APPENDIX A

LABORATORY QUESTIONNAIRE ON FERROUS ARMOUR CORROSION PRODUCTS:

DELIVERED QUESTIONNAIRE

Heritage Malta

Friday 4 May 2007

Mr James CRAWFORD
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Re: Questionnaire on armour corrosion products

Dear Colleague,

My name is James Crawford, a metals conservator following a Masters in Applied Conservation Studies at The Institute of Conservation and Management of Cultural Heritage, Heritage Malta. I initially trained and worked in Australia and then worked in a French conservation lab specialised in the treatment of iron-based objects where I found my interest in determining the original surfaces of metal artefacts.

I write seeking your advice on a culturally significant collection of ferrous (iron/steel) body armour under investigation through my Master's research dissertation. I believe you and your colleagues might have experience with this type of artefact material and its corrosion phenomena and request your contribution via the completion of the following questionnaire.

This armour collection (circa 16-17th centuries) formerly of the Knights of the Order of St John, Malta was mostly manufactured in Italy. It is still housed in the Grand Master's Palace at Valletta, Malta, since 1604. The armour's *early* life (circa 1530-1798) experienced a variable history of action and maintenance while serving as an arsenal in warfare, and during times of peace suffered from technological obsolescence and neglect. More *recently* (1798-present), the aging and non-functional artefacts reached antiquarian status.

Today, some armour feature degraded corrosion protection coatings and ferrous corrosion products. With the recent formation of Heritage Malta, a professional organisation responsible for the management of heritage in Malta, the time has come to address these outstanding issues. In preparation for further preventive conservation measures (i.e. improved environment, maintenance) in conjunction with improved protective coatings, this research dissertation investigates the concept of original surfaces and conservation-restoration approaches to corroded armour.

Since this research is dedicated to investigating conservation-restoration approaches to corroded armour worldwide, conservation professionals who might already be familiar with the issues are being surveyed with this questionnaire for their unpublished current practices and philosophies. Please refer to the following document "Armour Collection & Research Background" for a description of the type of armour. The purpose of the questionnaire is to determine current armour conservation practices towards ferrous corrosion products and the ideas behind the approaches taken.

The final date for return of the completed questionnaire is in two weeks time, Thursday May 17 2007, with a summary of the questionnaire results being announced in August 2007.

It is appreciated that you might make the time to complete the enclosed "Ferrous Armour Corrosion Product Questionnaire" after reading "Armour Questionnaire Background", thereby making your contribution to the development of the armour conservation profession and to help further safeguard this valued heritage collection.

If you have armourer/restorer/conservator colleagues with experience working on armour then it would be appreciated if you could forward this document to them. Respondent confidentiality is assured and information drawn from the questionnaire will be used to determine trends between/within continents/countries. Institutions or individuals will not be referred to in the evaluation of the questionnaire results.

Do not hesitate to get in contact if you have any questions.

Thanking you in advance.

Yours sincerely,

James CRAWFORD
Candidate for Masters in Applied Conservation Studies

Armour Questionnaire Background

Aim

The purpose of the following questionnaire is to collect an impression of the **varying experiences and perspectives** of armour conservation-restoration professionals and their **various methods of approaching ferrous corrosion products on ferrous armour.** The **research focus** is the **motivation** behind any corrosion product related procedures and any used **techniques (i.e. materials/equipment & application method)**.

Armour - Description, Provenance & Fabrication

As an *artefact genre*, the armour displayed on the walls at the Palace Armoury (PA), Malta, can be referred to as being munitions/field armour resembling a design typical of mid 16th-mid 17th century North Italian style. Characteristic of this genre is its modest decoration. The most common surface features are volutes (spirals) and edges formed by hammering the sheet metal reverse (repoussé), filed/hammered roped-edges and less frequently single etched/engraved lines. Some edges are cut in a curved (scalloped) or indented manner (along a lame's centre-line). The armour outer surfaces do not feature planes of acid-etching, gilding, bluing or browning. While it appears that the inner surfaces are unpolished. The most common armour pieces are helmets (e.g. morions, cabassets), while breastplates, backplates, pauldrons (shoulder piece), tassets (upper thigh piece) and arm (i.e. forearm (lower cannon/vambrace), upperarm (upper cannon/rerebrace) and elbow (couter) pieces also feature. This armour is relatively thin (0.8-1.2mm).

