Titanic's Antifouling Paint (revised)

By Bob Read, D.M.D.

Introduction

The purpose of this article is primarily to document the type of antifouling paint used on *Titanic* and to try to determine a close approximation of the color of this antifouling paint. This article is a revision of the original article I wrote on this subject. It is being revised to present new evidence and to answer questions which have been posed by critics of the original article. I will also challenge these critics with questions of my own.

Titanic's Antifouling Paint Composition

In the early development of antifouling paints for iron and steel hulled ships, very few patents were issued up to 1830. By 1867, over 300 antifouling patents had been issued. Titanic had a very specific type of antifouling paint. The Suter, Hartmann & Rahtjens formula was exclusively used.

Between 1860 and 1865, John Rahtjen invented his paint formula to protect the hulls of iron and steel ships. In 1873 this formula was patented in Britain. This formula was a shellac type antifouling composition which used mercuric oxide and arsenic as its toxics. Others have claimed that *Titanic's* antifouling paint contained red lead or cuprous oxide but neither is the case. For the first time the original 1873 Rahtjens patent is reproduced as an appendix to this article. It is a complex formula with numerous ingredients. This formula was never re-patented.

Some have tried to reconstruct the color of this antifouling paint based on what they believed were its ingredients. They were not only wrong about the ingredients used in this formula but they were unaware of the component of the formula which actually was the pigment for this paint.

The pigment used in Rahtjens patent was "Venetian red". Venetian red is a natural earth containing clay tinted by iron oxide. It is also known as "red ochre". This pigment has been used since prehistoric times and is one of the most durable of pigments. Those who are skeptical of the durability of *Titanic's* antifouling paint pigment should consider the cave paintings in the Cueva de las Manos in Santa Cruz, Argentina. This art, shown in Figure 1, dates between 11,000 to 7000 B.C. The pigments used for the reds are iron oxides, or red ochre, like that used in *Titanic's* antifouling paint. This should prove the durability of this pigment.

Figure 1

Cave painting using red ochre pigment

Samples of *Titanic's* Antifouling Paint

Modelers and artists in search of authentic colors to represent those used on *Titanic* have always lamented, "*If only we had a paint sample from the wreck."* In the case of *Titanic's* antifouling paint, we are fortunate in that we do have examples of antifouling paint from the wreck. Figures 2-4 show photos of varying quality. They are shown more to demonstrate the durability of the color rather than to identify a specific shade.

Figure 2

Titanic's antifouling paint

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Figure 3

Titanic's antifouling paint

Figure 4

Titanic's antifouling paint

The problem with these photos is that they are all locations where the antifouling paint is applied to steel. The underlying steel has rusticles forming which affect the true color of the antifouling paint.

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Fortunately, we have a photo where the antifouling paint is unaffected by rusticles, silt, and other accretions. Figure 5 shows *Titanic's* port wing propeller.

Figure 5

Titanic's port wing propeller blade with adhering antifouling paint

At the root of the blade is a pristine example of the antifouling paint. The propeller blades are manganese bronze so they don't rust like steel shell plating. If one looks at the propeller blade, it is free from corrosion.

Light

Photos of *Titanic's* wreck have been taken with various lighting. There is no natural light at the depth of the wreck. Therefore, the quality of any photos is quite variable. To analyze a color shade accurately, full spectrum lighting is essential. If full spectrum lighting is not used, the photos have a primarily "blue" look.

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Figure 6 shows a comparison of a capstan taken without and with full spectrum lighting. Fortunately Figure 5 of *Titanic's* propeller is taken with full spectrum lighting.

