ALABASTER SCULPTURE IN EUROPE 1300–1650

Edited by MARJAN DEBAENE

With essays by Jessica Barker | Marjan Debaene | Lloyd de Beer
Judy De Roy | Laurent Fontaine | Sophie Jugie
Wolfram Kloppmann | Aleksandra Lipińska
Carmen Morte García | Sofie Muller | Géraldine Patigny
Stefan Roller | Soetkin Vanhauwaert | Michaela Zöschg

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Judy De Roy, Laurent Fontaine and Géraldine Patigny

'Marbre d'alabastre': Status of the Interdisciplinary Research Project on Marble and Alabaster

FIG. 1
Two Pharisees,
14th century. Detail of fig. 4.

Introduction

Alabaster or white marble, the distinction is sometimes difficult to make.[1] Visually, these two types of stone can appear very similar as both are white to beige in colour and translucid and can be finished to a specific gloss. Chemically and mineralogically, however, the two types of stone have little or nothing in common. In the field of mineralogy, alabaster is a variant of the mineral gypsum or anhydrite (calcium sulfates), while metamorphic marble is composed of carbonate minerals, mainly calcite and dolomite. Generally speaking, it is hard to define the source of the white, translucid type of stone unless some outspoken characteristics are present, such as veining. Furthermore, it is often difficult to distinguish between them due to the poor state of preservation of the work of art or the presence of old surface treatments, such as wax or oil.

The aim of our ongoing study, titled 'Marble or Alabaster? Non-invasive Research to Distinguish Sculptures in Alabaster and White Marble from the Low Countries, the Principality of Liège and Northern France during the late Middle Ages and early Renaissance (c. 1270–1530)', is therefore to examine the application of these two materials and distinguish between them using a non-invasive method. The project is funded by the Professor Jean-Jacques Comhaire Fund of the King Baudouin Foundation and is carried out by an interdisciplinary team of the Royal Institute for Cultural Heritage (KIK-IRPA, Brussels) consisting of a geologist, an art historian and a conservator-restorer.

Historical use of marble and alabaster

White, translucid types of stone, such as marble and alabaster, were in great demand for the manufacture of late medieval and early Renaissance sculptures in the Low Countries, the Principality of Liège and northern France.

For the period under review, alabaster is considered one of the most important stone materials in medieval sculpture in Europe. White marble, in particular Carrara marble, gradually fell into oblivion after being widely used in antiquity.[2] It was not until the 14th century that the extraction of this material resumed. In the geographical area under consideration, white marble began to be used again at the turn of the 16th and 17th centuries.

In the current state of knowledge there is no evidence that alabaster was used in these parts before 1300.[3] Nevertheless, from the 14th century onwards, it became a prestigious material, sought after in particular for the tombs of high dignitaries.[4] From the 15th century it came to be widely used as a material for sculpture and the following century saw the emergence of specialized workshops, mainly located in Mechelen and Antwerp, which exported a large part of their production.[5] In the meantime, as a result of the Italian Wars, specifically at the time of Charles VIII, Louis XII and Francis I, interest in marble gradually increased, first through the importation of works by Italian artists and then through the appearance of marble sculptures carved by Flemish artists.[6]

However, this linear representation of the use of these two materials must be qualified. In fact, a group of marble works produced during the 14th century has been preserved, grouped around a name of convenience, the Master of the Mosan Madonnas, and more loosely under the name 'Mosan marbles'.[7] The use of Carrara marble at this time is a primarily linked to one or more workshops in the Liège area. These works therefore bear witness to the use of Carrara marble well before the 17th century, in parallel with the use of alabaster.[8] The presence of these marbles in the mid-14th century is somewhat at odds with the findings of Christiane Klapisch-Zuber, who published her rich and well-documented study on the Carrara quarries in 1969.[9] She established that during the 14th century and until the early 16th, the trade in Carrara marble rarely went beyond Pisa and Genoa. However, with the arrival of Genoese merchants in the marble trade, especially from the first half of the 15th century onwards, blocks of Carrara marble may have been sent across Europe.[10] The case of the 'Mosan marbles' is thus surprising in this context and deserves further investigation.[11]

