibrations with like-sample standard reference materials such as copper-based ancient alloys.



**TRACER 5™ XRF investigating a cassone**

*Image courtesy of Yale institute for the Preservation of Cultural Heritage*

The TRACER 5™ and Bruker's S1 TITAN™ incorporate a Rh X-ray tube with high performance SDD detector; 5-filter wheel; and SharpBeam™ geometry for high performance, speed and sensitivity. They also have touchscreen operation, an internal camera, wireless communication, battery or AC operation and are desktop, tripod and extend-a-pole compatible. Each is lightweight and is supplied with a water tight transport case.



**TRACER 5™  
Handheld  
XRF analyzer  
Na (11) to U (92)**

Bruker's TRACER 5™ provides scientists the greatest handheld optimization capability

- Control of all measurement conditions
- Air, helium or vacuum paths
- User configurable, custom filter slot
- Manually selectable sample spot size
- Comprehensive PC data analysis software
- Full qualitative and quantitative capability

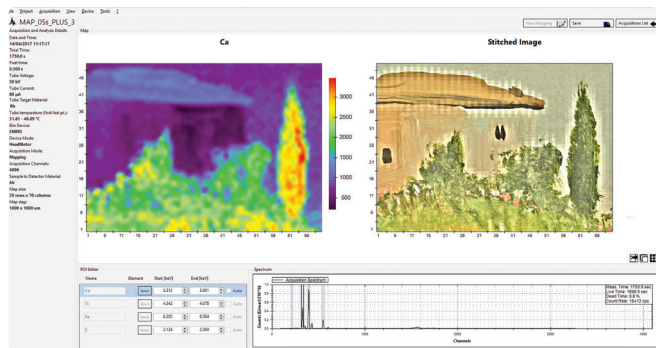


**S1 TITAN™ Handheld  
XRF analyzer  
Mg (12) to U (92)**

- **Portable 2D XRF Elemental Analyzer:** Portable XRF analyzer with programmable large area X-Y scanning stage measures elements from sodium (Na) to uranium (U) at concentrations as low as parts-per-million to high percentage levels on sample spots as small as 1mm. Visual maps of a sample's elemental distribution can be generated.

Bruker's non-contact, open-beam portable 2D XRF ELIO™ spectrometer has a 4W X-ray tube, silicon drift detector, CUBE™ preamplifier, microscope and external video camera, as well as alignment lasers. ELIO spot size is down to 1mm for great detail definition in a portable instrument. With the addition of its light and compact X-Y stage, the ELIO becomes a truly portable mapping system. The ELIO mapping system comes with an easy-to-use software interface for acquisition and visualization of the elemental maps.

The live PC-controlled software display is user configurable to show sample image, spot area, spectra, elemental concentration and other technical information as needed to perform scientific research of a given sample.



**ELIO™ XRF elemental distribution map of a painting and spectra of one spot on the painting**

**XRAMAN™** is a fully integrated XRF and Raman system for simultaneous elemental and compound analysis.



**CRONO™** is a mobile, configurable XRF scanner designed for in-situ, very fast and non-invasive elemental mapping.

The XRF components are fully integrated into a compact detection head (3 kg).

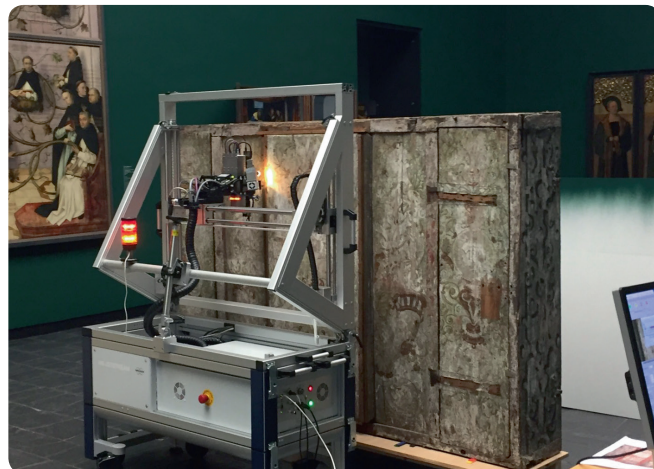
The detection head is mounted on a motorized large area stage that allows for up to 60 cm x 45 cm area scanning (XY).



