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Research paper

The use of pottery clay for canvas priming in Italian Baroque – An example of technology transfer

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ABSTRACT

In the Baroque European painting technology, various coloured clays had been used to prime canvases. These clays are generally considered to be carefully selected in terms of colour and other technological properties (adhesiveness, ductility etc.), as the painting represented the most delicate field of fine art. However, it seems that the availability of the material at a given place as well as its price often played a much more significant role than previously thought. It led to the usage of highly heterogeneous cheap pottery clays in painting, even though they often had to be additionally coloured. For the first time, a clear evidence is provided that a very similar pottery clay material was applied in three different technological ways: i) as a clay body of an unfired terracotta statue created in Florence or Bologna at the end of 16th century, ii) as a secondary putty on the Renaissance painting by Antonello da Saliba (1466–1535), and iii) as a preparation layer – ground – of an oil-on-canvas paintings attributed to Italian Caravaggists (17th century) or also to Carlo Maratta or workshop (1655–1713). The identity of the material was confirmed by mineralogical analyses as well as description of nannofossils, which enable to date the clay to Eocene – Oligocene.

1. Introduction

In the traditional European art, two main types of priming layers (grounds) appear on easel paintings: white gypsum- or chalk-based and colour clay-based ones (Hradil et al., 2015; Stols-Witlox, 2012). From Byzantium to Gothic, the white/grey grounds prevailed; while in the Central Europe, their usage persisted up to the second half of the 16th century and the early 17th century, concurrently, the artists in Italian environment had already started to use the clay-based (earthy) grounds typical for Baroque. (Duval, 1994; Bergeon and Martin, 1994; Roy, 1999) Based on their chemical and mineralogical composition, the Italian clay-based grounds differ significantly from those used in Central Europe (Hradil et al., 2015), which is clearly related to the availability of various regionally important types of clays. This regional specificity of Baroque grounds makes them important for provenance analysis of anonymous works of art and may be conveniently applied in the interdisciplinary fields of research, such as, e.g., technical art history.

Provenance analysis of the fine art is a complex discipline, combining artistic, historical and materials/technological issues. It includes the authorship and/or workshop attributions, but also period and geographical relationships. The composition of clay-based grounds corresponds to the regional provenance of the painting, because coloured clays were cheaply available in many places and therefore, it did not make sense to transport them for a longer distance. It is also necessary to take into account that in Baroque, the painters usually bought the already primed canvases in the place where they were working. Therefore, the grounds refer rather to the place of a painting creation, and not to the painter. It also means that according to grounds, we can distinguish the paintings of one particular painter created in various locations during his life. To trace the regional provenance the description of sufficiently conclusive signs that allow a safe identification of the material within comparative studies is particularly important. These “fingerprints” can be found in variability of, e.g., crystal structures of minerals, admixtures, trace elements, isotopes, and also microfossils. Especially the micropalaeontological analysis in clay-based artistic materials remains almost completely neglected by researchers in the cultural heritage field, although it can provide accurate information about the geological age of the material used and significantly reduce the number of potential source localities.

Clay-based (earthy) pigments are very common in nature – they are most often products of silicate rocks weathering (red/yellow earths as

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well as white earths – kaolins), or, eventually, products of hydrothermal/volcanic alterations (green earths – celadonites) or diagenesis (glauconites). Ferric ochres and reds cover also materials from ore deposits oxidation zones, but these usually contain only a small proportion of alumosilicates (clays). In particular, earthy pigments from Italy were well-known to painters and sold all over the world. Italy was not only a major centre for trade in and processing of the pigments themselves, but became, by the fourteenth and fifteenth centuries, a centre for the production of artists' manuals and collections of recipes for paints, dyes and inks. (Friedman and Figg, 2000)

Probably the most famous ones are “Terra di Siena” (poorly crystallized brown-yellow goethite from lacustrine sediment of Monte Amiata near Siena, southern Tuscany) (Manasse and Mellini, 2006; Manasse and Viti, 2007) and “Italian green earth” (celadonite from the Monte Baldo area near Verona, Veneto) (Grissom, 1986). There are several other areas in Italy known for the production of earthy pigments – for example Lessinni mountains in Veneto (exploited since Prehistory, Cavallo et al., 2016), Piedmont (Cavallo and Gianoli, 2015) and the southern part of Sardinia. The Sardinian earths are still available on the European market of artistic pigments (see, e.g. product No. 40490, Rosso Sartorius, offered by Kremer-Pigmente, Ltd.). However, the variety of earthy pigments is vast and it seems to be difficult to match the pigment with its source. The only way to distinguish, for example, Italian and Cypriot type of the green earth, is to determine the geological age of celadonite using the K/Ar method – however, it cannot be done non-destructively and with insufficient amounts of a pure material. The matter is further complicated by the fact that it was probably not economically feasible to use high-quality pigments for grounds as they were usually thicker than the paint layers – more material was needed to cover the entire surface of the canvas. Moreover, as documented in 2015 by Hradil et al., 2015., a frequently used Italian pale brown ground (designated as “D type” by the authors) has been often intentionally coloured by various pigments – therefore, the starting clay material was probably not a pigment at all.