As an *artefact material*, the armour is predominantly multiple sheets (lames) of wrought-forged steel and/or iron [Vella et al 2004 : 230[1]] combined with minor, but integral lame joining elements of ferrous rivets, often with copper alloy coloured plated heads and rosettes. The many wrought-forged sheet metal pieces are likely to have been made from bloomery furnaces or blast furnaces & finery forges. Leather or textile remnants formerly in interiors are very uncommon and if present are locally restricted to riveted areas.

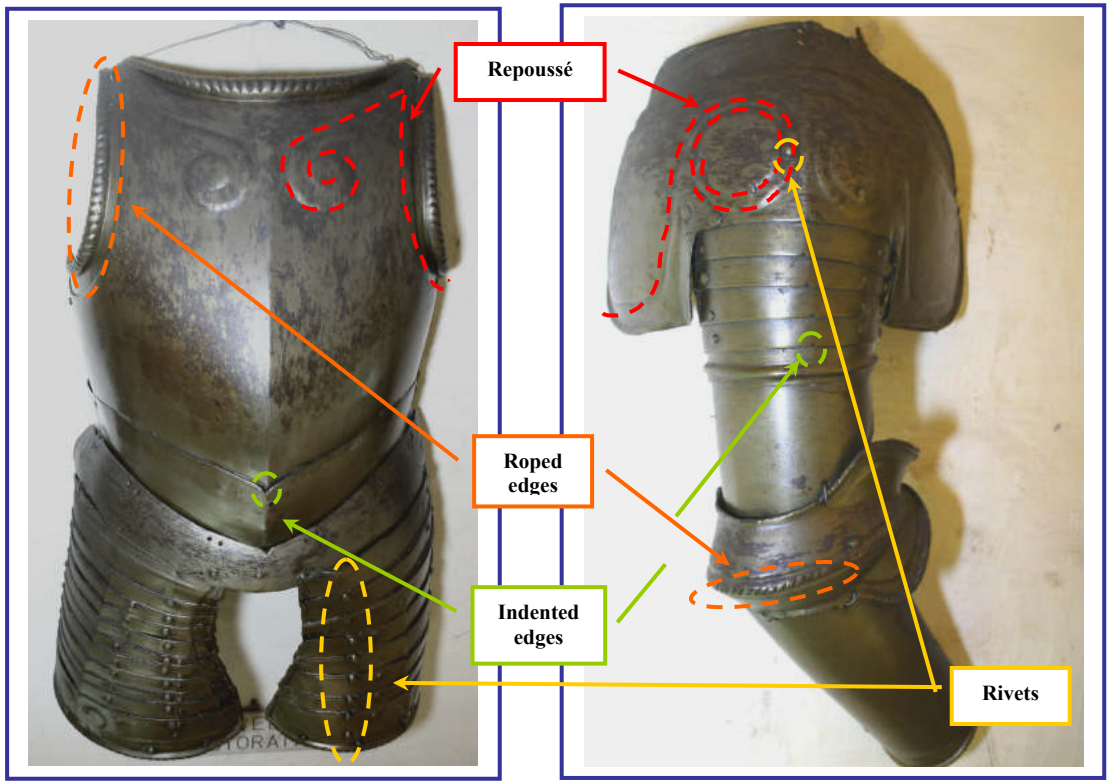


Figure 1 Typical late 16th-mid 17th century North Italian style munitions armour at the Palace Armoury. Left: Breastplate and tassets. Right: Pauldron, upper cannon, couter and lower cannon

[1] [1] Vella, D. Degrigny, C., Grech, M. Williams, A. (2004). "Metallurgy of armour exhibited at the Palace Armoury Valletta, Malta", in Metal 04 Proceedings of the international conference on metals conservation. Eds. David Hallam & John Ashton pp. 215-233. National Museum of Australia : Canberra.

Armour Corrosion

- Corrosion has occurred following coating failure that could have occurred due to high relative humidity and exacerbated by sea mist aerosols and particle pollution.
- Original metallic surface of armour appears to have been covered with corrosion products or modified into corrosion products to varying extents. Refer to Table 1.

