STSM Abstract

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Title: Documenting the light sensitivity of Levantine rock art paintings in Cova Remigia, Castellon (Spain)

The National Museum in Krakow (NMK) is interested in continuing its research on the photosensitivity of colored systems found not only in cultural heritage (CH) objects, but also in CH sites. For this reason, a scientific mission was proposed in collaboration with the Universidad Politécnica de Valencia and the Universidad de Valencia since these two institutions are making considerable progress in the integral documentation of prehistoric rock art, using traditional methods and combining 2D and 3D digital recording techniques. The aim of this short term scientific mission (STSM) was to conduct a case study to evaluate the feasibility of using microfading spectrometry (MFS) for the study of colored systems found in rock art paintings located in Cova Remigia, Valltorta ravine, Ares del Maestre, Castellón (Spain). This cave is part of the rock art of the Mediterranean basin on the Iberian Peninsula included in UNESCO's World Heritage Sites. Some of the paintings belonging to this group are exposed to environmental factors including natural daylight, wind and rain, depending on the time of the day and the season of the year. Therefore, their preservation is a major concern to people responsible for protecting and studying these valuable works.

The experimental work in Cueva Remigia focused on measuring the reflectance curves (380-870 nm) and determining the photostability of various areas containing red and black pigments. These are the two main pigments found on the rock paintings at Cova Remigia. The stability of Blue Wool (BW) standards 1-3 was also measured with the aim of comparing the fading rates obtained for these reference materials with those obtained for the colored systems found in the rock paintings. The BW material is ISO standardized for the evaluation of photostability with BW 3 being the most and BW 1 the least stable. In general, the red

areas evaluated showed similar fading curves to the ones obtained for BW 3 confirming that these systems have relatively lower sensitivity to light irradiation. This result was somehow expected since red pigments were previously identified as Fe-based and these pigments generally exhibit good lightfastness properties. In contrast, a black zone containing an organic pigment gave a similar response to the one observed for BW2. Likewise, similar black areas containing organic pigments can be identified as systems with very high sensitivity to light. None of the evaluated zones showed a rate comparable to that of BW1, which is considered an extremely light sensitive material. Although the origin of this unexpected change is unknown, a possible hypothesis is the contact of these systems with water, which is known for decreasing the light stability of this pigment. This lower stability of the carbon-based pigment can also be due to the interactions taking place at the pigment/substrate and pigment/calcite interlayers.

The results obtained from this STSM indicate that MFS is a suitable technique for studying the response to light of rock/pigment systems found in rock art sites. The optimal conditions for analyzing the photostability of pigments in rock art paintings were identified. Systems containing Fe-based red pigments exhibited low sensitivity to the action of light showing a stability similar or higher than BW3. In contrast, systems containing organic black pigments were found to be very sensitive showing a changing rate similar to the one recorded for BW2. In addition, the technological approaches of both partners were compared and options for a comprehensive documentation of the paintings that includes spatial, spectral, and time components were outlined. In summary, MFS can provide complementary information to the one obtained using other analytical and documentation techniques. A multi-technique approach is recommended for better understanding the chemical composition of the materials, for assessing their current state of preservation, and for making virtual reconstructions of potential visual changes taking place in the long term.

Acquisition

Example of an investigated figure

Results