Looks can be deceiving: not just chalk in chalk. Analysis of the materials of Madonnari art by XRPD and ATR-FTIR

Analysis of the materials of *Madonnara* art by XRPD and ATR-FTIR

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1 - Introduction

The aim of this study is the characterisation of painting materials of *Madonnara art.*

Madonnara art is a particular *ephemeral category of street art* that entails the use of materials not intended to last over time.

Paintings are realised on the cobbles or asphalt (*Fig.1.1*), nevertheless there is an increasing intention to use mobile substrates, consequently, can be preserved and musealised.

For this reason investigating the type of material is helpful for defining the workability and durability of the artworks.

The study involved curators and artists involved in *Arte Madonnara Festival: the* 24-hour international art competition, conceived in 1973 and annually held in Grazie di Curtatone (Mantua, Italy) at the turn of August 14 and 15 (*Fig.1.2*).

Figure 1.1 Artists creating their work on asphalt in the churchyard of Grazie di Curtatone.

Figure 1.2 Arte Madonnara Festival. Photo by Francesco Toscani

2 - Materials and Methods

34 differently coloured samples were analysed:

- **8 reclaimed materials** (*Fig. 2.1a*) stones, brick and charcoal fragments found by the river (MM).
- **4 homemade chalks** (*Fig. 2.1b*) by Mariano Bottoli (HMM) and Gabriella Romani (HMG).
- **21 commercial chalks** (*Fig. 2.1c*) Rembrandt (RBD), Ferrari (FER), Raphaello (RPH), Boreado (BOR).

X-ray powder Diffraction (XRPD)
Acquisition of diffractometric patterns characteristic of the crystalline phases constituting the materials (*Fig. 2.2a*).

Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR)
Acquisition of spectra with characteristic signals of organic molecules' functional groups constituting pigments, dyes, softening agents and stabilisers (*Fig. 2.2b*).

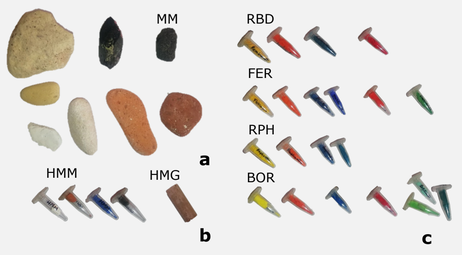

Figure 2.1 Reclaimed materials (a), home-made (b) and commercial 'chalks' (c) used by some *Madonnari* artists.

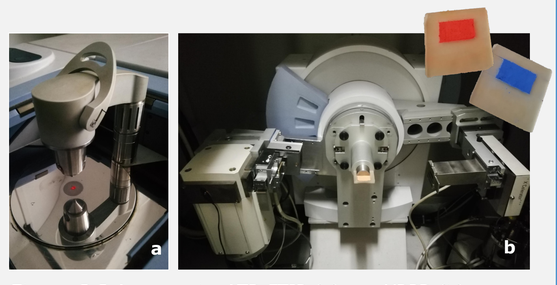

Figure 2.2 Analyses by ATR-FTIR (a) and XRPD (b).

3 - Results

Fillers
gypsum (*Fig.3.1*), anhydrite, calcite (*Figs.3.2 and 3.3*), aragonite
magnesite, dolomite, barite, kaolinite, rutile, anatase, quartz.
In different ratio/combination.

Lipid components: oil and ester compounds (*Fig.3.4*)

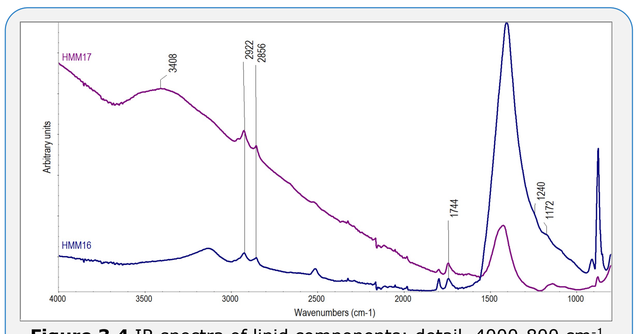

Figure 3.4 IR spectra of lipid components; detail 4000-800 cm^{-1}

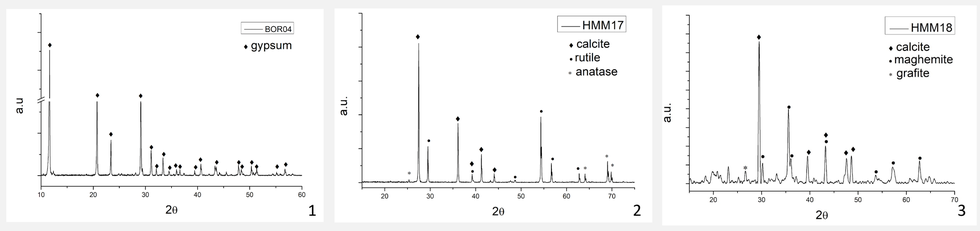

Figure 3 Diffractograms of blue-green BOR04 filler (**1**), of white HMM17 (**2**) and of black HMM18 (**3**)

High variability in the type of filler is observed:

- FER and RBD consist mainly of barite and kaolinite;
- RPH consist mainly of calcite;
- BOR are mainly made of gypsum.

