ARCHAEOLAB SECYR: studies of Archaeological Heritage

Description

The SECYR (**Service for the Conservation, Restoration and Scientific Studies of Archaeological Heritage)** is a laboratory focused on the research of archaeological materials for the characterization of artefacts, the knowledge of decay patterns and the evaluation of the best conservation practices for the future. Due to its long experience in the field, since its foundation in 2006, and the availability and applicability of a set of instrumental techniques, it offers a solid facility able to carry out scientific analysis on the most diverse archaeological pieces. Thus, it helps solving the questions related to technology, conservation and restoration.

This laboratory is composed of an examination device, a **structure light 3D scanning system** to create digitalized 360° 3D models of artefacts, which are a valuable tool to perform exhaustive inspections of surfaces, alteration structures and technological marks; and three analytical techniques: **X-ray fluorescence, laser induced breakdown spectroscopy** and **μ-Raman spectroscopy**, used to identify the chemical composition of inorganic samples. In addition, the expertise of the laboratory team on conservation-restoration of archaeological materials guarantees the proper handling of complex heterogeneous pieces and the correct interpretation of the analytical data.

Fields of application

Cultural heritage
Archaeology, Art, Architecture, Industrial and Scientific Heritage.

Materials

inorganic
pigments, metals, ceramic, mural paintings, glass, stone, bone, ivory.

Equipment

The equipment and tools of the ARCHAEOLAB SECYR are related to two categories: examination and chemical analysis, always with the perspective of the technological knowledge and the subsequent conservation-restoration of the archaeological objects.

Examination device:

- 3D Structured Light Scanner Pro S3 of HP (DAVID SLS-3). A portable scanner based on the detection of patterns beamed out by a LED projector. It captures the physical dimensions of the objects -every

corner, edge, alteration and detail- creating a digitized 360° 3D model with up to 0.05 mm resolution, thanks to the tripod, the HD cameras, the rotating base on which the objects are placed and the 3D Scan Software – Professional Edition v5. This equipment allows an initial examination with a high-quality graphic record, the identification of the topographic and technological characteristics of the objects and the precise location of the alteration products derived from their pathologies, which afterwards must be characterized with the specific analytical techniques.

Analytical equipment:

- X-ray fluorescence (XRF) offers information about the elemental composition of the surface of the artefact or sample (qualitative and in the case of specific chemical elements, such as Cu, Pb and Zn, semi quantitative) in a non-invasive way. The portable equipment consists of an x-ray tube ECLIPSE III of AMPTEK, with Ag anode and W cathode, that operates in the range 4-30 KeV and reaches a maximum current of 100 μA; laser positioners (635 nm) to focus the x-ray beam on the sample; a Si-PIN detector and preamplifier XR-100 CR with an energy resolution of 200 FWHM and a digital pulse processor PX4, both of AMPTEK.
- Laser Induced Breakdown Spectroscopy (LIBS) is a μ-destructive technique that, through the detection of the atomic emission of a laser ablated micro-sample from the surface of the pieces, provides the elemental composition of the surface of the pieces, and it is also capable of performing micro-stratigraphical composition studies. The SECYR system is composed by a Q-switched Nd: YAG laser, operating at 532 nm with pulses of 7ns; glass lenses to focus the laser beam and to collect the emission signals and a Czerny-Turner spectrograph (diffraction grating 1200 lines/mm) coupled to an ICCD camera.
- RAMAN Spectroscopy detects a wide variety of mineral phases (optional some organic compounds) through recognition of molecular species, without previous sample preparation. The employed equipment is portable and energy autonomous. It is a i-Raman Pro 785S from BWTEK with and excitation laser of λ=785 nm (red laser), an optical fiber probe whose spot is of 5 mm in diameter and a spectrometer BWS475-785S with a spectral range between 65 and 3350 cm^{-1} and a resolution under 4.5 cm^{-1}. A video microscope BAC151B with LED illumination and different lens (x20, x50 y x80) is included to perform μ-Raman analyses with a spot diameter of tens or hundreds of microns.

Potential Results

The SECYR laboratory is optimum for the diagnosis of the state of conservation of archaeological materials. The combination of techniques allows to identify and map the alteration compounds (corrosion products, oxidation/alteration patinas, deposited sediments, etc.) and to assess the structural state of pieces through the location and evaluation of defects, heterogeneities, fractures, cracks, etc. Consequently, the correct interpretation of obtained data helps in choosing the proper restoration-conservation treatments, as well as their evaluation and validation. Besides, the study yields information about the technological characteristics/features of artefacts or samples: the composition of metallic alloys, the determination of metallurgical methods employed in the manufacture, the identification of palette of pigments applied on different archaeological substrates, etc.

In addition, SECYR has implemented and maintained a quality management system that according to the certification of IQNE and AENOR fulfils the requirements of the standard ISO 9001:2015, with the following scope: *"the design, development, realization of restoration works belonging to the archaeological patrimony and characterization tests through microscopy and X-ray fluorescence techniques, Laser Induced Breakdown Spectroscopy (LIBS)"*

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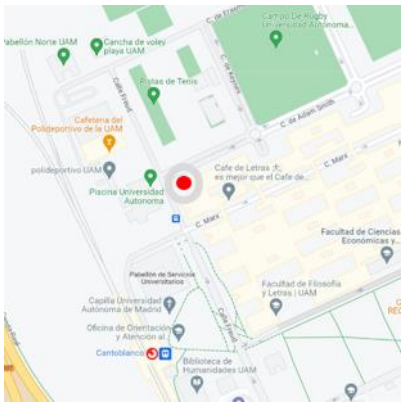
Sample or service requisites

- Minimum amount of sample required for analytical techniques.

Provider



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