In medieval language, alabaster and marble may have been regarded as equivalent.[12] This is indeed what emerges from a series of documents. The marble Virgin and Child from Diest (now The Met, New York), dated 1345, for instance, is mentioned in a contemporary document relating to its purchase as being made of alabaster (fig. 2).[13] A similar confusion regarding the material used existed with respect to the 14th-century sculpture of St Catherine in Kortrijk, the case study further elaborated in this article. Later, in the 16th century, Dürer mentions Michelangelo's 'Madonna of Bruges' in his diary as being made of alabaster.[14]

In addition to the confusion one may encounter in archival documents, some museum catalogues or early publications would also have misled researchers in listing (and repeating) material descriptions solely based on examination with the naked eye. On the other hand, some works may have been designed to imitate one material or another. Ligier Richier, for example, gave his Cadaver Tomb of René de Chalon (1545–47) the appearance of marble, even though the work is made of limestone coated with a wax-based preparation applied to the heated stone.[15] Although this example goes somewhat beyond the chronological framework defined for the purpose of our study, the possibility of finding such a surface treatment prior to this date should lead us to caution.

FIG. 2
Virgin and Child, Southern Netherlands, 1345, marble, H 116.2 cm. The Met, New York, Fletcher Fund, 1924, no. 24.215.

Research project

The previous examples demonstrate that it is important to remain cautious in identifying materials with the naked eye and that the implementation of a protocol-based analysis will be a real added value for the research field. In order not to damage the works of art in any way, a non-invasive scientific approach is used to differentiate alabaster from marble to identify, on the one hand, the use of these materials during the period under study and, on the other hand, the contradictory references in literature and archives. The determination of the material can be important in the orientation given to research. In addition to allowing us to make a much more meticulous study of these sculptures by refining their origins, dating and overall analysis, knowledge of the stone type is also of major importance for the conservator-restorer to determine the correct treatment.

Our research is limited to sculpture from the late Middle Ages and early Renaissance, as this period is determined by the evolution of the import of raw alabaster in the Low Countries, the Principality of Liège and northern France. Gypsum alabaster was mined in quarries spread across Europe, in Germany, France, Spain and England. The import of raw alabaster from England began to expand from 1530 onwards, strongly encouraged by the Reformation, which brought an end to the local production of sculpture. As a result, England gained a monopoly on the export of alabaster to the Low Countries. The provenance of the alabaster used in medieval and early Renaissance sculpture in the Low Countries, on the other hand, is rather unclear. The research method applied consists of an approach combining (art-)historical research, an analysis of old restoration interventions, standardized surface photography and X-ray fluorescence (XRF) analysis.

Within the framework of this research project, the chemical composition of sculptures in alabaster or white marble is determined by XRF using a portable analyser commonly called an XRF gun. This portable XRF device (pXRF) enables us to reduce the handling of the works of art to a minimum, since there is no need to transport them to a laboratory (fig. 3). The XRF instrument used is an S1 TITAN 800 (Bruker), with a beam of 5 mm diameter. It should be noted that a handheld device cannot measure all elements, but since the S1 TITAN 800 belongs to the XRF devices of the last generation, all elements starting from magnesium (Mg, atomic number 12) can be detected, and this with sufficiently low detection limits to make comparisons between samples. In practice, the chemical composition is determined by means of two consecutive XRF measurements. The first measurement (in mode GeoExploration) aims at having a global idea of the chemical composition. Based on this, the nature of the material (marble or alabaster) can be determined directly. Indeed, the joint presence of calcium (Ca) and sulfur (S) as the main elements indicates the use of alabaster (gypsum [$CaSO_4 \cdot 2H_2O$] or possibly anhydrite [$CaSO_4$]). In contrast, white crystalline marble is identified when only calcium (Ca), possibly in combination with magnesium (Mg), is determined as the main element. Pure calcite marble, consisting of calcium carbonate ($CaCO_3$), is identified if only calcium occurs as the main element. The combined presence of calcium and magnesium as main elements, on the other hand, indicates the use of magnesian calcite marble ($Ca_{1-x}Mg_xCO_3$ with $0.05 < x < 0.50$) or dolomite marble ($Ca_{0.5}Mg_{0.5}CO_3$ or $CaMg(CO_3)_2$). Using the GeoExploration mode, trace elements (such as metals) can be detected semi-quantitatively, but this is not the case for the light elements (those with atomic numbers between 12 and 20, such as Ca, K, S, P, Si, Al and Mg), which are difficult to quantify. Depending on the result of the first XRF measurement, a second measurement is carried out in the same place (in Limestone or Gypsum mode) depending on whether the material has been identified as marble or alabaster, respectively. These last modes work with lower-energy X-rays that better enable us to determine the content in light elements. The Limestone mode makes it possible automatically to calculate the marble composition on the basis of the XRF spectrum obtained, and the Gypsum mode allows the same for alabaster.

