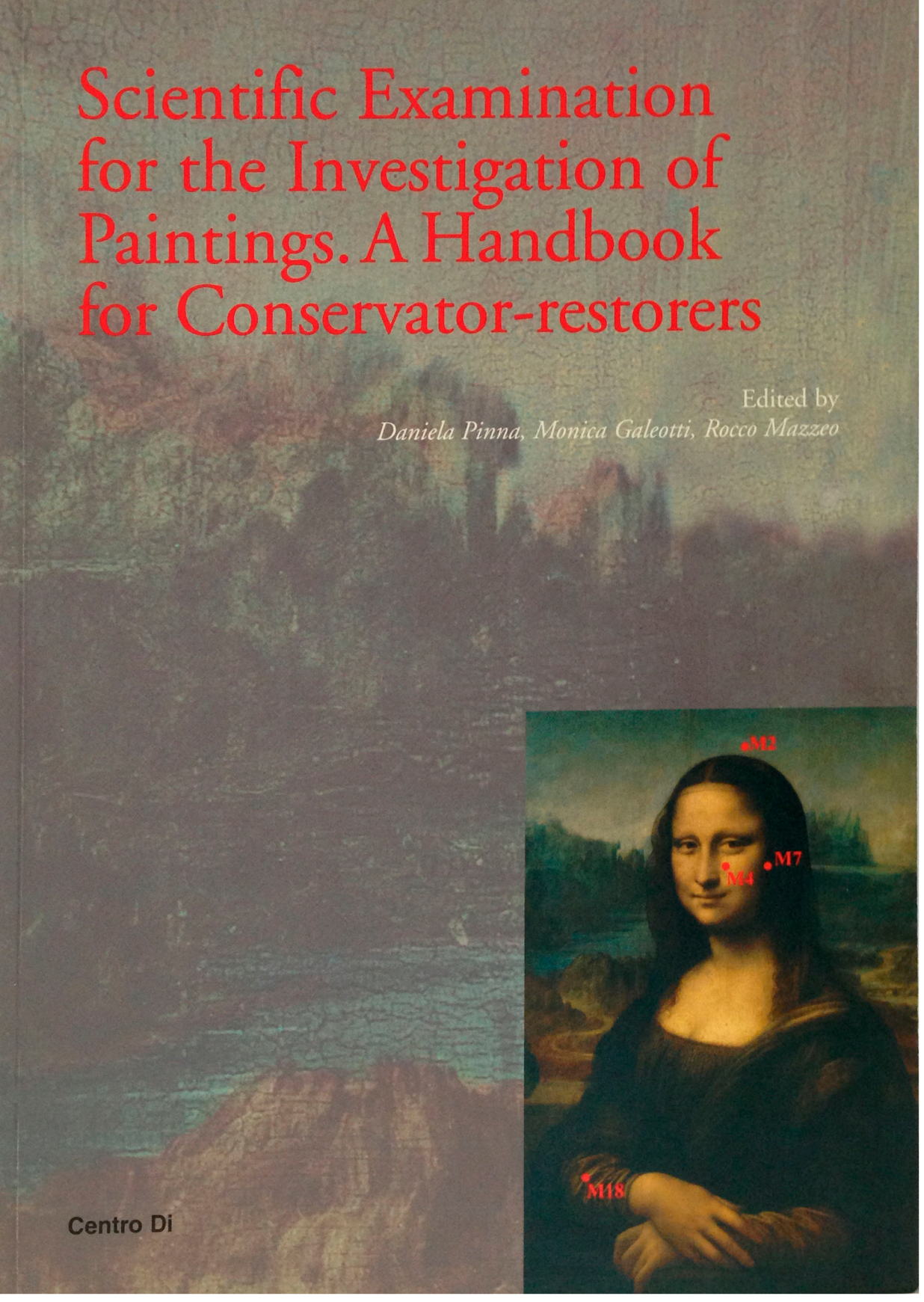


5. Paint layers

Constituent materials

5.1 How to identify the nature of a pigment?

NON-DESTRUCTIVE TECHNIQUES

5.1.1 *IR false colour imaging*

Two colours, very similar under visible light, as lapis lazuli and azurite, can be well differentiated in the infrared false colour image. Lapis lazuli does not absorb the infrared radiation, so the IR false colour image results in a red tone. Azurite absorbs the infrared radiation and looks a dark purple-blue (Figure 1).

The best results with this technique are achieved when the IR false colour images are compared with images obtained from standard samples of known pigments and with data produced by other investigation techniques.

5.1.2 *UV false colour imaging*

In the case of white pigments, they can be distinguished by the UV false colour technique because of their different reflectance at around 360 nm (Figure 2). This results in a recombination image, where lead white looks like white, while zinc white and titanium white give two different hues of yellow.