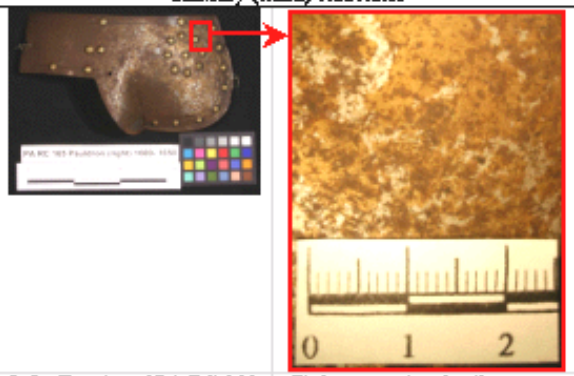
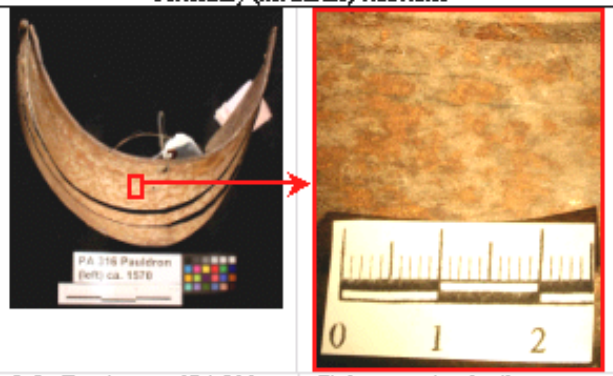
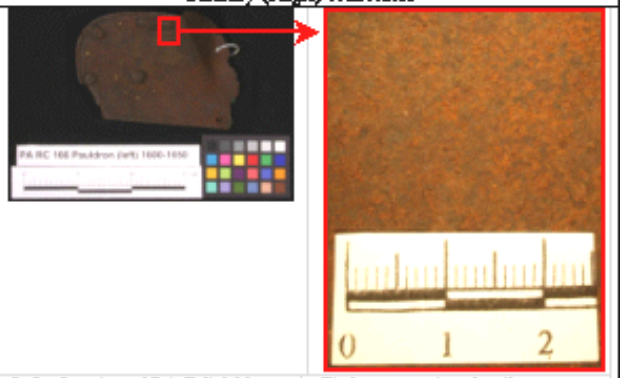
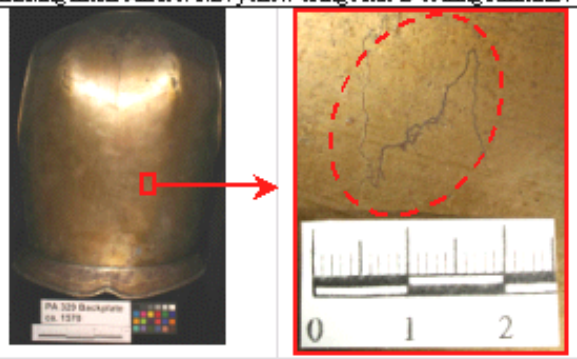
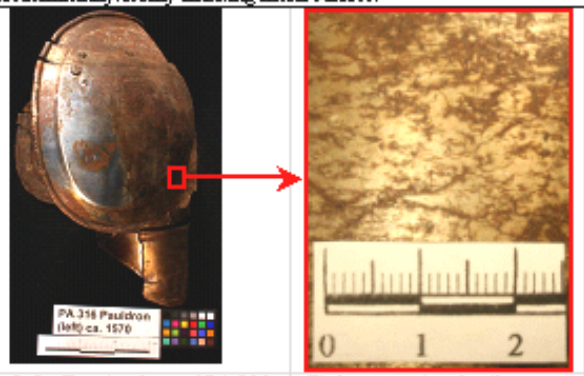
CORROSION PRODUCT MORPHOLOGY	CORROSION RELATIVE DEGREE OF DEVELOPMENT		
	Primary (Mild) corrosion	**Secondary (Moderate) corrosion**	**Tertiary (High) corrosion**
Uneven generalised corrosion	 *Left*: Exterior of PA RC 165 - Pauldron *Right*: corrosion detail	 *Left*: Exterior top of PA 316 - Pauldron *Right*: corrosion detail	 *Left*: Interior of PA RC 166 - Pauldron part *Right*: corrosion detail
	Isolated areas of apparently thin surface corrosion products partially masking metal surface. NB: yellow-orange hue is coating remnants.	United areas of apparently thin localised surface corrosion products predominantly/totally masking metal surface.	Evenly distributed and apparently thick area of surface corrosion products totally masking metal surface.
Filiform corrosion	 *Left*: Exterior of PA 329 - Backplate *Right*: corrosion detail	 *Left*: Exterior front of PA 316 - Pauldron *Right*: corrosion detail	 *Left*: Exterior side of PA 316 - Pauldron *Right*: corrosion detail
	Localised area of surface corrosion products restricted to the filiform filament morphology positioned underneath protective coating/s (yellow hue).	Filiform density has increased and corrosion products have dispersed outwards from the filament threads forming a corrosion product film over the metal. The filiform is still visible, but the film of corrosion products predominates and begins to locally deposit corrosion products above coating/s (yellow hue).	The dispersion of the corrosion product film continues and is heavily present above the coating/s. The filiform is almost obscured, but thin filament lines still provide a contrast against the white metal. More deposition of corrosion products above coating/s (yellow hue).

