

**Pigments from the *Zuiddorp*
(*Zuytdorp*) Ship Sculpture: Red,
white, and blue?**

By Wendy van Duivenvoorde

Introduction

This paper aims to add to the dataset of existing pigment studies of Dutch Renaissance sculptures and provide comparative records for studies of ship decorations. It highlights part of the ongoing investigations of the *Zuiddorp* caryatid herm and is focused specifically on the white, red, and blue pigments found on its surface and inside surface cracks. These pigments were analysed using Scanning Electron Microscope (SEM), X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD), and RAMAN spectrography in an attempt to identify their composition. The results assist in the identification of the types of pigments used by sculptors specialised in ship decorations and, in particular, that of Dutch East India Company ships.

A small number of 17th- and 18th-century ship sculptures have survived in historical or archaeological contexts. Undoubtedly, the best known and most abundant examples, c.200 in number, are those from the 1628 Swedish warship *Vasa* (Soop 1992, 1985). Sculptures and carved decorations found on ships built by European nations also include a collection of spectacular French pieces, mainly dating to the late 18th century and later (Musée National de la Marine 2003:45–57, 100; Mourot and Béland 2001).

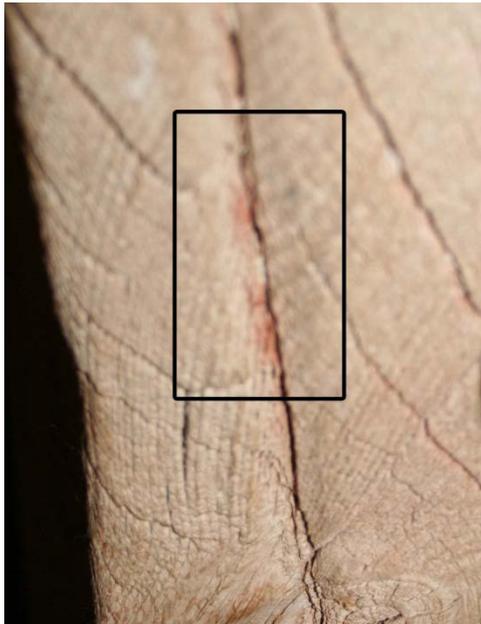
From Dutch ships, there is a sculpture of a satyr from an unknown 17th-century historic context in the collection of the Maritime Museum in Rotterdam (object no. M2163). It once supported a ship's cathead and measures 1.78 m in height (Beylen 1970:310; Van der Heide [n.d.]:27, fig. 21). The *Zuiddorp* sculpture is the only example of such decoration from an early 18th-century Dutch India ship and is, therefore, a significant addition to the limited corpus of such archaeological remains.

Background

This year marks the tercentennial of the shipwrecking of *Verenigde Oostindische Compagnie* (Dutch East India Company, or VOC) ship *Zuiddorp*. The 1152-ton ship had made two successful voyages to Batavia, departing from Wielingen in 1702 and 1707 (Bruijn *et al.* 1979a:1884.1, 2033.2; 1979b:6140.1, 6216.2). Its fateful third voyage commenced on 27 July 1711, when it set sail from the port of Vlissingen on the south coast of the Zeeland island of Walcheren. Due to unfavourable conditions off the western African coast, the ship had lost 112 of its 286 crewmembers by the time it reached the Cape of Good Hope in South Africa.

Photographs of analysis Locations

001 Proper Right
Red
Stain in Groove



002 Proper Right
Tassel Edge
Red Stain



003 Front Proper
Left Red Stain On
Tassel



Photographs of analysis Locations

004 Proper Right Side Next To
Top Tassel No Stain_001a



005 Proper Left On Pedestal Lower
Side Of Tassel No Stain_002



006 Directly Above Belly
Button No Stain 001



007 On Chin No Stain 002



STEPS REQUIRED TO DO SPECTRA ANALYSIS USING ARTAX SOFTWARE provided with the Tracer