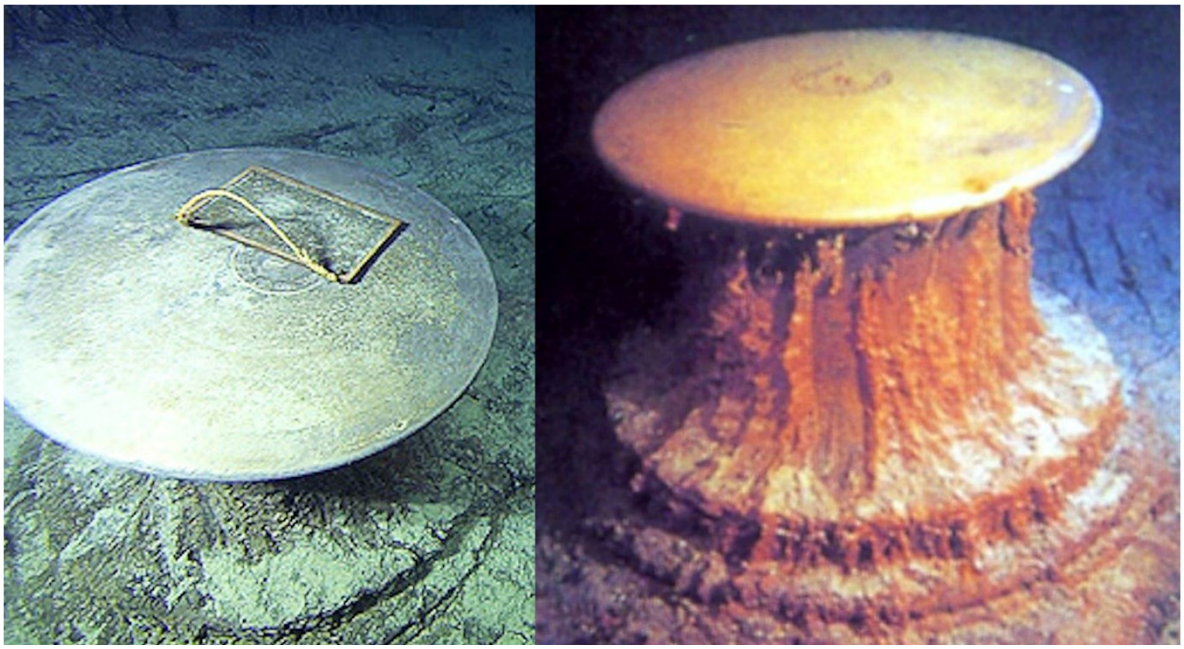

Figure 6

Titanic capstan without and with full spectrum lighting

Conditions

The conditions at the *Titanic* wreck site are severe in some aspects but they are actually beneficial for helping to preserve the red ochre pigment in the antifouling paint. These preservative conditions are:

1. No UV light exposure.
2. Low temperature just above freezing.
3. Low oxygen content in the seawater.

The Issue of Fading

The crux of the argument against the antifouling paint on *Titanic's* propeller being a representative shade of her antifouling paint as it was originally applied is the contention of the critics that "***It couldn't be that light. It had to have faded."*** This belief in the inevitability of the fading of this sample of *Titanic's* antifouling paint most likely stems from the critics' experience with paint which has been exposed to UV rays. For *Titanic,* this is not a factor.

When this line of argumentation failed, the critics then contended that the paint sample faded "chemically". My challenge to this new objection asserting "chemical fading" would be to ask them:

What exactly is the chemical reaction which would cause fading of red ochre pigment?

I have searched but have found no studies which have examined the effect of deep seawater conditions on paint. I don't expect that the critics are familiar with any such studies either.

Let's look at another aspect to see if this "chemical fading" theory holds up to scrutiny. I would ask the question:

Do we see other examples of paint fading on the *Titanic* wreck?

Much of the paint has been destroyed by the process of rusting or the degradation by rusticle forming bacteria. So, let's take an example where some of the paint pigment color has not been destroyed.

In the year 2000, conservation procedures were undertaken on an officers' quarters window recovered from the *Titanic* wreck. Over a period of a year, the bronze window frame was desalinated and cleaned. Figure 7 shows before and after photos of this conservation process.

Figure 7

Before and after photos of conservation procedures on *Titanic* window

Figure 8 is a close-up of the window frame showing the paint which in some areas were found to be adherent to the frame.

Figure 8

Dark mast paint remnants on *Titanic* window frame

We know this paint color to be "dark mast" from other sources. The color is very representative of "dark mast" and does not appear to be faded at all. The question for the critics then becomes:

If the paint sample on the officers' quarters window did not fade to any discernable extent, then why would we expect the antifouling paint sample on *Titanic's* propeller *must* have faded?

Historic Photos

As with other discussions of color on *Titanic,* it bears repeating that: **It is impossible to determine unknown colors from a black and white photo.** What makes the effort even more confusing is that photos in this era were taken with both orthochromatic (blue sensitive) film and panchromatic modern black and white film. Both have their own unique characteristics but neither type of film can be used to determine unknown colors. Therefore, black and white photos are unacceptable for purposes of this discussion.