The catalogue of works selected for this research project includes works in white, translucid stone of the marble/alabaster type within our preconceived geographical and historical demarcation. The sculptures examined are located in various Belgian churches, such as the Church of Our Lady in Kortrijk and museum collections, including the Art & History Museum in Brussels[16] and the Museum Mayer van den Bergh in Antwerp.[17] Of the fourteen sculptures examined from the Brussels museum, four are in marble and are

FIG. 3

X-ray fluorescence measurements with a portable device in the Art & History Museum, Brussels.

FIG. 4

Two Pharisees, 14th century. Marble and alabaster, H 36.2 cm. Art & History Museum, Brussels.

FIG. 5
André Beauneveu. St Catherine of Alexandria, 1374–86 [cat. 2]. Alabaster. Onze-Lieve-Vrouwekerk, Kortrijk.

dated to the 14th and 15th centuries. Among the works in alabaster, a sculpture representing two Pharisees bears some similarities to the works in the 'Mosan marbles' group, and it should be noted that they are dated to the same period (figs. 4 and 1). The collection of the Museum Mayer van den Bergh will also provide a valuable selection of research objects for the ongoing investigation, as it contains a comparable set of works in both marble and alabaster.

In the first phase of the study, reference measurements on materials of known nature and, if possible, of known provenance were made on samples stored at KIK-IRPA and on samples from the collection of antique marble slabs of the collection E. de Meester de Ravestein housed in the Art & History Museum,[18] as validation of the analysis methodology to identify the main types of composition (i.e. alabaster, pure calcite marble, magnesian calcite marble or dolomite marble). In the second phase of the study, measurements will be performed on various sculptures from different collections, such as the aforementioned museums. In this article, we will zoom in on the case study of the St Catherine of Alexandria carved by André Beauneveu around 1374 for the Gravenkapel (Counts' Chapel) in the Church of Our Lady in Kortrijk.

Case study: St Catherine of Alexandria

The choice of St Catherine of Alexandria by André Beauneveu as case study, a majestic work from the second half of the 14th century inscribed on the List of Masterpieces of the Flemish Community, is due to the controversy about the type of stone in which it was created (fig. 5).[19]

André Beauneveu (1335–1402) was known as a sculptor, painter and illuminator. Since he combined painting and sculpture, it is not surprising that he was also responsible for polychroming sculptures.[20] Beauneveu executed his sculptures in various types of stone, including limestone, of which the Madonna of Aynard in the Groeningemuseum in Bruges is a fine example. But, of course, he also worked in the more precious white and translucid types of stone, such as marble and alabaster, that were very popular at the courts he was associated with. In 1364 he was commissioned by Charles V 'the Wise' of France to create a group of royal tombs for the Basilica of Saint-Denis. All the surviving sculptural elements of the tomb of Charles V and his spouse Jeanne de Bourbon[21] – the recumbent effigies in the church, the architectural fragments in the Louvre and the group of two addorsed lions sold at Christie's in 2017[22] – are made of marble. Also, the other tombs by Beauneveu in the royal necropolis of the Basilica of Saint-Denis are carved in this material.

In the 1370s, Beauneveu worked on behalf of Louis of Male (1330–1384), Count of Flanders, on the realization of his funeral monument, which was destined to be installed in the Gravenkapel in the Church of Our Lady in Kortrijk. In 1384, the year of the patron's death, the monument had not yet been completed. Moreover, shortly before his death, the count had changed his mind about the location of his tomb

FIG. 6
Detail of the alabaster surface with grey veining of the St Catherine statue.

