

TECHNICAL ART HISTORY AND ARCHEOMETRY I *PATINA: HISTORICAL SCIENTIFIC AND PRACTICAL CONSIDERATIONS*

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Introduction: Technical Art History and Archeometry

The term *patina* with its varied associations, meanings and resonances is a useful topic to begin my three-part discussion of Technical Art History and Archeometry if for no other reasons than its very problematic nature and its fundamental bearing on the practice of art conservation. Further it serves as a useful demonstration of the importance of an integrative approach of a range of disciplines in the study of works of art—a study that has been in search of an appropriate name and which has most recently been designated “Technical Art History.” This newly-named but loosely-defined area of study was first proposed and described by David Bomford at a symposium held in Leiden in 1995, who described it as, “...a wide-ranging, inclusive evocation of the making of art and the means by which we throw light on that process.”(1) Stated in this way it would be inclusive of Archeometry, as the use of science and scientific methods is one of the principal means of understanding the materials and processes of art, as well as the art historical tasks of archival research and connoisseurship, and further the important inclusion of making reconstructions where manipulation of the materials can provide important insights unavailable by means of strictly cognitive research. The implications of the approach of Technical Art History have great importance for fostering co-operation and communication between art historians, conservators, conservation scientists and, I would add, artists. By extension, the aspects of technical art history involved with the materials and making of a work of art, provide an important avenue for the general public to connect with art of the past as exemplified in the London National Gallery “Art in the Making” exhibitions. (2)

Recently a new working group has been formed with the name, “Art Technical Source Research” (ATSR). (3) Like Technical Art History it seeks to establish a needed discipline in the gap where scientific analysis, source research on materials and techniques and reconstruction are viewed as the “three pillars of art technology”. (4) It is currently a provisional working group of ICOM-CC and has held its first symposium in Amsterdam in 2004. Art history and aspects of humanistic thought have been kept at bay in the defining documents of the group, with a view towards strictly serving “art technology” though art history is mentioned as a “type of source” and as something that ATSR “can be applied to”.

These recent developments are connected to yet another current concern, namely the need to communicate the complex concerns of conservation to the general public as was demonstrated in the theme of the ICOM-CC conference of 2004. This very urgent

need to educate a wider audience about the preservation of our cultural heritage, I believe, is directly connected to the impetus for defining the combined intellectual and practical foundation of our field and is the guiding principle of the work in which I am currently engaged, namely the study and teaching of reconstructions. We have found that the appeal of artists’ materials and working methods is far larger than explaining a conservation treatment, and particularly if manipulation of materials is involved, gives new insights about works of art and the materials from which they are made that has enormous appeal.



Fig.1 William Hogarth, *Time Smoking a Picture*, 1761.

In the three lectures here I will attempt to provide examples that support the necessity of an integrated approach to the study of works of art that most closely fits the label of Technical Art History. This places the field of conservation squarely into the sphere of the humanities for it is knowledge in the area of meaning, value and significance that governs the direction of scientific and technical study and evaluates its importance. Art Technical Source Research provides a valuable focus on materials and making, but the necessary ingredient of “meaning” is the essential “fourth pillar”. The new emphasis on doing reconstructions, or “informed copies” has proven an important and useful pathway to new technical insights

for the conservator as well as being a significant teaching tool providing uniquely meaningful connections of understanding for professionals and for the general public about those concerns directly relating to conservation, namely the materials, fabrication methods and an understanding of the creative act by means of which works of art are produced.

Patina: historical considerations

Patina today is most commonly used to refer to the green corrosion products that form in time on copper and copper alloys such as bronze when it is exposed to the open air or to burial conditions. This meaning of the word is relatively recent and can be found to have originated in the mid-18th century when the field of archeology had begun to develop along with admiration of the colored corrosion products formed by burial conditions on bronze artifacts. Prior to this time *patina*, an Italian word in use by mid 17th century, conveyed the effects of time on paintings—namely the darkening of varnishes. Filippo Baldinucci provided the first definition of *patina* or *patena* in his *Vocabolario Toscano dell' Arte del Disegno* of 1681 as “a term used by painters...namely that general dark tone which time causes to appear on paintings, that can occasionally be flattering to them.”(5) This original meaning of the word, which derives from the older use of *patena* that refers to a shiny black varnish applied to shoes, is well illustrated in William Hogarth's depiction of “Time Smoking a Picture” (Fig.1)

Pliny, writing in the first century C.E., used the term *aerugo* which can be translated as “the rust of bronze” to describe the colored corrosion products observed on ancient bronzes. Further he makes important distinctions between corrosion products that are formed “naturally” and those that are produced artificially, for example by exposing copper to the fumes of vinegar; and also the distinction between “noble corrosion” that is attractive, enhancing and stable (*aerugo nobilis*) and another (*virus aerugo*) or “virulent corrosion” that is unattractive, disfiguring and destructive.