Color Photos of Other Ships

The problem with trying to use color photos of other ships to determine *Titanic's* antifouling paint color is that there is a wide array of antifouling paint colors. The biggest obstacle in the use of color photos of other ships is that we have no idea what antifouling paint they used. If they didn't use the Rahtjens formula, then there is no basis for comparison.

Determining a Standard

Some might wonder if the Rahtjens patent formula was followed, could we arrive at the true color of *Titanic's* antifouling paint? The biggest obstacle to doing this successfully would be the fact that there are considerable variations in the shade of Venetian red pigment powder. We don't know the source for what Rahtjens specified so there is a considerable element of uncertainty in an exercise like this.

What we *do* have is photographic evidence of the actual paint applied to *Titanic* in 1912 which still exists. Could there be some variation due to the particular variables of the photo? Certainly. Could there have been some minor change in the color over time? Possibly. However, the most solid link we have to the color of *Titanic's* antifouling paint color is the photo of an actual surviving sample on her propeller blade. Is the color of *Titanic's* antifouling paint outside the range of documented color of antifouling paint? Certainly not. Therefore, substitution of other antifouling paint colors as being authentic is not only speculative but has no connection with any known *Titanic* evidence.

Figure 9 shows a drawing of *Titanic* with the color of antifouling derived from a digital sample of the paint color on *Titanic's* propeller. It would be impossible to say that it is exact but I believe it is within a fairly narrow range of the actual color based on the evidence.

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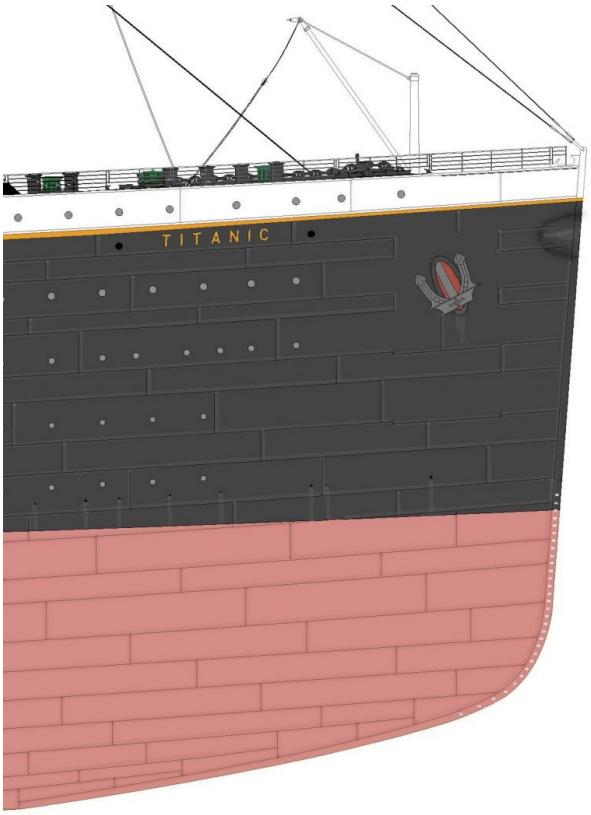

Figure 9

Color of *Titanic's* antifouling paint based on wreck evidence

Conclusion

This revised article has sought to introduce new evidence to the *Titanic* antifouling paint color discussion. Additionally, it has sought to answer critics' questions and to challenge their positions by asking logical questions. The purpose of this article is not to change anyone's mind. That will not likely happen. I have endeavored to make the case logically for what I believe is the closes approximation of the color of antifouling paint applied to *Titanic* in 1912 *based on the evidence.*

Appendix

1873 British Patent for Rahtjens Antifouling Paint

A.D. 1873, *29th November.* N° 3920.

Preservative Composition for Ships' Bottoms, &c.

LETTERS PATENT to Heinrich Rahtjen, of Bremerhaven, Germany, and temporarily of Basinghall Street, in the City of London, for the Invention of "AN IMPROVED ANTI-FOULING AND PRESERVATIVE COMPOSITION FOR SHIPS' BOTTOMS AND OTHER SUBMERGED STRUCTURES."

Sealed the 20th January 1874, and dated the 29th November 1873.

PROVISIONAL SPECIFICATION left by the said Heinrich Rahtjen at the Office of the Commissioners of Patents, with his Petition, on the 29th November 1873.

