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PROTECTIVE & MARINE COATINGS

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FAST DRY ALKYD FINISH COAT
CLEAR TINT BASE

Paint Analysis

Point Pinos Lighthouse

Pacific Grove, California

July 15, 2011

On Thursday, July 14, 2011 David Arbogast, architectural conservator, of Davenport, Iowa, received a set of nine paint samples from William Peake of Pacific Grove, California. The samples were collected from the Point Pinos Lighthouse in Pacific Grove by him on July 8, 2011 and were submitted for analysis to determine their historic colors.

Analysis of the paint samples was completed on Friday, July 15. Analysis was conducted using an optical Olympus microscope with magnification between 14 and 80 power. Each layer observed was color matched to the Munsell System of Color using natural north light. Only opaque, pigmented layers (i.e. paint layers) were matched. It is impossible to determine colors for finishes such as metallic paints and leafs and shellacs and varnishes because their color varies according to their translucency and reflectance.

The Munsell System of Color is a scientific system in which colors have been ranged into a color fan based upon three attributes: hue or color, the chroma or color saturation, and the value or neutral lightness or darkness. Unlike color systems developed by paint manufacturers, the Munsell system provides an unchanging standard of reference which is unaffected by the marketplace and changing tastes in colors.

The hue notation, the color, indicates the relation of the sample to a visually equally spaced scale of 100 hues. There are 10 major hues, five principal and five intermediate within this scale. The hues are identified by initials indicating the central member of the group: red R, yellow-red YR, yellow Y, yellow-green YG, green G, blue-green BG, blue B, purple-blue PB, purple P, and red-purple RP. The hues in each group are identified by the numbers 1 to 10. The most purplish of the red hues, 1 on the scale of 100, is designated as 1R, the most yellowish as 10R, and the central hue as 5R. The hue 10R can also be expressed as 10, 5Y as 25, and so forth if a notation of the hue as a number is desired.

Chroma indicates the degree of departure of a given hue from the neutral gray axis of the same value. It is the strength of saturation of color from neutral gray, written /0 to /14 or further for maximum color saturation.

Value, or lightness, makes up the neutral gray axis of the color wheel, ranging from black, number 1, to white at the top of the axis, number 10. A visual value can be approximated by the help of the neutral gray chips of the Rock or Soil Color chart with ten intervals. The color parameters can be expressed with figures semi-quantitatively as: hue, value/chroma (H, V/C). The color "medium red" should serve as an example for presentation with the three color attributes, 5R 5.5/6. This means that 5R is located in the middle of the red hue, 5.5 is the lightness of Munsell value near the middle between light and dark, and 6 is the degree of the Munsell chroma, or the color saturation, which is about in the middle of the saturation scale.

The samples were collected in manila coin envelopes with pertinent identification information written on the faces of the envelopes. Although they were unusually small in size, the samples ranged from good to excellent in condition. Their discussion lists the layers from the most recent at the top to the oldest at the bottom of the list. The results obtained, are as follow:

Sample 1	Münsell
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/

The first sample was collected from the watch room window frame. It revealed a set of extremely thin layers of white paint. Although the precise number of layers could not be determined because of their similarity, there were at least eight layers observed.

Sample 2	Munsell
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/

The second sample was removed from the watch room sash. It proved to be identical to its counterpart, the first sample.

Sample 3	Münsell
Gray	N 6.0/
Light gray	N 7.5/
Dark gray	N 3.5/
Gray	N 5.0/
Dark gray	N 3.5/
Light gray	N 7.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/

The third sample came from the sill of the watch room. Beneath a collection of gray paint layers of varying shades was a set of at least four very thin layers of white paint.

Sample 4	Munsell
Gray	N 6.0/
Light gray	N 7.5/
Dark gray	N 3.5/
Gray	N 5.0/
Tan	2.5Y 7/4

The fourth sample was taken from the baseboard of the watch room. Its top four layers matched those of the third sample. Beneath these four layers was a tan layer. Given the location of the sample, it is quite possible that earlier paint may have worn off or may have been otherwise removed from the wood substrate.

