STUDIES FOR THE CONSERVATION OF THE MONUMENTAL SCULPTURES IN TERRACOTA FROM THE MONASTERY OF ALCOBAÇA (PORTUGAL): PROJECT TACELO

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Introduction

The Monastery of Alcobaça is the first example of gothic architecture in Portugal, being classified by UNESCO as World Heritage since 1987. On the inside several sets of monumental terracotta sculpture are kept, with approximately 2m height (Fig. 1 - 4). Those represent part of the significant ceramic production made throughout time in the region.

Fig 1 – Our Lady of the Assumption

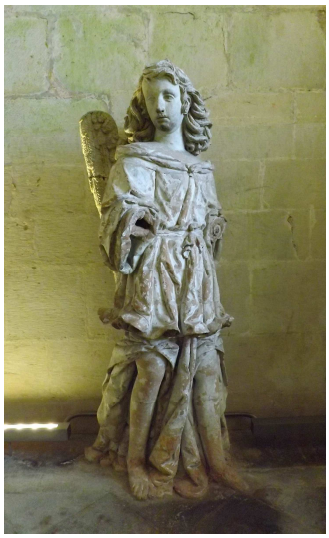

Fig. 2 – Anjel musician

Fig 3 – Cistercian and Benedictine saints

Fig. 4 – Transit of st. Bernard, altarpiece

Motivation

Due to several factors that naturally occur along time, like environmental ones, as well as due to negligence, vandalism or misguided actions, these sets of sculptures were severely altered. The majority of them were moved from their original locations or kept in storage areas. Within this context, several institutions became interested in moving forward with a project that would aim to mitigate the degradation presented by some of the sculptures, as well as to study those same sculptures in different domains: artistic, historical, environmental, physicochemical, etc... Resulting from all these wills, it was created the project "TACELO: Studies for the conservation of the monumental terracotta sculptures from de Monastery of Alcobaça".

Diagnosis

The most relevant problems arising from the materials alteration and alterability, and concerning the terracotta under layer, are the evident loss of significant parts of the sculptures, the loss of terracotta through flaking and low cohesion on the surfaces and the existence of cracks and fractures due to the material nature or fabrication processes (Fig. 5). These problems are mainly consequences of human actions (either during dismantling and assembling the sculptures, through vandalism or even as a result of the lack of conservative actions), of water absorption by capillarity and of the exposure to extreme environmental conditions.
Other relevant aspect identified in these sculptures is related with the lack of adhesion between layers, resulting from the materials' differences in behavior and the alterations they suffered. The original polychrome layer is covered with a white layer, already very altered too.
The sets conservation condition is worrying since many of the observed problems are a consequence of the terracotta under layer conservation, which is putting the sculpture in risk.

Fig. 5 – A) Loss of material by dustiness; B) Loss of a hand; C) Craquelures; D) Fractures; E) Flaking

Materials and methods

The conservation and restoration intervention intended implies the full knowledge of the terracotta conservation condition, so samples were collected covering all the different situations observed within the set, where enough sampling material was available.
The analyses considered for this study involved mineralogical characterization by X-Ray Diffraction and the chemical characterization by X-Ray Fluorescence Spectrometry. Physical tests were also performed, like open porosity, water absorption and specific gravity.

Results

The samples mineralogy is very similar and fundamental constituted by quartz (SiO_2) and calcite ($CaCO_3$), which represent the phases that occur with more intensity, except for ALC 1 and ALC 4, where gehlenite occur ($Ca_2Al_2SiO_7$), and illite/muscovite is practically untraceable. Gehlenite results from the thermal transformation between calcite and aluminosilicates when the firing temperature is at least over 850ºC. As secondary phases phyllossilicates as muscovite ($KAl_3Si_3O_{10}(OH,F)_2$) were observed, as well as goethite (α-FeO(OH)) and potassium feldspar($KAlSi_3O_8$). In sample ALC 6 the presence of kaolinite was observed ($Al_2Si_2O_5(OH)_4$) (Fig. 6).

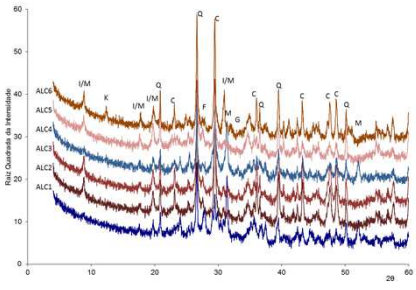

Fig. 6 – Diffractograms of the samples collected from the sculptures kept in the Monastery's storage. Q-Quartz; I/M-Illite/muscovite; K-Kaolinite; C-Calcite; M-Melilite(gehlenite); G-goethite.

AMOSTRA	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	CaO (%)	MgO (%)	K_2O (%)	Na_2O (%)	TiO_2 (%)	P.R. (%)
ACL1	46,18	19,08	5,92	17,74	1,94	3,44	0,23	0.65	4,34
ACL2	39,10	16,34	4,28	16,08	2,47	2,61	0,18	0,52	17,57
ACL3	52,04	18,24	5,05	14,68	1,65	2,82	0,20	0,73	12,30
ACL4	37,64	15,79	5,13	20,85	2,65	2,71	0,17	0,50	11,64
ACL5	50,84	20,19	5,13	9,96	1,61	2,43	0,22	0,74	6,82
ACL6	37,42	15,88	4,02	13,73	2,58	2,40	0,14	0,54	19,25

Table 1 – Chemical composition obtained by XRF, of the samples collected from the sculptures kept in the Monastery's storage.

Conclusions

From the results already obtained, one can conclude that despite the sculptures being from diferente sets, the clays provenience is similar and local. They are essentially calcitic clays (illite-kaolinite) (Table 1). The production is local, made trough complete modeling. After being modeled they were sectioned in "tacelos", in order to make handling, drying and firing easier. The firing was made in ovens that didn't allowed homogeneous temperatures, since some of the tacelos are properly fired, with the presence of new chrystallographic phases like gehlenite, that occurs in temperatures over 850ºC, and others weren't, with the presence of argillaceous phases like kaolinite, that collapses in temperatures over 550ºC.
From the diagnosis one can conclude that the conservation conditions in some of the sculptures is not problematic, although some of the sculptures in the chapter house, for example, present some very damaged "tacelos", that put in risk the entire sculpture. Some of the sculptures in storage present a high state of fragmentation that implies time to proceed to their reconstitution and restoration.

Acknowledgments

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