I, HEINRICH RAHTJEN, of Bremerhaven, Germany, and temporarily of Basinghall Street, in the City of London, do hereby declare the nature of the said Invention for "AN IMPROVED ANTI-FOULING AND PRESERVATIVE COMPOSITION FOR SHIPS' BOTTOMS AND OTHER SUBMERGED STRUCTURES," to be as follows:—

This Invention relates to an improved composition for preserving and preventing the fouling of iron ships' bottoms as well as other submerged iron structures.

Rahtjen's Improved Preservative Composition for Ships' Bottoms, &c.

The following are the ingredients of this improved composition, namely :—

No. 1. Alcohol, wood naptha, or methylated spirit.
No. 2. Shellac.
No. 3. Thick turpentine.
No. 4. Linseed oil.
No. 5. Common rosin.
No. 6. Galipot.
No. 7. Tar spirit.
No. 8. Tallow.
No. 9. Venetian red.
No. 10. Arsenic.
No. 11. Oxide of zinc.
No. 12. Oxide of mercury.

These ingredients are incorporated together in the following manner :— I first dissolve No. 2 in No. 1, I then take Nos. 3, 4, 5, 6, 7, 8, and heat them together, and when in a cold state I mix with them the solution of shellac. Lastly, I mix Nos. 9, 10, 11, and 12, in a dry state with the foregoing and incorporate the whole well together by stirring, and after standing a day or two the composition is fit for use.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Heinrich Rahtjen in the Great Seal Patent Office on the 18th May 1874.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, HEINRICH RAHTJEN, of Bremerhaven, Germany, and temporarily of Basinghall Street, in the City of London, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-ninth day of November, in the year of our Lord One thousand eight hundred and seventy-three, in the thirty-seventh year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Heinrich Rahtjen, Her special licence that I, the said Heinrich Rahtjen, my executors, administrators, and assigns, or such others as I, the said Heinrich Rahtjen, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use,

exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "AN IMPROVED ANTI-FOULING AND PRESERVATIVE COMPOSITION FOR SHIPS' BOTTOMS AND OTHER SUBMERGED STRUCTURES," upon the condition (amongst others) that I, the said Heinrich Rahtjen, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Heinrich Rahtjen, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, that is to say:—

This Invention relates to an improved anti-fouling and preservative composition to be applied to the bottoms of iron ships and other submerged iron structures.

The composition consists of the ingredients hereafter named. The proportions annexed thereto are calculated by weight and are those which I find to answer best in practice, although I do not confine myself to the precise proportions given, as it will be understood that the same may be varied without departing from my Invention.

No. 1.	Alcohol, wood naptha, or methylated spirit -	120 parts.
No. 2.	Shellac - - - - -	42 „
No. 3.	Thick turpentine - - - -	8 „
No. 4.	Linseed oil (boiled) - - -	20 „
No. 5.	Common rosin - - - -	15 „
No. 6.	Galipot - - - - -	10 „
No. 7.	Tar spirit (otherwise called tar oil) - -	6 „
No. 8.	Tallow - - - - -	6 „
No. 9.	Venetian red - - - -	120 „
No. 10.	Arsenic - - - - -	20 „
No. 11.	Oxide of zinc - - - -	3 „
No. 12.	Oxide of mercury - - - -	30 „
	Total - -	400

Rahtjen's Improved Preservative Composition for Ships' Bottoms, &c.

These ingredients are incorporated together in the following manner:—I first dissolve the ingredients indicated above by Nos. 2 and 3 in ingredient No. 1, I then melt together over a moderate fire ingredients Nos. 5, 6, and 8, and afterwards allow the same to cool somewhat until only warm enough to maintain its fluidity, and then mix therewith ingredients Nos. 4 and 7. I then take the first solution of ingredients Nos. 1, 2, and 3, and add it to the above mixture of ingredients Nos. 4, 5, 6, 7, 8, and stir the whole well together until thoroughly mixed, and I then add thereto the ingredients Nos. 9, 10, 11, 12, either separately or together, and mix well together until thoroughly commingled and no sediment is found. The composition will then be fit for use.

Having described the nature of the Invention and the manner of performing the same, I declare that what I claim as the Invention to be protected by the herein-before in part recited Letters Patent is, the anti-fouling and preservative composition consisting of the ingredients and prepared in the manner substantially as herein specified.

In witness whereof, I, the said Heinrich Rahtjen, have hereunto set my hand and seal, this Sixteenth day of May, in the year of our Lord One thousand eight hundred and seventy-four.

HEINRICH RAHTJEN. (L.S.)

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1874.

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