The shift in meaning and reference of the word *patina* to refer to the green corrosion products on bronze sculpture and artifacts appears to have come with the French adaptation of the Italian where in the *French Encyclopédie* of 1751 it is defined as a word borrowed from the Italian and which describes the “beautiful and brilliant color of verdigris that copper does not always assume”. While the resonance of meaning referring to the visible effects of the passage of time have remained, particularly in the literature where the philosophy of conservation has been discussed notably by Brandi and Phillipot (6) the most common association of the term today is with the green corrosion products on bronze sculpture and archeological artifacts. As in the ancient literature the descriptions of patina typically distinguish between noble and virulent on the one hand and natural and artificial on the other. (8) An example of a noble patina can be seen in Fig. 2.

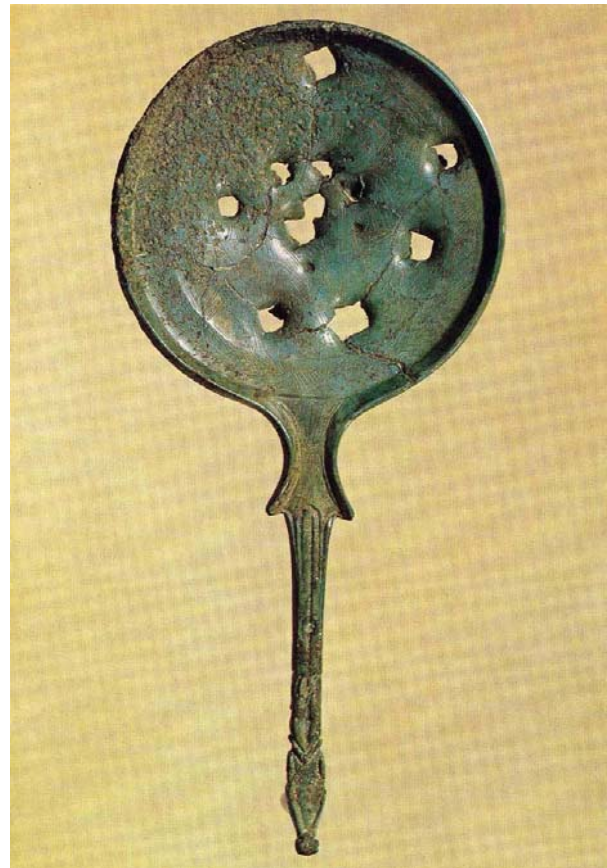


Fig. 2 Etruscan mirror, c. 3rd century B.C.E., Fogg Art Museum, Harvard University.

Archeologists and historians of ancient sculpture have presumed until very recently that ancient bronzes, like those made in modern times, were given an artificial chemical patination that was either black or green. Pliny mentions the application of bitumen or pitch as a protective coating and this was presumed to present a dark black appearance. While patinas on ancient bronzes and on outdoor bronze sculpture were studied scientifically in some detail beginning in the late 19th century, with the great range of mineral corrosion products identified, only two historians of ancient sculpture were convinced that the original appearance of ancient bronzes was for the most part a bright and brilliant polish, with no chemical coloration, but with an essentially warm-toned, translucent coating of bitumen that both allowed the brilliant golden color of the metal to predominate and served as a protective and maintainable coating.(9) Both Eric Pernice and Gisela Richter writing in 1910-1915, argued, on the basis of literary evidence and careful observation of numerous artifacts, that where coloristic effects were desired, these were obtained by means of varying the color of the alloy and by the use of colored inlays, for example of colored marble for eyes, pinkish copper for lips, and silver for teeth. Pernice went so far as to do a reconstruction painting a coating of bitumen on to polished bronze demonstrating the result of representing the appearance of glowing tanned skin. The effect is impressive as I was able to demonstrate in repeating Pernice's experiment. (Fig.3)



Fig. 3 Application of a coating of bitumen (pine tar pitch) on a polished bronze 85:5:5:5 plate.