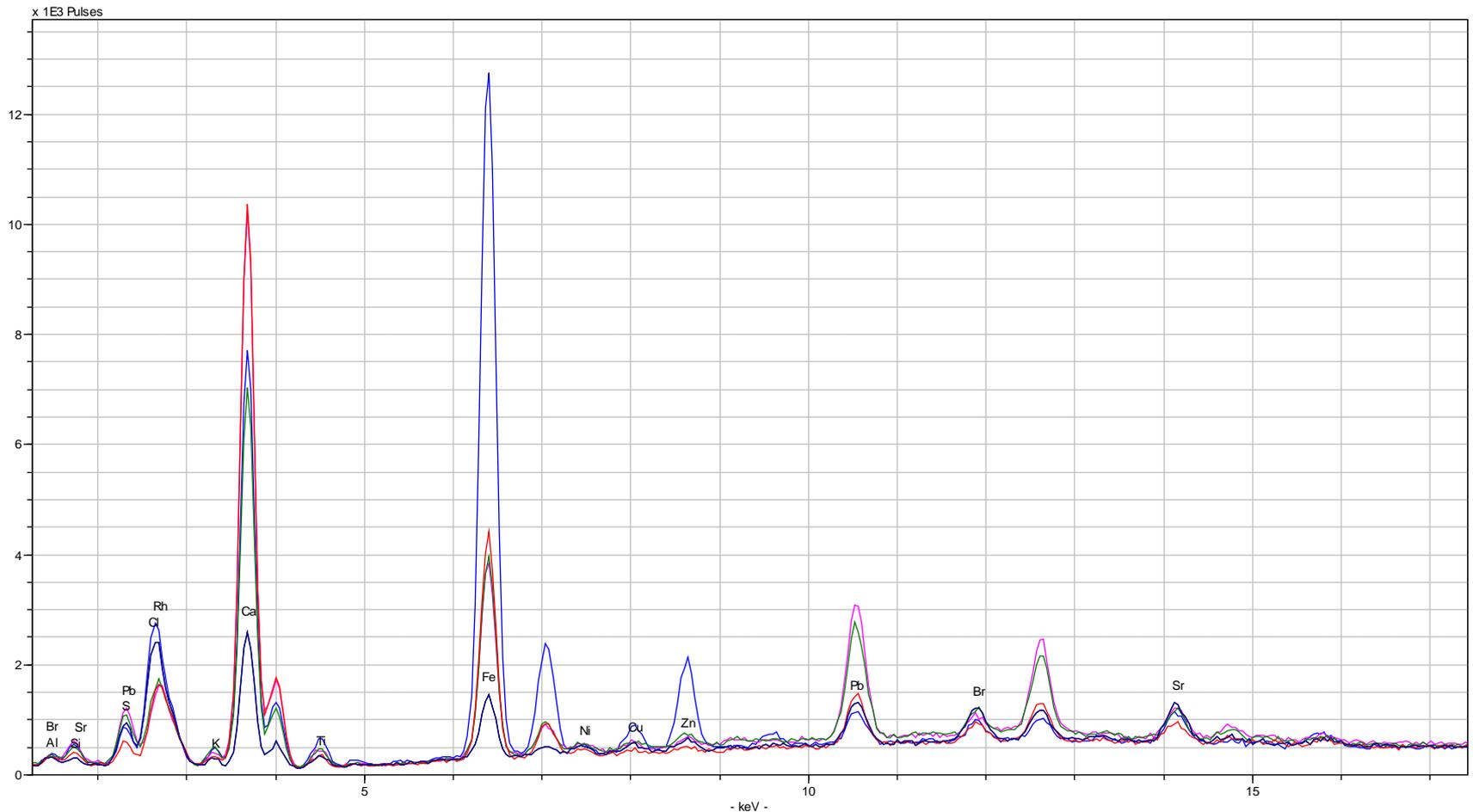
Net area analysis in Artax 7

1. In ARTAX, click on 'File', click on "open spectrum", file the folder that has all your txt spectrum files, highlight them all and click open
2. Click on "project", click on "new project", right click on "object", click on "add node", enter "Points" in name box. Highlight this folder.
3. Go back to "Project" tab. click on "Add spectrum".
4. Click on "File", click on "save project", give a name (.rtx), click on "save"
5. Click on "spectrum" tab
6. Go to method list and pick your method! See below
7. Highlight the Points folder
8. Click on "Analyze" and then on "Evaluate Results", a progress bar should appear as all the spectra are being evaluated with "your named method"
9. Then click on "Export" and then on "Results to Excel" Then a box will appear so you name the excel file and put it in a folder that you want the results to be in!
10. Now immediately resave your project file because it now contains your spectra and your results. Use the same name you did before and save on top of the old version of the rtx file.
11. Now go to the folder you saved your results in and open the file and got to the Points tab to see all your net area data. You then edit out the area that gives you no information.