Table 1 Summary of common corrosion morphologies found on the PA munitions armour and their relative degree of development

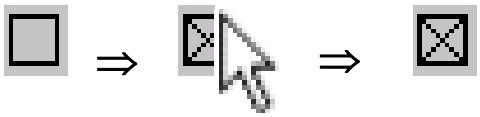
Ferrous armour corrosion product questionnaire

This questionnaire has been produced as part of the Masters dissertation research project, "Case studies in the determination of the original surface limits of the ferrous armour of the Knights of St John, Palace Armoury, Malta," conducted by James Crawford, Institute of Conservation and Management of Cultural Heritage, Heritage Malta.

If you have experience working as an armourer, restorer or conservator of wrought-forged ferrous (iron or steel) armour kindly complete the following questionnaire after reading the accompanying Cover letter and document "Armour Questionnaire Background".

QUESTIONNAIRE INSTRUCTIONS

1. "Cross" the appropriate grey boxes (☐) with your computer mouse pointer ( ), as below.



1 **2** **3**

2. Type out any text responses in the grey underlined spaces provided.

1 **2** **3**

3. Kindly email the completed and saved document to jamesbcrawford76@gmail.com.

If you prefer, the questionnaire can be printed, completed by pen and posted to:

Mr J. Crawford
Heritage Malta – Conservation Division
Kalkara, Bighi CSP12
MALTA

Questionnaire final submission date: **Thursday 17th May 2007**.

QUESTIONNAIRE START

Question 1) Which types of wrought-forged ferrous (iron/steel) metal armour do you have experience working on? Select as many responses as appropriate and continue to Question 2.

- **A** ☐ **Ferrous sheet/plate armour**
- **B** ☐ **Ferrous chain-mail armour**
- **C** ☐ **Ferrous scale armour**
- **D** ☐ **Other ferrous armour, specify…**

Question 2) Have you worked on ferrous (iron/steel) armour with areas not featuring decorated surfaces? e.g. no gilt, etched, blued or browned surfaces. Select one response only.

- **A** ☐ **Yes** If selected A, continue to Question 3.
- **B** ☐ **No** If selected B, continue to Question 21.

Question 3) Have you worked on ferrous (i.e. iron/steel) sheet/plate armour with decorated surfaces? e.g. gilt, etched, blued or browned surfaces. Select one response only and continue to Question 4.

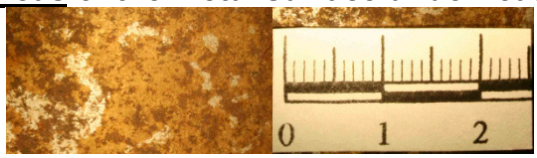
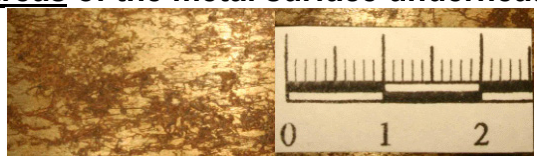
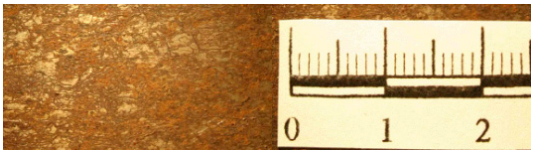
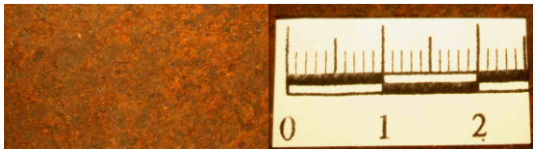
- **A** ☐ **Yes** If selected A, **NOTE that for the remainder of the questionnaire, it is requested you consider only armour with areas not featuring decorated surfaces.**
- **B** ☐ **No**

Question 4) Do you have experience with outer surfaces (i.e. side not facing the wearer) of ferrous armour that feature ferrous corrosion products? Select one response only

A ☐ **Yes** If selected A, continue to Question 5.
B ☐ **No** If selected B, continue to Question 10.