In some cases, the hues of the chalk analysed are obtained by mixing different pigments.

In commercial materials, the use of organic pigments is prevalent, especially for red, yellow and orange (Figure 3.5).

Yellows - 6 gehlenite, coalingite, siderite, iron oxide, cadmium yellow PY35, strontium yellow PY32, bismuth vanadate yellow PY134, crocoite PY34, monoazo arilide yellow PY74, isoindoline PY139, monoazo PO5	**Reds - 6** ematite, goethite, pyrrol derivatives, monoazo PR49 and other monoazo red pigments in mixture	**Blues - 5** ultramarine blue PB29, prussian blue PB27, genuine manganese blue PB33, phthalocyanine blue PB15, cobalt cyanide dihydrate
Greens - 6 chlorinated copper phthalocyanine PG7, permanent yellow PY14, ultramarine blue PB29, cadmium yellow PY35, bismuth vanadate yellow PY134	**Oranges - 4** crocoite PY34, bismuth vanadate yellow PY134, monoazo arylide yellow PY3, diazo pigment orange PO13, cadmium yellow PY35 and other azo-pigments	**Pink - 1** glycine (on the basis of the artist's statement but not detected) **Whites - 3** calcite, rutile, anatase **Blacks - 3** carbon, grafite, maghemite

Inorganic and organic coloured pigments detected on the basis of hue and number of samples analysed

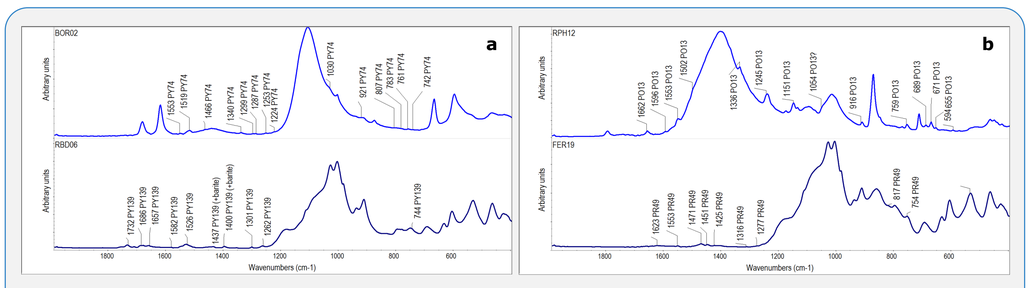

Figure 3.5 IR spectra of yellow BOR02 and RBD06 (a), IR spectra of orange RPH12 and red FER19 (b); detail 2000-400 cm^{-1}

4 - Discussion

So far, the use of this kind of materials denotes a choice aimed at the cost-effectiveness of the material without particular attention to its durability over time.

The adoption of less expensive organic pigments leads to less stability and durability due to their low lightfastness and different interaction with the other components such as fillers and stabilisers[3 4].

Obtaining information on the durability of materials becomes of considerable importance intending the conservation of certain works of *Madonnara art*.

Some *Madonnara* paintings, made on tablets simulating rammed earth, are conserved at *Museo dei Madonnari* of Grazie (Fig.4), founded in the mid-1990s and recently renovated.

Figure 4 Museo dei Madonnari, photo by Marina Tomasi

5 - Conclusions

The analysis of the composition of the materials used by *Madonnari* artists is the first step in the study of the chemical-physical properties of this type of *street art*.

This research is useful to better understand issues related to the usability of the materials in different contexts and their conservation over time (Fig. 5).
In particular, it would be relevant to broaden the study on the stability of pigments simply in the powder form, since most of the literature introduces their behaviour within paints, thus added to binder and other components.

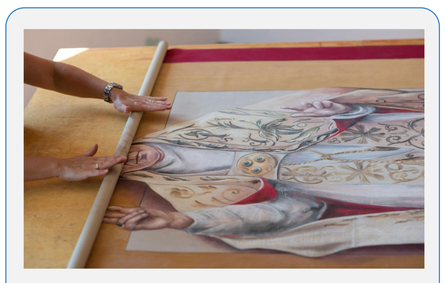

Figure 5 An example of painting on mobile support: San Pio X by Mariangela Cappa

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