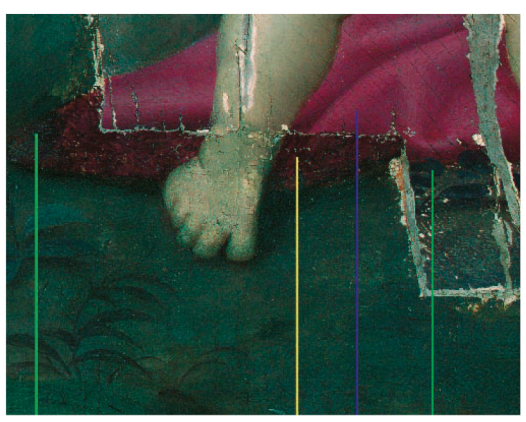


Figure 1. The yellow line indicates use of azurite, the blue line indicates lapis lazuli, the white Prussian blue, the green copper green.

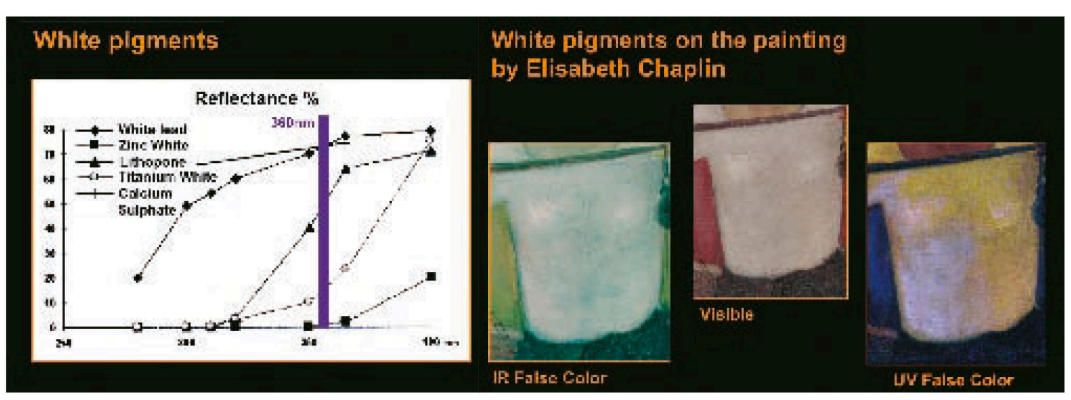


Figure 2: a) Difference in percentage of reflectance relative to the reflectance from a Spectralon surface for the most common white pigment and b) example of characterization of the white pigments showing the use of zinc white (yellow) and lithopone (white) in UV false colour.

Figure 52. Presence of red lake highlighted by orange false colour response (detail of painting by Rosso Fiorentino: left, IR false colour; right, visible)

5.5.2 *IR/UV false colour imaging*

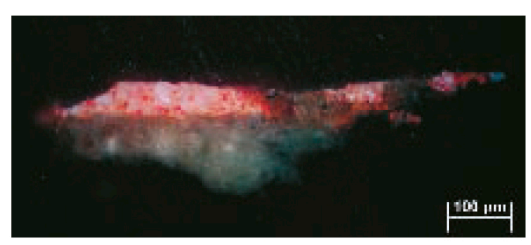
Like inorganic pigments, organic ones used in painting can be identified by means of IR false colour imaging. Only for red lakes, however, very reliable comparisons with standard material painting layers are possible (Figure 52), even though the technique does not allow the full characterization of the chromophore. At present, the identification of other organic pigments used in painting is not possible.

DESTRUCTIVE OR MICRO-DESTRUCTIVE TECHNIQUES

5.5.3 *Optical Microscopy (OM) and UV fluorescence*

Microscope observation of paint cross section under ultraviolet illumination allows the fluorescence phenomena generated by some inorganic pigments to be detected. The case of madder lake identification, shown in Figure 53, is an example. The image shows a cross section of a paint sample from the red mantle of Boethius, a painting on wood attributed to Juste de Gand. The typical pinkish fluorescence showed by madder lake pigments is visible in the UV light microphotograph (Figure 53 b), which also highlights the possible presence of an oily binder through the yellowish fluorescence showed by the red paint layer. Figure 54 shows a small fragment of red paint from Giovanni Antonio Pellegrini's 'Rebecca at the Well' (National Gallery, London, UK). The sample has been flattened beneath a cover slip to allow the pigments to be viewed in transmitted light under the polarised light microscope (Figure 54 a). The paint contains red lake, which can be seen as transparent pinkish particles. Some round colourless particles are also visible; the one at the top left of the image is particularly large. Under crossed polars (Figure 54 b) these show a characteristic dark extinction cross, typical of starch. The starch is present as an extender for the red lake pigment.

Figure 53. Portrait of Boethius, attributed to Just de Gand (Ducal Palace of Urbino, Urbino, Italy). Cross section photomicrograph of a paint sample from the red mantel; a) visible light image; b) UV light image.



5.5.4 *Raman Micro-spectroscopy*

Several variations of Raman spectroscopy have been developed. The usual purpose is to enhance the sensitivity (e.g. surface-enhanced Raman), to improve the spatial resolution (Raman microscopy), or to acquire very specific infor-