Method Creation

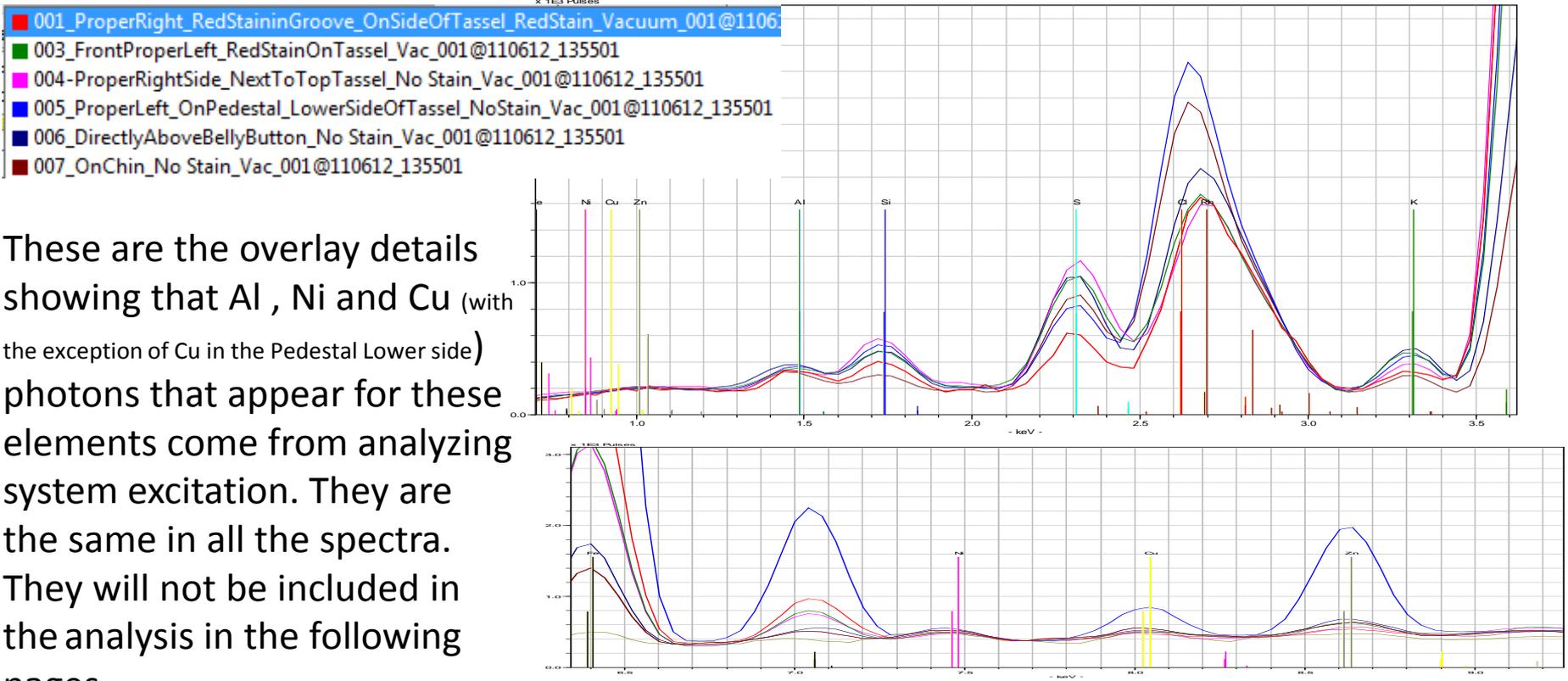
- To create a method open a spectrum that is typical of the spectra you want to analysis, get the periodic table and LABEL ALL THE ELEMENTS THAT ARE IN THE SPECTRUM, YOU CAN NOT SKIP ONE JUST BECAUSE YOU ARE NOT INTERESTED IN IT, YOU MUST LABEL ALL THE ELEMENTS THAT THE SYSTEM HAS DETECTED IN YOUR SAMPLE.
 - Then click on the Method editor that is to the left of the method name.
 - Click on Identification and make sure the dot is in the Preset list option to the left of the periodic table
 - Then click Get elements
 - Then go to the Name box and type in whatever name you would like for your method
 - Click on Corrections then set cycles at 9 and then pick your energy range for fitting, typically the range of analysis.
 - Then click on add
- Then click on ok at the bottom of the popup method editor window. Your method should now be in the method window at the top of the Artax screen

This is an overlay of all the raw photon spectrum of all the analysis. It is apparent from this that most of the Al, Ni and Cu photons seen in the spectra come from the Tracer system itself, because all spectrum show very close to the same intensity, while all the other elements show large variations, indicating they are the result of elements present for some reason on the sample itself.