Question 5) Regarding only armour you have experienced with areas of ferrous corrosion products on outer surfaces (i.e. side not facing the wearer), indicate below in the given categories approximately the amount of corrosion products present and its relative frequency (%).

- Do not include armour without corrosion products on the outer surfaces, and do not include the corrosion product-free areas of armour featuring corrosion products.
- The total percentage from subsections A, B, C & D should equal 100%. For example, A. (40%) + B. (30%) + C. (20%) + D. (10%) = 100%

Relative corrosion product quantity (centimetre scale)	Relative frequency of total experience with corroded armour outer surfaces (A + B + C + D = 100%)
A Areas with very thin layers of corrosion products that obscure/conceal some areas of the metal surface underneath 	Select one response only 10% ☐ 20% ☐ 30% ☐ 40% ☐ 50% ☐ 60% ☐ 70% ☐ 80% ☐ 90% ☐ 100% ☐
B Areas with thin layers of corrosion products that obscure/conceal many areas of the metal surface underneath 	Select one response only 10% ☐ 20% ☐ 30% ☐ 40% ☐ 50% ☐ 60% ☐ 70% ☐ 80% ☐ 90% ☐ 100% ☐
C Areas with thick layers of corrosion products that obscure/conceal most areas of the metal surface underneath 	Select one response only 10% ☐ 20% ☐ 30% ☐ 40% ☐ 50% ☐ 60% ☐ 70% ☐ 80% ☐ 90% ☐ 100% ☐
D Areas with thicker layers of corrosion products that obscure/conceal all areas of the metal surface underneath 	Select one response only 10% ☐ 20% ☐ 30% ☐ 40% ☐ 50% ☐ 60% ☐ 70% ☐ 80% ☐ 90% ☐ 100% ☐

Question 6) What do you most commonly do when you have ferrous corrosion products present on the outer surface (i.e. side not facing the wearer) of ferrous armour? Select one response only

- **A** ☐ **Modify with rust converter solutions** If selected A, continue to Question 7
- **B** ☐ **Remove some or all** If selected B, continue to Question 8
- **C** ☐ **Leave them all, do not intervene** If selected C, continue to Question 10
- **D** ☐ **Other, specify**… If selected D, continue to Question 10

Question 7) Which solutions do you use to convert corrosion products on armour outer surfaces (i.e. side not facing the wearer)? Select as many responses as appropriate and continue to Question 10.

- **A** ☐ **Tannic acid solution** concentration… dissolved in… applied by/with (e.g. brush, immersion)…
- **B** ☐ **Phosphoric acid solution** concentration… dissolved in… applied by/with (e.g. brush, immersion)…
- **C** ☐ **Tannic & phosphoric acid solution** concentrations… dissolved in… applied by/with (e.g. brush, immersion)…
- **D** ☐ **Other, specify**… concentration… dissolved in… applied by/with (e.g. brush, immersion)…

Question 8) Which corrosion products, do you most commonly remove from corroded ferrous armour that has ferrous corrosion products on the outer surface (i.e. side not facing the wearer)? Select one response only and continue to Question 9.

- **A** ☐ **Remove all corrosion products until a metal surface is revealed**
- **B** ☐ **Remove red-brown corrosion products, and almost all of the dark grey/black corrosion products in/above the corrosion pits**
- **C** ☐ **Remove red-brown corrosion products, leaving most/all dark grey/black corrosion products in/above the corrosion pits**
- **D** ☐ **Other, specify**…

Question 9) Which factors determine which corrosion products you remove from corroded ferrous armour that has ferrous corrosion products on the outer surface (i.e. side not facing the wearer)?

- Select as many responses as appropriate to cover any of the circumstances you have experienced.
- Specify any further details from your experiences.
- Indicate the degree of influence of each determining factor by selecting one response only from the scale of five boxes (Very high to Very low).

For example,

- **A** ☒ **Display aesthetics requirements, specify**…corrosion products are removed so the marks do not contrast with the adjacent metal surfaces.

Select one response only				
☐ **Very high**	☐ **High**	☒ **Moderate**	☐ **Low**	☐ **Very low**

A ☐ **Display aesthetics requirements, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

B ☐ **Armour's metal surface level adjacent to corrosion pits, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

C ☐ **Corrosion prevention, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

D ☐ **Armour's surface information, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

E ☐ **Museum visitor expectation, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

F ☐ **Curator's instruction, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

G ☐ **Storage requirements, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

H ☐ **Other, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

I ☐ **Other, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

Question 10) Do you have experience with inner surfaces (i.e. side facing the wearer) of ferrous armour that feature ferrous corrosion products? Select one response only

A ☐ **Yes** If selected A, continue to Question 11.
B ☐ **No** If selected B, continue to Question 15.