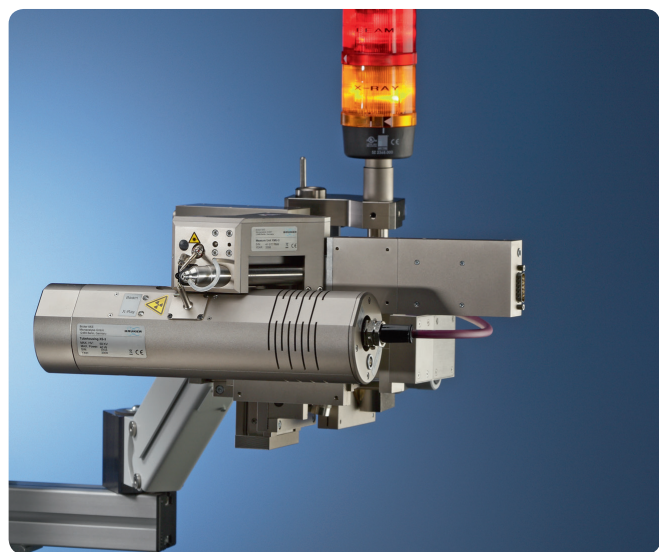
**CRONO™ XRF large area scanner Na (11) to U (92)**

- **Mobile 2D/3D Micro XRF Elemental Analyzers:**  $\mu$ -XRF analyzers with a motor-driven X-Y-Z positioning stage measure elements from sodium (Na) to uranium (U) at concentrations as low as ppm to high percentage levels on sample spots as small as 70  $\mu$ m. Advanced software enables the addition of visual maps of a sample's elemental distribution.

Bruker's non-contact mobile  $\mu$ -XRF large area M6 JETSTREAM™ enables scanning areas of 600 mm x 800 mm with a variable spot size from 100 to 500  $\mu$ m with polycapillary optics. Scan speeds are up to 100 mm/s with an acceleration of 200 mm/s<sup>2</sup>. This spectrometer incorporates a specially designed,  $\mu$ -focus X-ray tube with polycapillary optics producing primary X-radiation and a 30 mm<sup>2</sup> or 60 mm<sup>2</sup> detector. Helium purge along with use in vertical or horizontal positions provide optimization for any given analysis needs.



**M6 JETSTREAM™  $\mu$ -XRF analyzer**  
at Stadel Museum Frankfurt

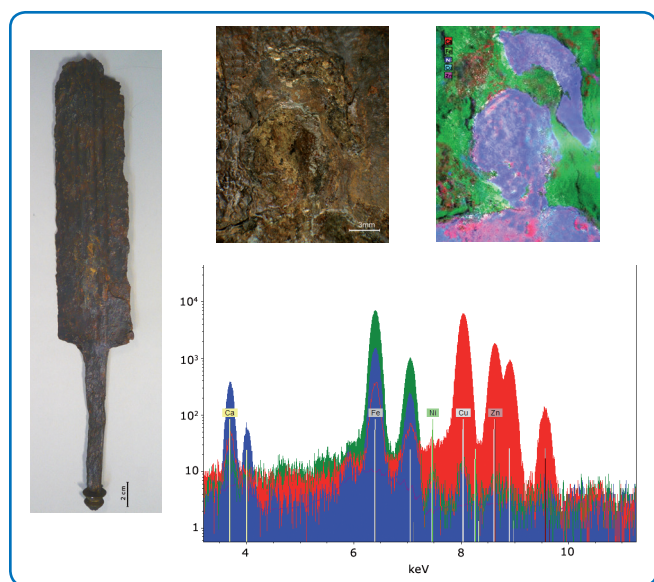


**ARTAX™ Mobile  $\mu$ -XRF Analyzer for Na (11) to U (92)**

Although not mobile, Bruker's dual-tube  $\mu$ -XRF M4 TORNADO™ is a powerful and flexible laboratory tool for composition and elemental distribution analysis of virtually any kind of inorganic, organic, solid or liquid sample. Along with a large TurboSpeed X-Y-Z stage for 2D analysis, its Spectra Evaluation, HyperMap, M-Quant and new XMethod software modules provide scientists with comprehensive measurement control and data analysis capabilities.