Note all numbers are the relative net number of photons from each element noted in the 300 seconds of analysis at each location noted in the photographs

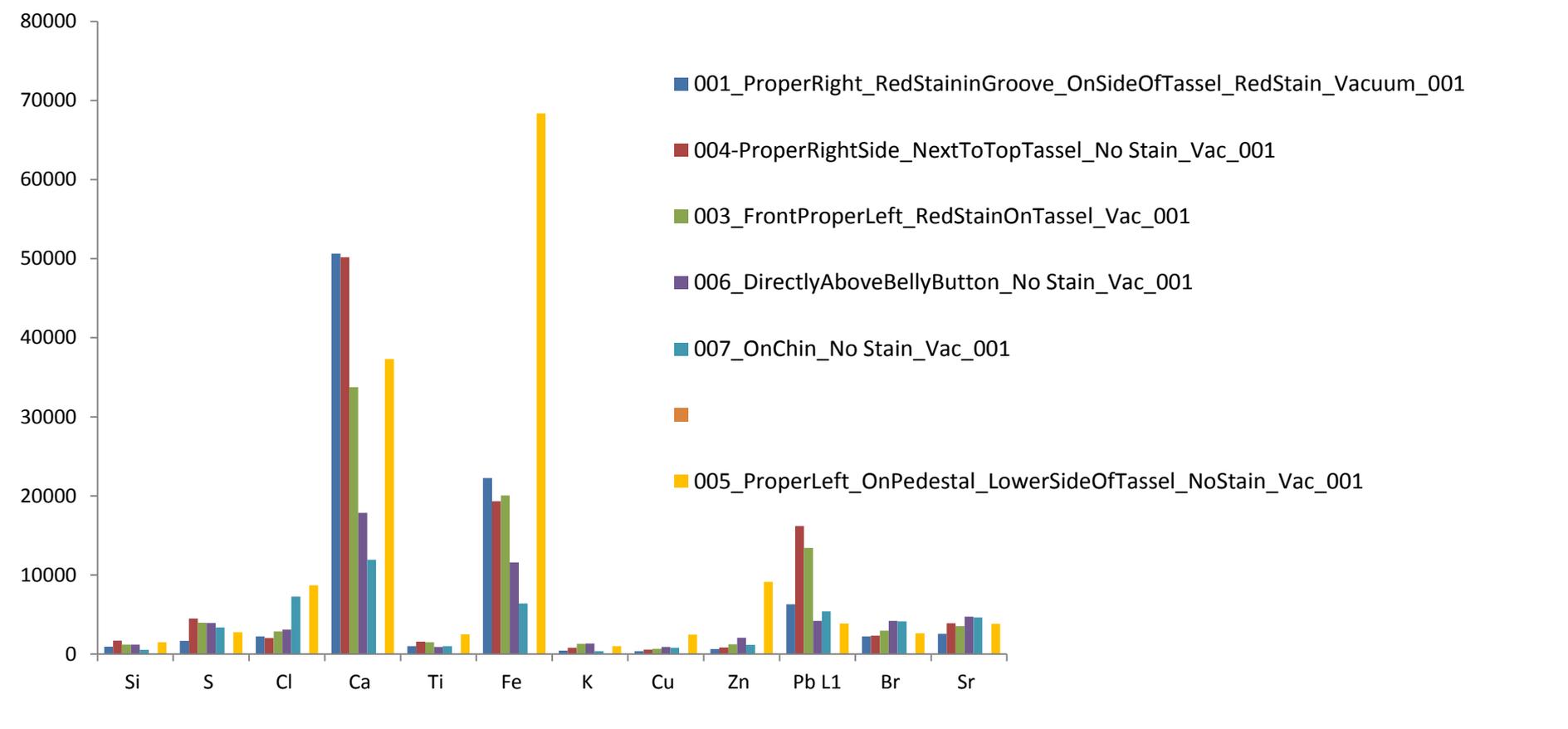
	Al	Si	S	Cl	Ca	Ti	Fe	K	Cu	Zn	Pb L1	Br	Sr	blank	Pb M1
001_ProperRight_RedStaininGroove_OnSideOfTassel_RedStain_Vacuum_001	671	930	1674	2234	50652	1014	22275	434	375	644	6298	2230	2576		0
003_FrontProperLeft_RedStainOnTassel_Vac_001	722	1215	3989	2886	33754	1508	20061	1296	665	1243	13447	2980	3531		0
004-ProperRightSide_NextToTopTassel_No Stain_Vac_001	736	1717	4500	2050	50177	1570	19318	799	586	850	16208	2332	3898		0
005_ProperLeft_OnPedestal_LowerSideOfTassel_NoStain_Vac_001	854	1521	2769	8704	37313	2514	68356	1005	2479	9126	3886	2631	3843		0
006_DirectlyAboveBellyButton_No Stain_Vac_001	998	1221	3942	3106	17863	903	11616	1346	922	2078	4200	4195	4744		0
007_OnChin_No Stain_Vac_001	787	554	3380	7273	11923	1018	6400	395	825	1174	5419	4132	4630		0
002_ProperRight_TasselEdge_RedStain_Vac_001	784	81	53	325	505	219	486	0	256	272	930	535	405		0