FIG. 7
Photomicrograph of the gold-coloured inclusions in the alabaster of the St Catherine (Hirox microscope).

and stipulated in a new will that he wished to be buried in Lille instead. However, in 1386, two years after the death of the count, the St Catherine statue that was meant for the initial tomb was received by the Dean and Chapter of Our Lady from the *recheveur* (auditor) of Lille [see cat. 2].[23]

The oldest document from 1374 referring to the tomb of Louis of Male mentions, among other things, the purchase and transport of an undefined stone for the monument: 'A Andrieu Biaunevopt, maistre ouvrier des thombes, sur le voiture des pierres d'une nouvelle thombe qu'il doit faire pour monseigneur a Courtray.... '[24] The aforementioned record of 1386, however, specifies that the delivery concerns '... une image de piere d'alebastre de sainte Kathérine ...'[25] Although Roggen published these documents preserved in the Brussels State Archives, he mentions in the first sentence of his article, by way of introduction, that it deals with 'the famous marble statue of St Catherine'. This pinpoints the complex interrelationship between the two types of stone, in general and regarding the St Catherine. Both earlier and more recent sources on the statue refer alternately to one of the two types of stone. Based on visual observations, the stone can be described as beige-white with isolated slight grey veining composed of gold-coloured inclusions (probably pyrite, FeS_2), characteristics that can be found in both marble and alabaster (figs. 6 and 7).

In order to resolve this issue conclusively, six locations were analysed by PXRF, according to the methodology described above. Four analyses were carried out St Catherine, three in the white matrix and one in a light-grey vein. Analyses were also carried out on two pieces that are not part of the original sculpture but were added during a restoration by the sculptor Constant De Vreese in 1866,[26] namely the wheel (location 5) and the crown (location 6). Due to the small variation in major elements between the four analyses in the sculpture block, only the average and standard deviation are presented in Table 1. The average content of 98.50 per cent in calcium sulfate is unequivocal and clearly indicates that the white material used for the sculpture corresponds to alabaster. Silicon and phosphorus can also be detected with an average content between 0.5 and 1.0 per cent. The average content of the other elements is less than 0.05 per cent or below the limit of detection (< LOD). Although the calcium sulfate content of the two non-original parts of the sculpture is similar to that of the actual sculpture, the silicon content appears to be significantly higher. Furthermore, aluminium and

MAJOR ELEMENTS	average locations 1–4 (%)	standard deviation locations 1–4 (%)	location 5 (%)	location 6 (%)
$CaSO_4$	98.50	0.41	98.32	98.79
SiO_2	0.57	0.22	1.43	0.94
Al_2O_3	0.02	0.03	< LOD	< LOD
K_2O	0.05	0.02	0.04	0.15
Fe_2O_3	0.05	0.00	0.07	0.07
MnO	0.01	0.00	0.06	0.03
MgO	< LOD	< LOD	< LOD	< LOD
P_2O_5	0.64	0.15	< LOD	< LOD
TiO_2	0.01	0.00	0.08	0.02

TABLE 1 Composition in major elements: average and standard deviation of the analyses 1–4 (sculpture block), and individual results of the analysis on the wheel (location 5) and on the crown (location 6).

FIG. 8

X-ray fluorescence measurements on the St Catherine with a portable device.

>> FIG. 9

André Beauneveu. St Catherine of Alexandria, 1374–86. Detail of Fig. 5.

phosphorus are below the detection limit while they were detected in the sculpture. These two findings suggest that another source of alabaster was used (fig. 8).

The trace elements detected are presented in Table 2. Only elements with a concentration close to or above 100 parts per million (ppm) are included, as the reliability of pXRF measurements can be questioned for trace elements present in smaller quantities. Approximatively 200 ppm of strontium and of lead are found in the sculpture block. No other elements in concentrations close to or above 100 ppm can be detected. In the wheel and in the crown, the content in strontium is significantly higher (about one to two tenths of a per cent), which suggests a different provenance. The fact that small amounts of indium, tin and sometimes barium are present in the wheel and the crown, also supports this hypothesis.

The present total height of the sculpture is 186 cm. Since the crown on her head was added in the 19th century, we cannot be certain about the original height, but it must have been at least 171 cm. Therefore, André Beauneveu carved Catherine and Emperor Maximian depicted at her feet (fig. 9) from a large stone block that had at least the following dimensions: 171 × 58.5 × 35.0 cm. A block of alabaster of this exceptional size and homogeneity was undoubtedly not common and was probably obtained by a very specific order. The question remains where this giant block of alabaster was mined before being transported to Beauneveu's workshop. It is known that during the late Middle Ages, large blocks of English alabaster were imported by sea to Continental Europe,[27] but French and German quarries were also suppliers of alabaster, albeit possibly more locally.

The provenance of the alabaster of the St Catherine could be determined by multi-isotope fingerprinting (sulfur, oxygen and strontium isotopes).[28] This method and the associated data were recently developed by a French research team (see Kloppmann's essay, pp. 24–29). The disadvantage of this method of analysis, however, is that it is an invasive and destructive technique, since it requires a sample of 100 milligrams which is equivalent to a size of 5 mm³. It remains to be seen with all the stakeholders whether this is acceptable and desirable.

