Re.S.Artes

Le Regard de la Science sur les Arts et le patrimoine culturel

Scientific analysis of bronze sculptures : some elements of understanding

The scientific study of bronze objects is based upon the analysis of a sample of the raw material that will permit to determine the composition of the alloy and to evaluate the nature and the extent of its weathering.

For authentication purpose, it is possible to state about the compatibility of this information with the presumed antiquity of the object:
if the metal contains elements coming from a modern metallurgy, or if it is not or few corroded or if it has been submitted to chemical attacks in order to simulate its weathering,
then the object is considered as modern.

This is a complementary approach to the stylistic study of works: it provides objective information that comes support (or refute) the point of view of the expert.
In some cases, it can be useful to complete this study with a Lead 210 authenticity test.
It can be also necessary to perform an X-ray imaging in order to confirm the homogeneity of the piece and to extrapolate the analysis results to the whole object.

Principle et measurements

The experimental protocol is based on the observation of the sample with scanning electron microscope (SEM) and the determination of the elementary composition of the metal and some superficial products with EDS analysis (energy dispersive spectrometry) for major and minor elements.

Taken with a handsaw perpendicularly from the surface of the object, then put into a resin (epoxy) and polished, the sample presents a clear section from the surface to the inside part of the object.

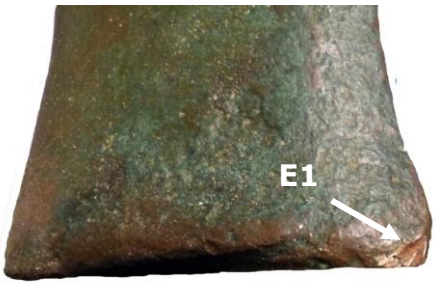
SEM technique allows obtaining black and white pictures of the material, with huge magnification, because of an electron beam directed by electromagnetic fields. We used the following observation mode: the backscattered electron imaging (BSE) that shows the chemical element contrast of the material. Furthermore, the energy of the electrons used is enough to produce interactions with the material which emits X-rays detected and transformed in data through a spectrum (X-ray energy-dispersive spectra, EDS), giving the elementary composition of the analyzed material (major and minor elements – more than 0.1%).

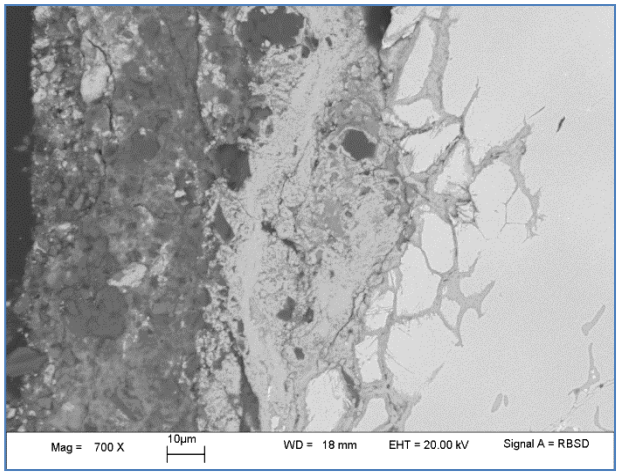
Finally, the results obtained on the section, both as regards the imaging and the elemental analysis, allow to determine the composition of the alloy and to obtain information about its surface state, that are useful to validate their compatibility with the presumed antiquity of the object.

SAS Re.S.Artes au capital de 15.000 €
84 rue du Tondu, 33000 Bordeaux, France
Tel / Fax : +33 (0)5 56 81 64 42
Mobile : +33 (0)6 62 79 14 80

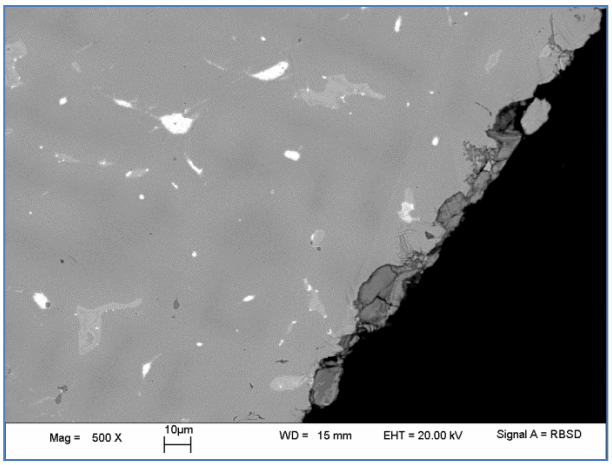
752 793 224 RCS Bordeaux – NAF 7120B
SIRET 752 793 224 00011
N° TVA : FR 76752793224
info@res-artes.com - www.res-artes.com

Two examples





Bronze sculpture, Asia, presumed from Archaïc period
The composition of the bronze is compatible with ancient metals. Furthermore, the weathering products and corrosion phenomena that were identified correspond to natural and long time processes. These results are consistent with the presumed antiquity of the object.



Bronze sculpture, Greece, presumed from Hellenistic period
The composition of the bronze is compatible with ancient metals. Nevertheless, the corrosion phenoma observed correspond to short time processes. These results are not consistent the presumed antiquity of the object.

SAS Re.S.Artes au capital de 15.000 €
84 rue du Tondu, 33000 Bordeaux, France
Tel / Fax : +33 (0)5 56 81 64 42
Mobile : +33 (0)6 62 79 14 80

752 793 224 RCS Bordeaux – NAF 7120B
SIRET 752 793 224 00011
N° TVA : FR 76752793224
info@res-artes.com - www.res-artes.com