Recently much new evidence has come to light proving the accuracy of Pernice and Richter's observations. With newly found objects, such as the bronze *Warriors* brought up from beneath the sea at Riace and various bronze vessels such as the calyx krater in the Metropolitan Museum, NY, and with recent scientific studies accompanied by reconstructions undertaken in several museum laboratories, among which the joint efforts of the Vatican Museums, the Ny Carlsberg Glyptotek, and the Munich Glyptothek, we now have a very different view of what patination meant to ancient sculptors in bronze as well as stone. (10) We are so accustomed to sculpture that has a relatively uniform surface coloration that the ancient taste for naturalistic polychromy on both bronze and stone sculpture comes as a surprise and requires us to radically readjust our aesthetic preconceptions. (Figs. 4-5) This new understanding has developed through the combination of historical study, scientific technical examination techniques and reconstruction techniques brought to bear on many objects.

The revival of bronze casting in Renaissance Italy with artists such as Ghiberti, Donatello, and Verrocchio sought its models from classical antiquity which in all cases, with the exception of gilded bronzes, had altered considerably in appearance from the effects of atmospheric exposure, burial or submersion in sea water. Prevailing taste for treatment of surfaces was for a uniform dark and opaque oil or resin coating that could hide casting flaws, later tending toward a more translucent red-brown as casting techniques improved. (fig. 6) Gilded decoration such as found on the Cellini *Perseus* in its most recent conservation treatment was apparently the only variation on the basically uniform coloration imparted by coatings and somewhat later by means of exposure to smoke to achieve a stable, evenly reacted and attractive surface.

It was not until the nineteenth century that patination of sculpture by chemical means became the norm for bronze sculpture and *patina* became the accepted term for colored corrosion products on bronzes. The advent of the industrial revolution and accompanying developments in the field of chemistry became both the cause of corrosive attack on outdoor

bronzes as well as the means of identifying corrosion products.

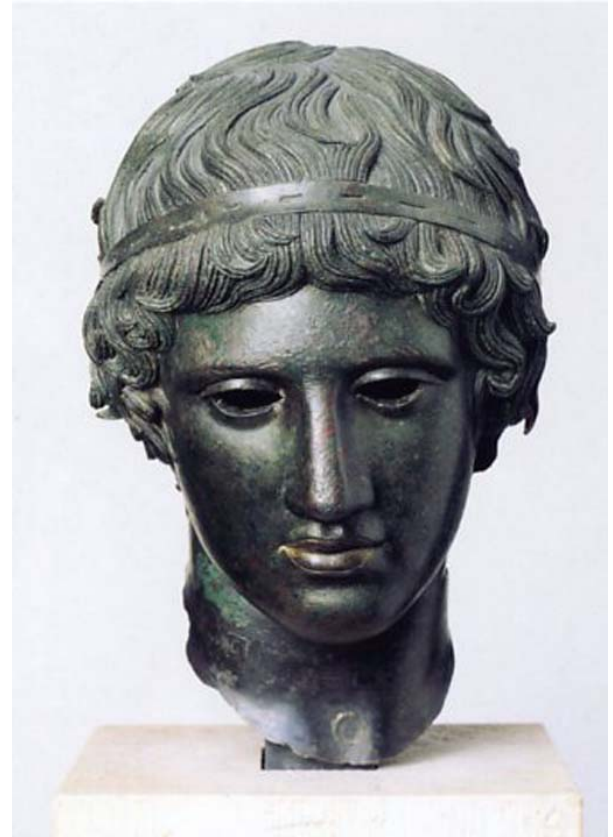


Fig. 4 Head of a Youth, c. 20 BCE, Munich, Glyptothek [from *I Colori del Bianco*, fig 234, see n. 10 below]

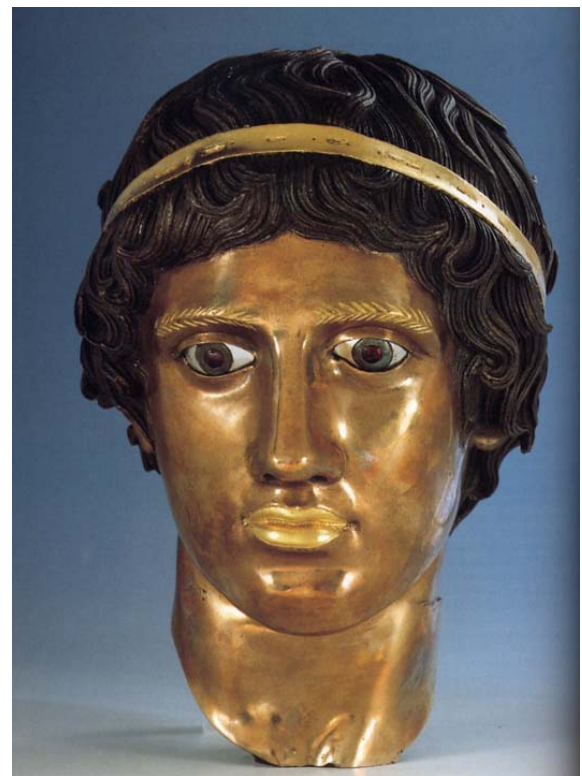


Fig. 5 Head of a Youth, reconstruction of Youth in Fig. 4 by Wünsche and Herzog [*I Colori del Bianco*, fig. 215, see n. 10 below]



