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Investigating the degradation effects of a compartment fire protocol on wall-paintings

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Wall painting technique identification is an ongoing problem, as identification criteria are still a matter of discussion. The main purpose of this study is to examine the possibility of detecting organic binders as a function of the maximum developed temperature in the case of a fire. This is important in the case of wall paintings, as the presence or absence of organics is one of the criteria for the determination of the applied painting technique. Thus, the study of the characterization of a wall painting that has undergone such an incident may lead to erroneous conclusions about the presence or the absence of organic binders. In general, the effects of fire on artifacts vary and depend on the time of exposure to the event, but also on the temperatures developed during it. In the case of wall paintings, these effects range from the deposition of surface pollutants, to their total destruction due to the collapse of the substrate or masonry.

In the framework of this study, traditional recipes were applied for the preparation of wall painting mock-ups. Thus, using yellow ochre, the painting layer was applied on freshly prepared $\text{Ca}(\text{OH})_2$ ground using water (fresco technique), and on dried grounds using egg yolk, linseed oil, gum arabic, and casein as the organic binders (secco technique). After undergoing a fire protocol representative of temperatures/duration for compartment fires, the mock-ups were studied by Fourier transform infrared spectroscopy (FTIR), X-rays diffraction (XRD), thermogravimetry (TGA), UV-Vis spectrophotometry, X-rays photoelectron spectroscopy (XPS) and optical microscopy. The results showed that there are strong indications that a wall painting which has survived after a fire incident can carry information regarding the applied binder.

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Primary authors: MALLETZIDOU, Lamprini (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki); ZORBA, Triantafyllia (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki); KARFARIDIS, Dimitrios (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki); CHRIS-SAFIS, Konstantinos (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki); VOURLIAS, George (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki); PARASKEVOPOULOS, Konstantinos M. (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki)

Presenter: MALLETZIDOU, Lamprini (School of Physics, Faculty of Sciences, Aristotle University of Thessaloniki)

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