PRESENTATION SPEECH ICCROM 1997
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ALABASTER STONE

The motive of choosing alabaster as the topic of my presentation in this twelfth International Course on the Technology of Stone Conservation, is to propose the study of a material that is much less well known compared to other types of stones.

Surely some of my next works will consist in the restoration of pieces of sculpture in alabaster. Confronted with the necessity of starting to inform myself about the geological characteristics of the material, its comportment and preceding conservation works, I have been able to verify the scarcity of documentation that exists on this subject compared with the great quantity of information that there is on marble, sandstone or limestone, to cite some examples.

The figures that I actually posses are very general but sufficient enough to call attention to some points that can be resumed in the following way:

1-Compared to other sedimentary rocks, alabaster is a scarce natural material.

2-It is a carving material that has been used since Antiquity as we know from the archeological heritage that has reached us. In Spain, however, its use is amply represented in sculpture from the fourteenth to the eighteenth century in Catalunya, Aragon and Valencia, where some of the most important deposits of this stone are found.

3-The mechanism of decay is worthy of interest and produces very particular macroscopic alterations.

4-This fact poses conservation problems since alabaster will have, logically, a different comportment with respect to some of the usual treatments for other types of stones.

According to Paul Philippot, there are no materials that we can consider poor or noble. The selection of a material for artistic creation depends on its availability, sociological aspects such as price and trade, but also on its technical possibilities and the specific intentions of the artist. The material suggest a use and the artist adapts it to fit his purpose. The predominance of certain materials throughout history and in certain areas is fundamentally symptomatic of diverse forms of sensibility.

After the fall of the Roman Empire the marble trade in Europe and other countries in the Mediterranean Basin went into crisis. It was a poorest economic period and there was a tendency to utilize local stones. Small and medium size sculptures of a devotional nature were realized with alabaster. While wood or porous stones appeared totally polychromed, concealing the lapidary material that only served as a support, alabaster was uncompletelly

polichromed and its luminous surface forms part of the aesthetic aspect of the sculptures, in conjunction with color and gilt.

Alabaster was used considerably in the royal courts of the fourteenth century in England, Spain, Italy and Flanders, above all to represent the image of the Virgin. For example, the English alabasters from the quarries of the Triasic Age in Staffordshire, Derby and Nottingham had a great reputation and gave rise to a true industry of semi-manufactured products in the proximity of the quarries.

SLIDE 1- The Trinity, fifteenth century, from England, is found in the collection of the National Museum of Art of Catalonia MNAC. Restored in 1992, it was my first encounter with the alabaster.

In a period where light had an important spiritual role, this translucent material allowed the faces of figures to be illuminated in accordance with the aesthetics and religious pretensions of the time. In cathedral architecture of that epoch, windows of alabaster plaques let ligth pass to the interior of the temple, substituting glas windows in some cases.

SLIDE 2- This is the exterior of the dome of the Valencia Cathedral, fourteenth century.

SLIDE 3- This is the interior, observe how the ligth passes through the plaques of alabaster that cover the windows.

In Valencia, Catalunya and Aragon from the fourteenth to the eighteenth centuries, sculptors like Damià Forment worked almost exclusively in alabaster and wood. His works are monumental if we consider the small blocks of alabaster that normally are obtained from the quarries. Its carving facility and its texture made it appropiate for surface pictorial treatment in Baroque sculptures, as we can see in the work of Ignacio Vergara.

SLIDE 4- Sarcophagus of San Millán de la Cogolla. Logroño, twelfth century. Brown alabaster.

SLIDE 5-6- Details.

SLIDE 7- Gastón de Moncada, fifteenth century. Museum of Fine Arts of Valencia.

SLIDE 8- Virgen del Parto, Joan de Castellnou. fifteenth century. Valencia Cathedral.

SLIDE 9- Eternal Father. Pere Joan, fifteenth century. MNAC.

SLIDE 10- Mausoleum of the Kings of Aragon. Damià Forment, sixteenth century. Poblet (Catalunya).

SLIDE 11- Major altar of the Huesca Cathedral. (Aragon). Damià Forment, sixteenth century.

SLIDE 12- Detail.

SLIDE 13- Major altar of the Pilar Basilica of Zaragoza. (Aragon). Damià Forment, sixteenth century. The blocks of alabaster in the principle figures are two point seven meters high. They are from the Xelsa quarries in the meganodular belt of the Ebro Valley.

SLIDE 14- Detail.

SLIDE 15- Alter piece of the MBBAA. Valencia, sixteenth century.

SLIDE 16- Noli me tangere. Detail of the central piece.

SLIDE 17- Entierro de Cristo. Detail. Is a different type of alabaster. Surely the alter piece was mounted on a base of works of distinct artists and origins.

SLIDE 18- Santo Caliz Chapel in the Valencia Cathedral.

SLIDE 19- Santo Sepulcro Chapel in the Valencia Cathedral, sixteenth century.

SLIDE 20- San Vicente Martir. MBBAA. Valencia, eighteenth century.

SLIDE 21- Door of the Marques de Dos Aguas Palace. Ignacio Vergara. Valencia, eighteenth century.