Fig. 6 Pietro Tacca, *Peter the Great on Horseback*, c. 1600, bronze with translucent red-brown lacquer

Patina: Implications for Conservation Treatment

A conservator seeking to specialize in outdoor bronze sculpture in the 1970's had very little precedent to build upon. Sculpture conservation had not been established as a field whether by reason of scale and inaccessibility in the case of outdoor sculpture or by misunderstanding of the true vulnerability of bronze sculpture to attack by increasing levels of sulfur dioxide and other pollutants. Scientific studies in Berlin during the 1860's identified sulfur dioxide issuing from new industrialization as the cause of unattractive color changes on outdoor bronze sculpture, and a Patina Commission was established to investigate ways to restore and protect these valued civic ornaments. (11) In these early efforts to treat outdoor bronze monuments the problem of aesthetics and change in appearance became an issue resulting in bitter disputes, one of which was described in 1883 as a "Patina War" concerning the restoration and maintenance of the Maximilian monument in Innsbruck. (12)

With the intervention of two world wars these early studies were overlooked when attention once again became focused on the question of preserving bronze and copper in an outdoor environment. Intense study of the green corrosion products on copper roofs was undertaken beginning in the late 1920's in England by Vernon and Whitby who concluded that the green corrosion crust was: 1) primarily basic copper sulfate, 2) was protective to the metal beneath, 3) was stable, 4) natural and 5) had aesthetic value. (13) It was perhaps these conclusions that lulled the 20th century conservation community into complacency regarding the state of preservation of outdoor bronze sculpture. What was not realized was that copper roofs and outdoor bronze sculptures respond very differently to industrial urban environments, and that through decades of neglect, the more vulnerable surfaces of cast bronze sculpture had already undergone serious,

irreversible damage. Copper roofs have the advantage of being an unalloyed metal as well as being fabricated in such a way as to produce a more-or-less uniform wrought metallic structure. Bronze sculpture has a cast and therefore heterogeneous structure, which makes it more vulnerable to pitting attack. Where copper roofs tend to form protective and evenly-colored patinas of pleasing color, outdoor bronzes in urban areas will form speckled and heterogeneous coloration with local action corrosion cells that promote ongoing surface dissolution as well as an unattractive, visually destructive appearance. (14) The corrosion crust that forms on outdoor bronzes can in no way be called "natural" as it is the result of the man-made products of industrialization. The *Statue of Liberty* is something of an anomaly, being fabricated of wrought copper sheets that have assumed a relatively evenly colored and protective patina.

Studies of the ancient bronze horses on the façade of San Marco in Venice reported in the early 1970's showing that these notable monuments exposed outdoors with minimal change for 2,000 years were undergoing severe corrosive attack. (Fig 7) Industrial development since the 1950's on the mainland near Venice had resulted in a significant rise in the sulfur dioxide content of the air in Venice causing ongoing damage to both the stone and bronze works exposed to the open air. Studies undertaken elsewhere by Riederer in Munich and Lehmann in Poland were reported at the ICOM-CC meetings in Madrid in 1972. (15)

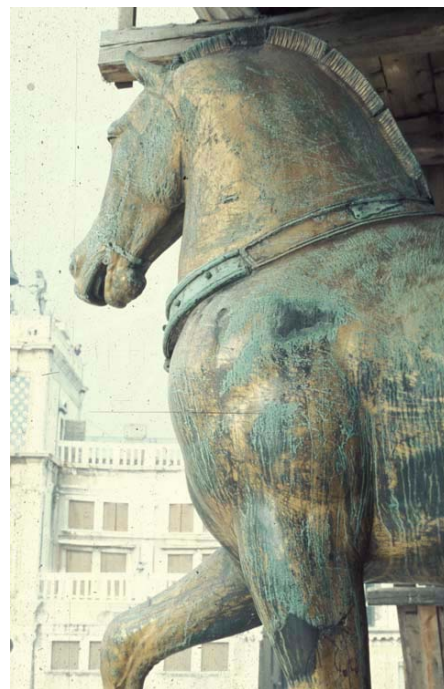


Fig. 7 One of four ancient bronze horses on the façade of S. Marco, Venice, before treatment.