TRACE ELEMENTS	average locations 1–4 (ppm)	standard deviation locations 1–4 (ppm)	location 5 (ppm)	location 6 (ppm)
Sr	209	30	2152	1420
In	< LOD	< LOD	238	220
Sn	< LOD	< LOD	104	87
Ba	< LOD	< LOD	286	< LOD
Pb	234	113	< LOD	376

TABLE 2 Concentration in trace elements close to or above 100 ppm: average and standard deviation of the analyses 1–4 (sculpture block), and individual results of the analysis on the wheel (location 5) and on the crown (location 6).

Conclusions

As the deadline for the ongoing project is scheduled in 2023, there is still a lot of data to be collected and interpreted. Various sculptures from the Museum Mayer van den Bergh and other case studies will be examined in order to obtain a well-founded insight into the use and historical trade routes of marble and alabaster in the second half of the 14th century in the Low Countries, the Principality of Liège and northern France.

By enlarging the number of reference works, we hope to be able to formulate new observations and hypotheses, which will make it possible to arouse interest and relaunch research. The selected works, with the exception of the St Catherine, are still little studied. Among this corpus, the works supposed to be in marble are generally dated to the 14th century and linked to the sphere of the 'Mosan marbles' or to commissioners from the French nobility and royalty, with sculptors such as Jean de Liège (1330–1381) or Jean de Cambrai (d. 1438).

The study and comparison with the case of the the group of monumental royal tombs for the Royal Monastery of Brou (1506–32) will also be important: commissioned by Margaret of Austria, the sculptures at the monastery are in marble and alabaster and were made by artists also working for the court in Mechelen. This royal commission was also the occasion for debates on the use of marble and alabaster, which are key witnesses to the issue of our study.

[1] On both materials, see Berto-Fontaine 2014, pp. 88–93.

[2] Klapisch-Zuber 1969, pp. 9–19.

[3] Lipińska 2013, p. 88.

[4] Woods 2012, p. 60.

[5] Lipińska 2015, pp. 44–46.

[6] Patigny 2020, pp. 139–146; Patigny-Extermann 2021, p. 250.

[7] Didier 1988; Van den Bossche 2015, pp. 119–45 (with previous bibliography).

[8] For the identification as Carrara marble, see Van den Bossche 2015, p. 142 (based on analyses conducted by Philippe Blanc).

[9] Klapisch-Zuber 1969.

[10] Klapisch-Zuber 1969, pp. 86, 188.

[11] Benoît Van den Bossche, mentioning other researchers, raises the possibility that some of these 'Mosan marbles' may have been made by an Italian artist or an artist from Liège who temporarily worked in Italy: Van den Bossche 2015, p. 142.

[12] Baudoin 1992, p. 31.

[13] Raymaekers 1862, pp. 133–34; Lipińska 2013, p. 101.

[14] Lipińska 2013, p. 101; Woods 2018, p. 7.

[15] Baudoin 1991, p. 54; Delivré 2008, p. 152.

[16] We would like to thank Emile Van Binnebeke, curator European Sculpture and Furniture, for his cooperation on this project.

[17] We are grateful to the Board of Regents for allowing us to examine their alabasters.

[18] We would like to thank Cécile Evers, Curator of Etruscan, Roman and Gallo-Roman Antiquities, for giving us permission to make these reference measurements.

[19] We would like to thank the Kerkfabriek Onze-Lieve-Vrouw Kortrijk and the Topstukkenraad for giving their consent to this research.

[20] Nash 2007, p. 48.

[21] Nash 2007, pp. 32–36.

[22] https://www.christies.com/lot/ lot-6083872?ldp_breadcrumb= back&intObjectID= 6083872&from= salessummary&lid=1, last accessed 25 April 2022

[23] Roggen 1954, p. 224.

[24] Nash 2007, p. 194. Source: ARA, Registre de la Chambre des Comptes, no. 2702. Comptes du receveur général de la Flandre, 17 April–10 November 1374.

[25] Roggen 1954, p. 224.

[26] Van de Putte 1875, p. 43.

[27] Woods 2018, p. 78.

[28] Kloppmann/Le Pogam/Leroux 2018 (with previous bibliography).