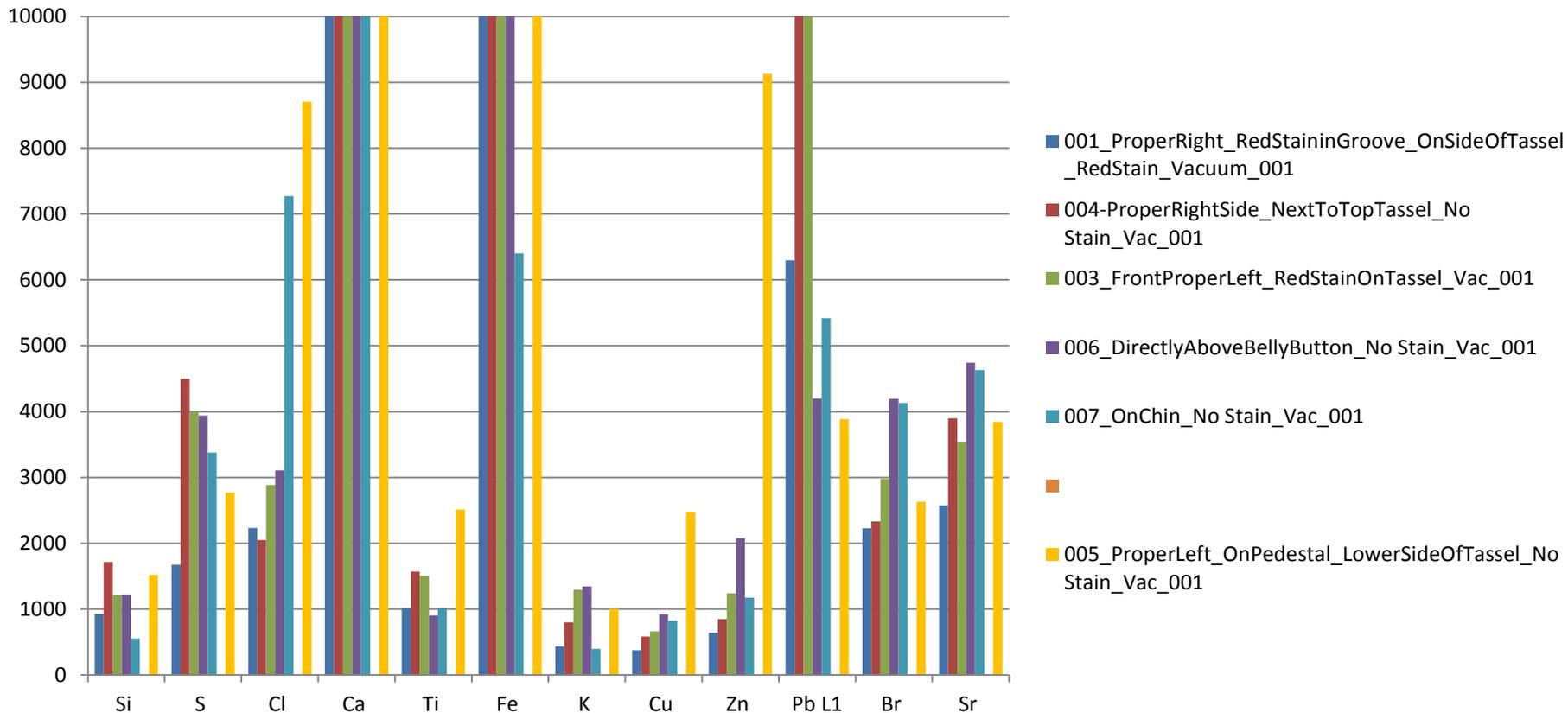
These are the overlay details showing that Al , Ni and Cu (with the exception of Cu in the Pedestal Lower side) photons that appear for these elements come from analyzing system excitation. They are the same in all the spectra. They will not be included in the analysis in the following pages.

