

SPECTRAL EVOLUTION

Analysis of Artifacts

For many conservation and restoration departments, as well as research departments in museums, art galleries, and universities, reflectance spectroscopy provides the best method for analyzing valuable artwork and historical artifacts, including paintings, manuscripts, glass objects, tapestries, frescos, archeological finds, ethnographic objects, and so on. With this scientific approach, cultural heritage researchers and art historians can learn more about the history of a piece of art or an artifact. For example, with paintings, reflectance spectroscopy can be used to characterize, differentiate, and map painting materials, especially pigments. In addition, artwork can be analyzed for authenticity, determining whether the artwork is real or a forgery, based on pigments and other materials the artist used. Museums can use reflectance spectroscopy to study the effects of light on displayed objects and the effect it may have on colors used in the artifact. In the field, reflectance spectroscopy can be used at archeological sites to determine where building materials originated.

In paintings, analyzing pigments can provide critical insight into the artwork. Paints have three basic components: pigment for color, a binder that sticks the paint to the substrate when it dries, and a vehicle to make the paint fluid during the act of painting. In typical analyses of paintings and other artwork, samples are required. Even micro samples, while done carefully, are still essentially destructive to the artwork. The development of non-invasive techniques, such as reflectance spectroscopy, is essential to analyze and preserve artwork.

Using a SPECTRAL EVOLUTION PSR-3500 or SR-3500 spectroradiometer with a Getac PS336 rugged handheld computer or a laptop computer, and a bi-furcated dark field reflectance fiber probe or fiber optics and a light source, a researcher can perform non-invasive analysis without the limitations and problems associated with sampling. In addition, because the PSR-3500 and SR-3500 weigh less than 8 lbs and are portable, analysis can be done at the lab or in the field without removing the artwork from its location in a museum, gallery, or in the case of an archeological find, at the dig site.

Analysis is accomplished with three array detector configuration covering the entire spectrum of UV/VIS/NIR:

- 512 element Si array – 350-1000nm
- 256 InGaAs array – 970-1900nm
- 256 InGaAs array – 1900-2500nm

Using a SPECTRAL EVOLUTION spectroradiometer, a wide range of pigments can be analyzed, non-destructively, in a short amount of time. Once the spectra are captured using the spectroradiometer's DARWin Data Acquisition software, they can be analyzed with a chemometrics software package – the data is saved in ASCII files for immediate use – no pre-processing is required.



Three basic components of paint: substrate, pigment, and binder.



NIR spectroscopy can be used to distinguish between an authentic artwork and a forgery.

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Typical Applications:

- ◆ Aging and environmental studies of paper substrates in historical documents
- ◆ Analytical characterization and dating of parchment
- ◆ Analysis of disc stability and sound recordings
- ◆ Polymer degradation studies in POP art and modern art
- ◆ Analysis of degradation in dauguerreotypes and photographs
- ◆ Analysis of storage conditions including VOC emissions, climate control/heat/cold
- ◆ Analysis of water and fire damage
- ◆ Color measurement and the effect of exhibit lighting on color in artifacts
- ◆ Ink analysis of documents
- ◆ Dating and authentication studies including accurate artifact sourcing using spectral measurement of clays and soils
- ◆ Conservation materials and methods, including cleaning methods
- ◆ Archeological site investigation and preservation
- ◆ Analysis of materials to determine origination

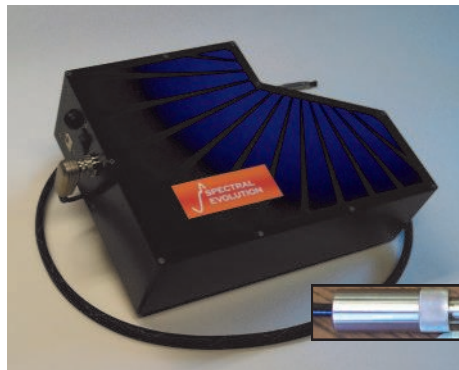
Reflectance spectra from white pigment lab samples can be recorded and used as a reference library for pigment identification to determine the authenticity of an older painting. By measuring for lead white, zinc white, and titanium white a researcher can determine if any re-touching or painting was done since approximately 1930/1940, as it will contain titanium white.

In a field application, a PSR-3500 with a Li-ion battery, could be used to determine where rocks used in a temple or pyramid were originally quarried. The instrument could also be used to identify the clay used in bowls, parts, figures, or pipes at an archeological dig.

The PSR-3500 and SR-3500 used in these applications feature:

- ◆ Spectral range of 350 – 2500nm
- ◆ Spectral resolution is 3.5nm (350-100nm); 3.8nm @ 1500nm; 2.5nm @ 2100nm
- ◆ USB and Wireless Bluetooth communications
- ◆ Getac PS236 PDA tags voice notes, pictures, and GPS information to spectra
- ◆ DARWIN SP Data Acquisition software
- ◆ Bi-furcated dark field reflectance fiber probe
- ◆ Contact probe with pistol grip and internal light source
- ◆ 5 watt tungsten halogen source – AC/DC or optional battery pack operation
- ◆ 1.2 meter metal clad fiber optic cable
- ◆ 2x2 inch 99% reflectance standard with custom case
- ◆ TENBA shootout mini backpack
- ◆ Rechargeable Li-ion battery and charger

In addition to the SM-3500 and other portable spectrometers, SPECTRAL EVOLUTION also offers a full range of portable spectroradiometers and lab spectrometers and spectrophotometers. For more information, visit: www.spectralevolution.com.



SR-3500 spectroradiometer and fiber optic probe for non-contact analysis



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