Sample 5	Munsell
White	N 9.5/
Off-white	2.5Y 8.5/1
White	N 9.5/
Blue-gray	10BG 6/1
Off-white	2.5Y 8.5/1
Rose	7.5R 6/4
White	N 9.5/

The fifth sample was obtained from the wall of the watch room. It revealed a great variety of colors. The oldest white layer was relatively thick and distinct. It was probably not a prime coat for the rose-colored layer.

banister upstairs + brown KH 7-29-13

Sample 6	Munsell
Very dark brown	5YR 2/2
Very dark brown	5YR 2.5/4
Very dark brown	5YR 3/1
Very dark brown	5YR 3/1
Very dark brown	5YR 3/1
Very dark brown	5YR 2/2
Light gray	N 7.5/

The sixth sample was from the banister of the lower stairwell. It retained a collection of six very dark brown layers, which varied slightly in tone. At the base was a distinct layer of light gray paint which is the apparent original color.

disregard must have been stripped

Sample 7	Munsell
White	N 9.5/

The seventh sample was found below the banister on the lower stairwell. It retained only a single layer of white latex paint.

Sample 8	Munsell
Charcoal	N 1.0/
Dark gray	N 4.5/
Charcoal	N 1.0/
Dark gray	N 4.5/
Dark gray	5Y 4/1

The eighth sample was collected from a riser of the stair in the lower stairwell. It had a series of pairs of dark gray and charcoal gray layers above an oil-based coat of dark gray which had shifted to the yellow end of the spectrum over time because of its oil content.

Sample 9	Munsell
White	N 9.5/
Off-white	2.5Y 8.5/1
Off-white	2.5Y 8.5/1
Blue-gray	5B 5/1
Blue-gray	5B 5/1
White	N 9.5/
White	N 9.5/
White	N 9.5/
White	N 9.5/
Khaki	5Y 6/4

The ninth sample was removed from the wall of the lower stairwell. It revealed a set of ten paint layers of which the oldest was a relatively thick and distinct yellowish-green color similar to khaki.

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Second Paint Analysis

Point Pinos Lighthouse

Pacific Grove, California
October 19, 2012

On Wednessday, October 17, 2012 David Arbogast, architectural conservator, of Davenport, Iowa, received a set of six paint samples from William Peake of Pacific Grove, California. The samples were collected from the Point Pinos Lighthouse in Pacific Grove by him on October 9, 2012 and were submitted for analysis to determine their historic colors. Prior to this a set of nine samples was analyzed on July 15, 2012 from the lighthouse. The reader is advised to consult the prior analysis in conjunction with this.

Analysis of the paint samples was completed on Friday, October 17. Analysis was conducted using the same methodology employed in the previous analysis. The samples were collected in manila coin envelopes with pertinent identification information written on the faces of the envelopes. Because they were unusually small in size, the samples ranged from challenging to excellent in condition. Numbering follows that of the previous analysis. The results obtained, are as follow:

	Sample 10	Munsell
youngest	Pink	2.5YR 7/6
	Cream	2.5Y 8.5/3
	Dark green	5G 4/4
*	Light gray	5Y 7/1
*	Cream	2.5Y 8.5/3
	Light brown	2.5Y 6/4
	White	N 9.5/
oldest	Light blue	5BG 8/1

The tenth sample was collected from the bedroom wall above the north window. It was particularly challenging, consisting of multiple bits of paint with contradictory seriation. A bit of the sample containing what appeared to be the most complete set of layers was analyzed and revealed the layers listed above. All but the two oldest layers appear to be typical paint layers. The white layer was extremely thick and grainy, which is very typical of whitewash. The light blue layer beneath it was relatively irregular and grainy and may have been a calcimine layer as opposed to a typical oil paint.

	Sample 11	Munsell
	White	5Y 9/1
*	Cream	2.5Y 8.5/3

The eleventh sample was removed from the north window sash of the bedroom. It retained two layers of paint on its wood substrate.

EF Bedroom

Sample 12	Munsell
White	5Y 9/1
Cream	2.5Y 8.5/3

The twelfth sample came from the north window trim of the bedroom. Not surprisingly, it matched its counterpart, sample 11.

Sample 13	Munsell
White	5Y 9/1
Pink	2.5YR 7/6
Cream	2.5Y 8.5/3
Dark green	5G 4/4
Light gray	5Y 7/1
Cream	2.5Y 8.5/3
Light brown	2.5Y 6/4
Brown	7,5YR 5/5
Dark brown	7.5YR 3/2
White	5Y 9/1

top cream

The thirteenth sample was taken from the masonry of the bedroom fireplace. Beneath a layer of white paint was a set of six layers matching the top six layers of sample 10. The oldest layer was a relatively thick layer of white paint.