This elemental photon data was sorted on the number of Ca photons (most to least) gathered from each sample as noted in the Table and on the pictures. Note that no Pb M line photons are not detected but there are lots of Pb L line photons at all locations(see table above). The Pb M line photons are only 2,500 eV and cannot penetrate even a very thin coating, while the Pb L line photons (10,500 eV) excited underneath the coating can easily penetrate the thin coating to reach the detector if excited. So the Pb appears everywhere but is under a coating of something. What?

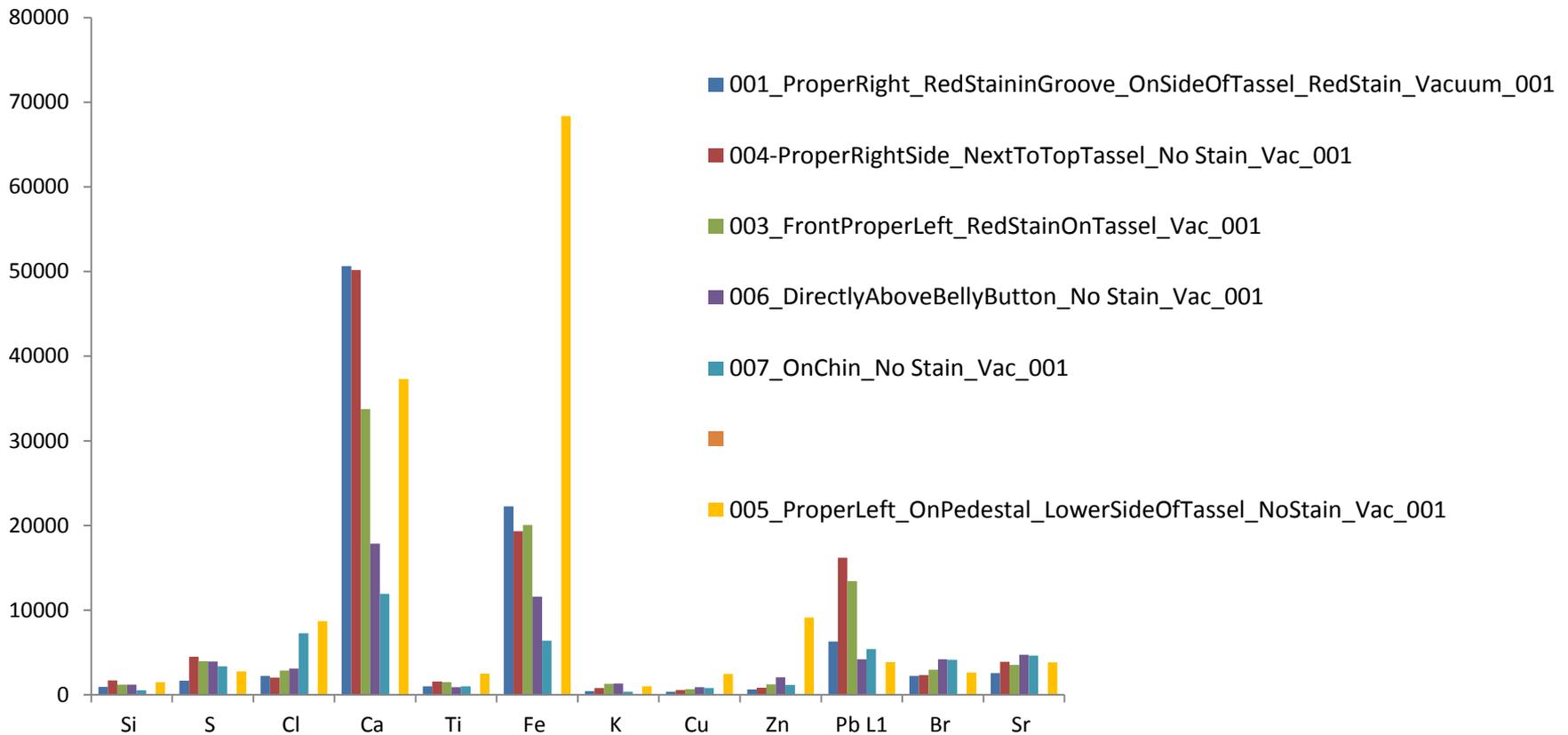
	Si	S	Cl	Ca	Ti	Fe	K	Cu	Zn	Pb L1	Br	Sr
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003_FrontProperLeft_RedStainOnTassel_Vac_001	1215	3989	2886	33754	1508	20061	1296	665	1243	13447	2980	3531
006_DirectlyAboveBellyButton_No Stain_Vac_001	1221	3942	3106	17863	903	11616	1346	922	2078	4200	4195	4744
007_OnChin_No Stain_Vac_001	554	3380	7273	11923	1018	6400	395	825	1174	5419	4132	4630
005_ProperLeft_OnPedestal_LowerSideOfTassel_NoStain_Vac_001	1521	2769	8704	37313	2514	68356	1005	2479	9126	3886	2631	3843