Question 11) What do you most commonly do when you have ferrous corrosion products present on the inner surface (i.e. side facing the wearer) of ferrous armour? Select one response only

A ☐ **Modify with rust converter solutions** If selected A, continue to Question 12.
B ☐ **Remove some or all** If selected B, continue to Question 13.
C ☐ **Leave them all, do not intervene** If selected C, continue to Question 21.
D ☐ **Other, specify**…_____ If selected D, continue to Question 21.

Question 12) Which solutions do you use to convert corrosion products on armour inner surfaces (i.e. side facing the wearer)? Select as many responses as appropriate and continue to Question 19.

A ☐ **Tannic acid solution** concentration… dissolved in… applied by/with…
B ☐ **Phosphoric acid solution** concentration… dissolved in… applied by/with…
C ☐ **Tannic & phosphoric acid solution** concentrations… dissolved in… applied by/with…
D ☐ **Other, specify**… concentration… dissolved in… applied by/with…

Question 13) Which corrosion products do you most commonly remove from corroded ferrous armour that has ferrous corrosion products on the inner surface (i.e. side facing the wearer)? Select one response only and continue to Question 14.

A ☐ **Remove all corrosion products present until a metal surface is revealed**
B ☐ **Remove red-brown corrosion products, and almost all of the dark grey/black corrosion products in/above the corrosion pits**
C ☐ **Remove red-brown corrosion products, leaving most/all dark grey/black corrosion products in/above the corrosion pits**
D ☐ **Other, specify**…_____

Question 14) Which factors determine which corrosion products you remove from corroded ferrous armour that has ferrous corrosion products on the inner surface (i.e. side facing the wearer)?

- Select as many responses as appropriate to cover any of the circumstances you have experienced.
- Specify any further details from your experiences.
- Indicate the degree of influence of each determining factor by selecting one response only from the scale of five boxes (Very high to Very low).

For example,

A ☒ **Display aesthetics requirements, specify**…corrosion products are removed to remove the marks that contrast with the adjacent metal surfaces.

Select one response only				
☐ **Very high**	☐ **High**	☒ **Moderate**	☐ **Low**	☐ **Very low**

A ☐ **Display aesthetics requirements, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

B ☐ **Armour's metal surface level adjacent to corrosion pits, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

C ☐ **Corrosion prevention, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

D ☐ **Armour's surface information, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

E ☐ **Museum visitor expectation, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

F ☐ **Curator's instruction, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

G ☐ **Storage requirements, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

H ☐ **Other, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

I ☐ **Other, specify…**

Select one response only				
☐ **Very high**	☐ **High**	☐ **Moderate**	☐ **Low**	☐ **Very low**

Question 15) Which equipment/materials and application methods do you use to remove corrosion products (from outer or inner armour surfaces)?
NOTE: If you do not practice or have experience with corrosion product removal continue to Question 20.

- Select as many responses as appropriate to cover any of the corrosion product removal circumstances you have experienced.
- Specify the application technique (e.g. hand/machine, speed, time, immersion etc) and complementary materials and procedures (e.g. lubricating liquids, rinsing liquids) used for the equipment/material procedure.

For example,

A ☒ **Steel wool** Specify below**,**

I) ☒ **Grade 1** applied by/with… as a small ball in a circular motion by hand and lubricated with WD-40 brand oil. Oil residue removed with acetone on cotton wool.

A ☐ **Steel wool** Specify below,

I) ☐ **Grade 1** applied by/with…
II) ☐ **Grade 0** applied by/with…
III) ☐ **Grade 00** applied by/with…
IV) ☐ **Grade 000** applied by/with…
V) ☐ **Grade 0000** applied by/with…
VI) ☐ **Others, specify,** grade… applied by/with…
VII) ☐ **Others, specify,** grade… applied by/with…
VIII) ☐ **Unsure or do not know grade** applied by/with…