Alabaster is a sedimentary evaporitic rock composed of secondary gypsum, calcium sulfate $SO_4 Ca . 2 H_2O$.

Is formed in marine or continental sedimentary basins by the deposition of primary gypsum. The sediments of primary gypsum lose the water during the proces to inter (anadiagenesis) becaming anhydrite, a subsurface evaporite. Later, during the exhumation, the anhydrite is hydrated by an isovolumetric replacement process, where different hydration patterns can be developed among which vein and concentric patterns stand out. The result is a secondary gypsum formation.

There are three types of secondary gypsum according to its petrologic characteristics: porphyroblastic, alabastrine and megacrystalline.

For the topic that we are concerned with, we will focus on the alabastrine gypsum which makes up the carving material used in sculptures. It is a crystalline mass of nodular and layered form, relatively homogeneous and fine-grained, and generally presents clear rose or yellow tonalities with veins and clouds. Reddish and brown variations exist, as we have seen.

In the alabaster we will find as a basic component microcrystalline formations of secondary gypsum but also, as accessory components, parts of anhydrite, primary gypsum, selenites and host sediment (carbonate, clay, etc).

We can list, at least, two causes of alteration of alabaster:

1-The principal cause is dissolution. Alabaster is fairly soluble in water, 7-9 grams par litre. In four hours the signs of dissolution are visible. Sometimes the dissolution can be selective depending on the variable quantity of primary gypsum, anhydrite, etc. that might be in the stone, creating a differential decay. The accumulation of atmospheric dust favors the hygroscopicity.

2-It is a physically fragile medium. Alabaster is very soft with an average hardness of about 2 on the Mosh scale and can be easily scratched with the fingernail.

To continue, we will focus on a case:
-The door of the Marques de Dos Aguas Palace in Valencia.

SLIDE 22-37- This is the actual state of the door, covered by a barricade because the building is the object of an architectural consolidation intervention. It is alabaster from the quarries of Ninyerola (Valencia). We will observe, among other things, the following morphology of the alterations:
-Significant superficial deposits.
-Disintegration by weathering.
-Erosion.

The causes of alteration are produced by the faulty functioning of the tile channels, that evacuate the water directly onto the monument and have brought total losses of volume in some elements by dissolution. The low percentage of rainfall in Valencia causes an inefficient washing of the facade surfaces and favors the deposit of atmospheric dust. Among other causes is the mechanic action that transients carry out on the soft surface through incisions, blows, etc.

SLIDES 38-39

The following slides have been given to me by the kindness of professor Juan Jose Alonso Pascual.

SLIDE 40- Optical microscope photograf (200x) of the dust layer formed for mineral airborne particles.

SLIDE 41- SEM photomicrograph (300x). We can see the difference between an altered and an unaltered zone. The crystals are transformed in amorph matter.

SLIDE 42- SEM. Unaltered zone (800x)

SLIDE 43- SEM. Altered zone (1100x)

- The use of water, very common in the cleaning process of stones is rejected in the cleaning of alabaster. Thus, the desalination recommended to remove dangerous products from the pores and prepare the stone to apply on it the consolidant is impossible. Generally the cleaning is realized by means of gels or emulsions of organic solvents. In this way dust and old artificial patinas are removed from the surface, improving notably the aesthetic aspect of the work, but the elimination of contaminating products is not done in depth. The surface result is good. But wat effect produce soluble salts from contamined water or from the concret on the calcium sulfate of the stone?

- Mechanical cleaning is another delicate point, because given the softness of the material it is necessary to work with extreme caution, and many of the methods normallly applied in other types of stones must be firmly discarded here.

- The synthetic resins and their compatibility with the different types of stone in the process of consolidation is a topic that has been studied extensively during the last few years, above all with sandstone, limestone or marble. For exemple, we know the affinity of silicone resins with stone of silica compounds or inclusive with the carbonatic compounds. But, how do these and other resins behave with a stone composed of calcium sulfate and with a great facility for retaining water in its interior?

- Finally, the filling or the sealing of fractures, cracks or looses presents aesthetic and conservative problems. Slaked lime based mortar, is normally recommended to other types of stones, beacause of its compatibility with the lapidary material. But it does not integrate aesthetically with alabaster. The opacity and the porousness necessary, as little as it is, to favor the entrance of CO2 in a mortar of this type, impede the integration with a fine and traslucent material. Moreover, the quantity of water necessary for the carbonatacion doesn't make it advisable either. In some cases, an epoxy resin as a binder with a inert filler has been opted for, perhaps lloking for a greater aesthetic union because of the carmel color and traslucent aspect of the resins. But the solution is not appropriate from the point of view of conservation. The joined material is harder than the original material and has difficult chemical and mechanical reversibility, subject as well to import color changes during its ageing. Would gypsum, normally discarded in favor of other types of stone, be appropriate because of its chemical compatibility?

I would like to thank professors:
Juan José Alonso Pascual and Luis Angel Alonso Matilla of the Politechnic University of Valencia, and professor Federico Ortí Cabo of the Central University of Barcelona.