This elemental photon data was sorted on the number of Ca photons (most to least) gathered from each sample as noted in the Table and on the pictures. Note that S and Fe follow same pattern as Ca. But Cl, Sr and Br vary inversely to the Ca concentration, see expanded plot below.



This elemental photon data was sorted on the number of Ca photons (most to least) gathered from each sample as noted in the Table and on the pictures. Note that S and Fe follow same pattern as Ca, but Cl, Sr and Br vary inversely to the Ca concentration. Note the Si, Ti and K all vary in unison but different than any other element, but at a very low level and are only on the surface because the photons from these elements would only come from the surface as they are low energy. It is likely that these are soil contamination from the days the object was in the environment as these elements are found in abundance in the sand and soil.



What of 005 Proper Left On Pedestal Lower Side Of Tassel No Stain 002 in yellow above it stands out as very different than all the spectra it has the highest Cl, Fe, Cu and Zn levels? Why?

Previous thoughts

Unfortunately, this method of analysis did not result in a positive identification of the red stains. Analysis of the red stained areas and those without visible pigment yielded similar results, with calcium, iron, and lead being the most prevalent elements on the surface of the *Zuiddorp* caryatid herm. Other elements present in lesser quantities include aluminium, bromine, chlorides, copper, potassium, nickel, rhodium, sulphur, silicon, strontium, titanium, tin, copper, zinc, and zirconium. The stains could have been from red pigments such as red lead or iron oxide (e.g., hematite), but XRF analysis cannot differentiate these from lead white or iron corrosion products from the fastenings. It is likely that lead white—lead compounds and gypsum—is still extant over the entire surface and within the sub-surface pore structure of the wood of the sculpture, even if not visible to the naked eye. The high peaks

New thoughts based on the above expanded analysis

Unfortunately, this method of analysis did not result in a positive identification of the red stains. To do this one should do a very positionally sensitive analysis of one of the darker red areas, with the yellow filter 0.001" Ti/0.012"Al) 40 kV analysis and with this setup take analysis in 1 mm steps across one of the areas of red stain. Relative concentration analysis of these spectra will show which element(s) forms the stain versus the wash that is over the entire object.

The surface of the *Zuiddorp* caryatid herm has been painted in layers with the under-layer being Pb white and the over layer being Ca, S and Fe. . S and Fe follow same pattern when looking at the analysis concentration pattern as a group as Ca, but Cl, Sr and Br vary inversely to the Ca concentration pattern. This indicates these elements come for a common source but different than the Pb and Ca coatings. Perhaps a result of the environment? Note the Si, Ti and K all vary in unison but different than any other element. They are at a very low levels indicating that they are likely not purposeful in their present but containments and are only on the surface because the photons from these elements would only come from the surface as they are low energy. It is likely that these are soil contamination from the days the object was in the environment as these elements are found in abundance in the sand and soil. Cu and Zn, the other 2 elements present in some of the analysis show no pattern and appear to be result of random environmental events.