B ☐ **Abrasive ("sand") papers** Specify below,

I) ☐ **Emery paper** grade… applied by/with…
II) ☐ **Garnet paper** grade… applied by/with…
III) ☐ **Silica carbide paper** grade… applied by/with…
IV) ☐ **Aluminium oxide paper** grade… applied by/with…
V) ☐ **Chromium oxide paper** grade… applied by/with…
VI) ☐ **Other, specify** grade… applied by/with…
VII) ☐ **Other, specify** grade… applied by/with…
VIII) ☐ **Unsure or do not know type or grade** applied by/with…

C ☐ **Mechanical rotating brushes on handheld device (e.g. "microdrill", Dremel®)** Specify below,

I) ☐ **Steel (ferrous) wire brushes** diameter… speed…
II) ☐ **Brass (copper alloy) wire brushes** diameter… speed…
III) ☐ **Other, specify** … diameter… speed…
IV) ☐ **Unsure or do not know type** diameter… speed…

D ☐ **Mechanical rotating wheels/mops/brushes on fixed device (e.g. pedestal or bench-mounted grinder/mop)** Specify below,

I) ☐ **Animal fibre brushes**
II) ☐ **Plastic brushes**
III) ☐ **Metal brushes**
IV) ☐ **Textile mops** If selected IV continue below.
(i) Do you use textile mops with a polishing compound (e.g. "jewellers rouge")?
a. ☐ **Yes**
b. ☐ **No**
V) ☐ **Unsure or do not know type** diameter… speed…

E ☐ **Handheld abrasive implements, specify below,**

- **I)** ☐ **Toothbrush** applied by/with…
- **II)** ☐ **Nylon brush** applied by/with…
- **III)** ☐ **Scalpel** applied by/with…
- **IV)** ☐ **Metal scraper** applied by/with…
- **V)** ☐ **Wooden sticks** applied by/with…
- **VI)** ☐ **Bamboo sticks** applied by/with…
- **VII)** ☐ **Plastic sticks** applied by/with…
- **VIII)** ☐ **Fibreglass pens** applied by/with…
- **IX)** ☐ **Custom made tools, specify,** _____ applied by/with…
- **X)** ☐ **Others, specify,** _____ applied by/with…

F ☐ **Abrasive wadding** Specify below,

- **I)** ☐ **Harrington's Metal Polish Wadding®** applied by/with…
- **II)** ☐ **Nevr Dull® by Ashland/EagleOne** applied by/with…
- **III)** ☐ **Ouator® M by Maison & Compagnie** applied by/with…
- **IV)** ☐ **Ouator® A by Maison & Compagnie** applied by/with…
- **V)** ☐ **Ouator® MPT by Maison & Compagnie** applied by/with…
- **VI)** ☐ **Other, specify** brand… applied by/with…
- **VII)** ☐ **Unsure or do not know type** applied by/with…

G ☐ **Abrasive powders** Specify below,

- **I)** ☐ **Chalk powder (calcium carbonate/whiting)** grade… applied by/with…
- **II)** ☐ **Tripoli/rottenstone (limestone-silica mixture)** grade… applied by/with…
- **III)** ☐ **Pumice powder** grade… applied by/with…
- **IV)** ☐ **Other, specify**… applied by/with…
- **V)** ☐ **Other, specify**… applied by/with…
- **VI)** ☐ **Unsure or do not know type** applied by/with…

H ☐ **Abrasive pastes/liquids** Specify below,

- **I)** ☐ **Prelim® paste by Picreator** applied by/with…
- **II)** ☐ **Autosol® liquid polish by CMS** applied by/with…
- **III)** ☐ **Flitz® Paste Metal, Plastic, Fibreglass Polish & Paint Restorer by Flitz** applied by/with…
- **IV)** ☐ **Flitz® Liquid Metal, Plastic, Fibreglass & Polish by Flitz** applied by/with…
- **V)** ☐ **Goddards® Brass & Copper Polish** applied by/with…
- **VI)** ☐ **Goddards® Cookware Cleaner** applied by/with…
- **VII)** ☐ **Brasso® liquid polish by ReckittBenckiser** applied by/with…
- **VIII)** ☐ **Silvo® liquid polish by ReckittBenckiser** applied by/with…
- **IX)** ☐ **Other, specify**… brand… applied by/with…
- **X)** ☐ **Other, specify**… brand… applied by/with…
- **XI)** ☐ **Unsure or do not know type** applied by/with…