The priming of canvases with clays first started in Italy; there must have been some source of inspiration as well as available material for such experiment, which eventually resulted in an extensive change in the European painting technology. One reasonable alternative to earth pigments (however never analytically confirmed) were the cheap and widely available pottery clays adapted for an experimental application in painting. The tradition of clay pottery and sculpture (all included under the Italian term “terracotta”) is very old and date back to the Etruscans – the ancient inhabitants of the Apennine peninsula (de Thomson Grummond and Simon, 2006). The revival of terracotta and a renewed popularity of clay sculptures took place in Italian Renaissance (15th to 16th century), when a new artistic centre was formed in Tuscany. The materials of clay bodies of terracotta sculptures (either fired or unfired) represent a largely unstudied topic. For the period of interest, i.e., from the 15th to the 18th century, mineralogical data in the scientific literature are sporadic.

The research of terracotta polychrome sculptures from the 16th (and the 17th) century usually focuses only on the polychrome layers due to conservation issues (Colombo et al., 2011a; Pelosi et al., 2017). Other authors studied also the clay body, but the information is incomplete, which is related also to their methodological approach. If the sculptures or taken samples are studied only by portable X-ray fluorescence (e.g., Križnar et al., 2009 or Colombo et al., 2011b) or, in addition, by spectroscopic methods (e.g., Amadori et al., 2013 or Colombo et al., 2011b), nothing can be deduced about the source of the clay materials. Potentially very promising is the information provided by Zucchiatti et al. (2003), who analysed clay bodies of a group of Italian Renaissance glazed terracotta angels by ICP-MS and a total of 53 chemical elements including the trace elements were identified. Unfortunately, only ten major components are listed in the results. Nevertheless, it can be clearly seen that the clay bodies were calcareous with 20–25 wt% CaO content, which is in agreement with other sources, for example the contribution by Hykin et al., 2007, at the interim meeting of the ICOM-CC Working Group in 2007. The authors mentioned that light-coloured calcareous clay bodies were used for glazed terracottas throughout the Italian Renaissance (see also Tite, 1991; Olson and Barbour, 2001; Bouquillon et al., 2004). This information is particularly important as the “D-type” grounds of Italian Baroque paintings described by Hradil et al. (2015) are characterised by a high Ca-content. It represents just an indication and the credible methodology to prove the identity of the employed materials has yet to be developed. The main difficulty is the limited availability of the material from paintings and sculptures and, therefore, the necessity for either a completely non-invasive, or micro-analytical approach applied on heterogeneous samples that are typically smaller than 1 mm.

In this paper, X-ray micro-diffraction analysis, Fourier-transformed infrared micro-spectroscopy and detailed clay structure description are combined with micropalaeontology (applied on the carbonate component) in order to compare clays used in the grounds of the 17th century Italian paintings with the clay body of unfired terracotta sculpture from Tuscany (dated to the end of the 16th century) and to discuss their possible source in nature. Due to the scarcity of the samples, micro-destructive approaches are very frequently limited. Therefore, an additional aim of this work is to show that in some cases, a tiny amount of consumed material is sufficient to obtain results of fundamental importance for provenance determination and that micro-destructive analysis (often completely forbidden) can be used in a targeted and statistically significant way. The new here-suggested approaches may be used in the future for a wider comparative analysis of clay and carbonate-based materials in the fine art.

2. Materials and methods

2.1. Studied artworks

Five paintings of the Italian Baroque art were selected for the purpose of this research. Their description is given in Table 1. Two of them (M1010 and S1855) were recently attributed to “Italian Caravaggists” (followers of Caravaggio) – “An old woman with coins” (M1010) and “David with Goliath's head” (S1855). On the next canvas (J1709) the Old Testament scene of Rebecca and Eliezer at the Well (Gn 24, 1–49) is depicted (Fig. 1). The historical and artistic comparison of this newly discovered painting (J1709) with an identical composition in the Indianapolis Museum of Art in the U.S.A. have put it in association with the work of a 17th century Roman painter Carlo Maratta (1655–1713) or his workshop (Hradilová et al., 2017). The Italian provenance of two other paintings (J1601 and J1633) is not as obvious as in the above-mentioned cases; it is formulated only vaguely by art-historians. The ground layers of all these paintings were first characterised based on their chemical and mineralogical composition. In order to provide a detailed micropalaeontological examination, two of them (M1010 and J1709) were then selected for a micro-destructive procedure. Within a comparative study, the same procedure was applied to examine the clay body of an unfired terracotta statuette dated to the end of the 16th century and attributed to a Florentine or Bolognese master (ClayS1) (Fig. 1), and also the secondary clay filling of damaged parts of the Italian Renaissance painting by Antonello da Saliba (J1536). (Table 1) This putty was included to the research because, according to stratigraphy of layers, it certainly represents a material from a non-original intervention, which is visually very similar to the material of Italian Baroque grounds. It was therefore very likely that comparative research would make it possible to specify this intervention not only chronologically, but also regionally.

2.2. Sample preparation and light microscopy

The micro-samples were first observed by stereoscope Leica S8 APO Stereozoom. Subsequently, they were embedded in Polylite 32,032–20

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