Our work in St. Louis began at Washington University in the mid-1970's and focused on developing technical examination methods, compiling documentation on fabrication and patination techniques, exploring and defining the mechanisms of deterioration, and seeking materials and methods for

appropriate treatments. Research was accompanied by practical application that was thoroughly documented and reported in a number of published articles and lectures. (16) The alarming extent of damage on most outdoor sculpture proved an immense challenge for conservation treatment. (Fig. 8)



Fig. 8 Houdon, *George Washington*, Lafayette Park, St. Louis, MO, bronze cast c. 1860 by Hubbard after the original marble in the State Capitol, Richmond, VA.

The contrast between a regularly maintained outdoor bronze (Fig. 9) with one that has been neglected provides a startling example of the importance of consistent care. Ease of maintenance is a primary concern for any treatment as is assurance that it will be carried out.



Fig. 9 Houdon, *George Washington*, Trafalgar Square, London, bronze cast after the original marble in the State Capitol, Richmond, VA. This bronze has been regularly maintained with a wax coating.

Establishing a treatment that would provide a patina that is both historically appropriate, stable and maintainable is a more complex problem and must be decided according to the specific needs of each sculpture. The range of surface conditions can extend from severe pitting on a 19th c. bronze in New York

City (Fig 10) to negligible surface destruction in the case of the Verrocchio *Christ* from the *Doubting Thomas* group on Or San Michele (1483). (Fig 11) The reddish copper oxide layer revealed in the mechanical removal of the corrosion crust, while not the “original patina”, probably a brown lacquer, is stable, attractive and maintainable.

Since 1980 several international conferences have been held (17) and numerous treatments have been undertaken including a major coordinated effort in the United States called, “S.O.S” (Save Outdoor Sculpture) (18) Conservation treatment of major sculptures have been accomplished including works by Giambologna, Cellini, Donatello and Verrocchio as well as ancient works such as the *Marcus Aurelius* in Rome. In some cases, such as with the *Venice Horses* and the Roman *Marcus Aurelius*, the decision has been made to keep them indoors, an unfortunate, but perhaps necessary step that is a foreboding comment on the growing menace of atmospheric pollution.



Fig. 10 Severe pitting attack where local-action corrosion cells have formed on a statue in Central Park, New York City

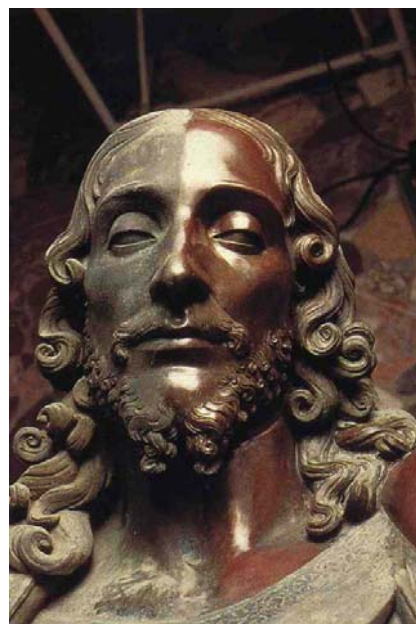


Fig. 11 Verrocchio, Head of *Christ* partially cleaned, from the group of *Christ and St. Thomas*, Florence, Or San Michele, 1483.

With increasing awareness of the true fragility of outdoor bronze sculpture most outdoor bronzes have received some kind of protective treatment and it is now, in the early 21st century, hard to find a green outdoor bronze unless the patina is an artificial one and the result of a 20th century taste for green patination formerly thought to be “natural” and protective.

Conclusions

Our current understanding of the meanings of *patina* has developed through historical investigation of the origin and use of the term. Use and meaning of *patina* reflects in turn the developing taste and aesthetic notions of the appropriate appearance of works of art. *Patina* generally has indicated a desirable and attractive surface condition indicative of age. The difficulty insofar as conservation is concerned involves judgment of a variety of complex factors including whether or not such surface conditions are “noble” or “virulent” and whether they reflect the artist’s original intent. The study of patinas in reference to the range of surface finishes on bronze sculpture has evolved through the interaction of historical, scientific and practical studies and applications of those studies in conservation practice and reconstructions.(19)

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- (5) Filippo Baldinucci, *vocabolario Toscano dell’Arte del Disegno* (Florence: Santi Franchi) 1681: “*Patena*, voce usata da’Pittori, e diconla altrimenti pelle, ed è quella universale scurità che il tempo fa apparire sopra le pitture, che anche talvolta le favorisce.”
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