I ☐ **Acid solutions** Specify below,

- **I)** ☐ **Phosphoric acid** concentration… applied by/with…
- **II)** ☐ **Oxalic acid** concentration… applied by/with…
- **III)** ☐ **Hydrochloric acid** concentration… applied by/with…
- **IV)** ☐ **Formic acid** concentration… applied by/with…
- **V)** ☐ **Tannic acid** concentration… applied by/with…
- **VI)** ☐ **Other, specify**… concentration… applied by/with…
- **VII)** ☐ **Other, specify**… concentration… applied by/with…

J ☐ **Alkaline solutions** Specify below,
- **I)** ☐ **Sodium hydroxide** concentration… applied by/with…
- **II)** ☐ **Ammonium hydroxide** concentration… applied by/with…
- **III)** ☐ **Other, specify**… concentration… applied by/with…
- **IV)** ☐ **Other, specify**… concentration… applied by/with…
- **V)** ☐ **Unsure or do not know type** applied by/with…

K ☐ **Chelating agent (complexing) solutions** Specify below,
- **I)** ☐ **NaEDTA (monosodium ethylene diamine tetra-acetic acid)** concentration… applied by/with…
- **II)** ☐ **2NaEDTA (disodium ethylene diamine tetra-acetic acid)** concentration… applied by/with…
- **III)** ☐ **3NaEDTA (trisodium ethylene diamine tetra-acetic acid)** concentration… applied by/with…
- **IV)** ☐ **4NaEDTA (tetrasodium ethylene diamine tetra-acetic acid)** concentration… applied by/with…
- **V)** ☐ **Other, specify**… concentration… applied by/with…
- **VI)** ☐ **Other, specify**… concentration… applied by/with…

L ☐ **Laser ablation** Specify below,
- **I)** ☐ **Laser source** … Wavelength… (nm)Fluence range … (J/cm^2)
- **II)** ☐ **Laser source** … Wavelength… (nm)Fluence range … (J/cm^2)

M ☐ **Air-abrasive "sandblasting"** Specify below,
- **I)** ☐ **Glass spheres** Size … (micron) Pressure range… (Bar)
- **II)** ☐ **Corundum** Size … (micron) Pressure range… (Bar)
- **III)** ☐ **Vegetable powder, specify**… Size … (micron) Pressure range … (Bar)
- **IV)** ☐ **Other, specify**… Size … (micron) Pressure… (Bar)
- **V)** ☐ **Unsure or do not know type**Size … (micron)Pressure. (Bar)

N Describe in brief any corrosion product removal technique (i.e. materials/equipment & application method) not described in Question 15. Specify …

Question 16) Do you remove protective coatings from the armour before removing corrosion product or corrosion converter solutions?

A ☐ **Yes** If selected A, continue to Question 17.
B ☐ **No** If selected B, continue to Question 18.

Question 17) How do you remove protective coatings from armour before removing corrosion products?

A ☐ **Solvent application**
B ☐ **Mechanical abrasion**
C ☐ **Other, specify**…

Question 18) After corrosion product removal do you polish adjacent metallic surfaces so as to homogenise the overall appearance with zones that have been polished during corrosion product removal? Select one response only and continue to Question 19.

A ☐ **Yes**
B ☐ **No**

Question 19) After corrosion product removal do you rinse the surface from corrosion product residues and powders? Select one response only and continue to Question 21.

A ☐ **No**

B ☐ **Yes, specify**

I) ☐ **Fibre/cloth (e.g. paper tissue, textile)**

II) ☐ **Solvent (e.g. acetone, white spirits, alcohol) and fibre/cloth (e.g. paper tissue, textile)**

III) ☐ **Liquid/solution, specify…**

IV) ☐ **Other, specify…**

Question 20) After corrosion product conversion do you rinse the surface from conversion solution residues? Select one response only and continue to Question 21.

A ☐ **No**

B ☐ **Yes, specify**

I) ☐ **Fibre/cloth (e.g. paper tissue, textile)**

II) ☐ **Solvent (e.g. acetone, white spirits, alcohol) and fibre/cloth (e.g. paper tissue, textile)**

III) ☐ **Liquid/solution, specify…**

IV) ☐ **Other, specify…**

Question 21) Please feel free to make any comments…

	CONTACT DETAILS
Contact name:	
Contact position:	
Name of institution:	
Country:	
Email address:	

QUESTIONNAIRE END

Thank you for your contribution.

Kindly email the completed and saved document to jamesbcrawford76@gmail.com.

If you completed the questionnaire by pen then it can be posted to:

Mr J. Crawford
Heritage Malta – Conservation Division
Kalkara, Bighi CSP12
MALTA

Questionnaire final submission date: **Thursday 17th May 2007**.