Sample 14	Munsell
Pink	2.5YR 8.5/4
Black	N 1.0/
White	5Y 9/1
White	5Y 9/1
White	5Y 9/1
Cream	2.5Y 8.5/3
Black	N 1.0/

top cream

The fourteenth sample was obtained from the mantle of the bedroom fireplace. It did not resemble its counterpart, sample 13, and revealed considerably more paint layers than the other two woodwork samples, nos. 11 and 12. In this case there was a very distinct black layer beneath the layer of cream paint.

Sample 15	Munsell
White	5Y 9/1
Cream	2.5Y 8.5/3
Light blue	10BG 8/1

The fifteenth sample was from the tongue-and-groove paneling of the bedroom. In addition to the white and cream layers observed on samples 11 and 12 there was an older layer of light blue which was quite similar, although not identical, to that observed in sample 10.

Third Paint Analysis

Point Pinos Lighthouse

Pacific Grove, California

February 5, 2013

On Monday, February 4, 2013 David Arbogast, architectural conservator, of Davenport, Iowa, received a set of five paint samples from William Peake of Pacific Grove, California. The samples were collected from war room of the Point Pinos Lighthouse in Pacific Grove by him on January 31, 2013 and were submitted for analysis to determine their historic colors. Prior to this a set of nine samples was analyzed on July 15, 2012 from the lighthouse followed by a set of six samples on October 19. The reader is advised to consult the prior analyses in conjunction with this one.

Analysis of the paint samples was completed on Tuesday, February 5. Analysis was conducted using the same methodology employed in the previous analysis. The samples were collected in manila coin envelopes with pertinent identification information written on the faces of the envelopes. Because they were unusually small in size, the samples ranged from challenging to excellent in condition. Numbering follows that of the previous analysis. The results obtained, are as follow:

Sample 16	Munsell
White	N 9.5/
Cream	2.5Y 8.5/3
Cream	2.5Y 8/4
White	N 9.5/
Pink	10YR 8/3
Light green	2.5G 8/2
Green	2.5G 5/2
Light green	2.5G 8/2
Light green	2.5GY 7/2
Light green	2.5G 7/2
White	5Y 9/1
Off-white	10YR 8/1
Off-white	10YR 8/1
Off-white	10YR 8/1
Off-white	10YR 8/1
Golden varnish	----------
Cream	2.5Y 8.5/3

The sixteenth sample was collected from the flue exterior. Although it was quite challenging, it revealed an extremely large number of layers. The top two layers were completely detached from the remaining layers. The top white layer was an extremely flexible layer of latex paint. Directly above the oldest layer of cream-colored paint was a distinct layer of golden varnish, which may have aged to that color. Its application on a plaster surface is atypical.

Sample 17	Munsell
White	N 9.5/
White	N 9.5/
White	N 9.5/
Dark gray	5Y 5/1

The seventeenth sample was removed from the ceiling. Beneath a set of slightly off-white paint layers was a distinct layer of dark gray paint.

Sample 18	Munsell
White	N 9.5/
Pink	10YR 8/3
Light green	2.5G 8/2
Green	2.5G 5/2
Light green	2.5G 8/2
Light green	2.5GY 7/2
Light green	2.5G 7/2
Cream	2.5Y 8/4
White	5Y 9/1

The eighteenth sample came from the closet door. It proved to be similar to the sixteenth sample, but without the oldest six layers of that sample. The oldest white layer was quite thin and probably served as a prime coat for a finish coat of cream-colored paint.

Sample 19	Munsell
White	5Y 9/1
Cream	2.5Y 8/4

The nineteenth sample was taken from the baseboard. It revealed only two layers of paint on its wood surface. The cream layer matched the cream layer seen in the previous sample.

Sample 20	Munsell
White	5Y 9/1
Cream	2.5Y 8/4

The twentieth sample was obtained from the inside dormer casing. It matched sample nineteen.

Of the five samples, sample 16 was, by far, the most complete sample. Sample 17 was unique. Had it retained a greater number of layers it might be reasonable to think that dark gray was the historic color. The other three samples appeared to relate to sample 16, but were considerably less complete.