#### Mobile, Non-Contact $\mu$ -XRF ARTAX™

- Mobile vibration damped tripod set-up
- Incorporates specially designed,  $\mu$ -focus X-ray tube with polycapillary optics
- Sample spots as small as 70 $\mu$ m
- Outstandingly high intensity and reproducibility of better than  $\pm 10\mu$ m
- CCD camera, laser spot and helium flush for precision and optimization



**M4 TORNADO™  $\mu$ -XRF analyzer**  
elemental distribution analysis of inlaid work  
close to the handle of a Roman sword

- **Portable Raman and FT-IR Compound Analyzers:** *On-the-go Raman and FT-IR analyzers from Bruker. Raman analyzers identify minerals from which pigments are derived while FT-IR analyzers identify varnishes used. These powerful tools help determine best courses of action without having to transport valuable and/or large samples.*

Bruker's handheld Raman BRAVO™ analyzer determines molecular content of inorganic and organic compounds. It incorporates spectral databases to identify unknown materials including the most common pigments, fillers, binders and waxes available. It allows scientists to build, validate and manage spectral libraries. The BRAVO™ fulfills demands of post data evaluation with advanced spectroscopy software.



**BRAVO™ Handheld Raman analyzer**

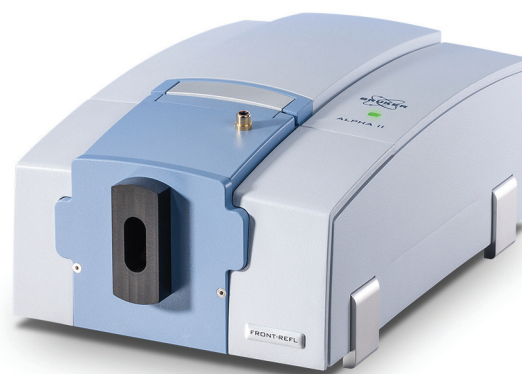


**BRAVO™ Raman analyzer**  
investigating a fresco

Bruker's portable FT-IR ALPHA II™ analyzer non-destructively identifies molecular structures and components to help determine optimum cleaning methods and solvents. It incorporates spectral databases of available varnishes, fibers and solvents to help guide restoration treatments. The ALPHA II™ includes a dedicated art object analysis module with an integrated video camera to pinpoint the desired measurement area.



**ALPHA II™ FT-IR analyzer**  
investigating a mural painting by Francesco Albani in Bologna, Italy



**ALPHA II™ Portable FT-IR analyzer**



## Mobile Scientific Solutions for Art Conservation and Archaeometry

Non-destructive Handheld, Portable & Mobile Elemental and Compound Analyzers



**Handheld XRF Elemental Analyzers:** *TRACER 5™ and S1 TITAN™ are the most agile XRF analyzers from Bruker Handheld XRF that simultaneously measure elements from sodium (Na) to uranium (U) at concentrations as low as parts-per-million to high percentage levels. These analyzers can be used on samples of any form (liquid, solid, powder, film) and analyzed at any location.*



**Portable 2D XRF Elemental Analyzer:** *ELIO™ portable XRF analyzer from Bruker Nano Analytics with programmable X-Y large area stage simultaneously measures elements from sodium (Na) to uranium (U) at concentrations as low as parts-per-million to high percentage levels. Visual maps of a sample's elemental distribution can be generated.*



**Mobile 2D/3D Micro XRF Elemental Analyzer:** *M6 JETSTREAM™ μ-XRF and CRONO™ from Bruker Nano Analytics with motor-driven X-Y-Z positioning stage simultaneously measures elements from sodium (Na) to uranium (U) at concentrations as low as ppm to high percentage levels. Variable spot sizes from 100-500 μm with speeds up to 100 mm/s (M6) and from 500 μm - 2 mm with speeds up to 40 mm/s (CRONO) provide elemental distribution maps.*



**Handheld Raman Compound Analyzer:** *BRAVO™ is the most nimble Raman spectroscopy analyzer from Bruker Optics. This handheld determines molecular content of inorganic and organic compounds with spectral databases identifying unknown materials including the most common pigments, fillers, binders and waxes available.*



**Portable FT-IR Compound Analyzer:** *ALPHA II™ is an on-the-go FT-IR analyzer from Bruker Optics. It identifies molecular structures and components to help determine optimum cleaning methods and solvents with spectral databases of available varnishes, fibers and solvent which help guide restoration treatments without transporting valuable samples.*

### • Contact Us

[www.bruker.com/art-conservation](http://www.bruker.com/art-conservation)

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