Investigation of metallic media in First Fleet natural history watercolours

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ABSTRACT

The use of metallic media had been observed in the State Library of New South Wales First Fleet era natural history watercolour collections. Ten drawings within SLNSW's First Fleet collection were identified as containing metallic media. A further ten drawings possibly containing metallic media were identified in other cultural institutions collections. Portable X-ray fluorescence was used to identify the metallic media in drawings in the SLNSW's and the National Library of Australia's collections. Metallic areas were identifies as gold, brass or silver. Microscopic examination of the application methods used revealed gold and brass leaf were the most common materials and were applied in a layered technique. Watercolour was applied to the gold and brass leaf to create iridescent effects. This technique was documented in artist manuals of the time. The limited availability of artist materials in First Fleet era Australia would have dictated artists' selection of metallic media.

Keywords: *First Fleet, Sydney Bird Painter, Gilding, Watercolour, Natural History, Gold*

INTRODUCTION

The State Library of New South Wales holds a premier collection of natural history watercolours from the First Fleet era. The recent acquisition of the TAL & Dai-ichi Life Derby Collection of Natural History Watercolours in 2011 has brought these collections into focus and has provided a broader context for their investigation, particularly the use of metallic media. Ten watercolours were identified in the SLNSW's collections and a possible ten more in other cultural institutions related collections. The identification of what metallic materials were used by artists in colonial Australia was identified as a priority as well as investigation of the application technique and skill required by the artists. The availability of metallic media in colonial Australia at the time was also under question.

THE WATERCOLOURS

Ten watercolours from the SLNSW First Fleet natural history watercolour collections were identified as containing metallic leaf or pigments. The metallic media was used on drawings of birds and fish creating iridescent highlights in wings, eyes, heads and throats. Four drawings from *Drawings of birds chiefly from Australia, 1791-1792* (PXD 226) acquired in 1887 and attributed to Sydney Bird Painter contain the most extensive use of metallic material. Sydney Bird Painter is a group of at least two unidentified artists working in colonial Australia (Anemaat 2014). PXD 226 f.46 is a drawing of two Golden Bronze Cuckoos and a Rufus Whistler, the first two birds have extensive metallic areas across their backs, wings and breasts. PXD 226 f82 a drawing of the Common Bronzewing Pigeon and PXD 226 f83 of the Brush Bronzewing Pigeon (see Figure 1) both contain metallic highlights on feathers in the wings. PXD 226 f84 of a Norfolk Island Pigeon (see Figure 2) contains metallic areas through the head, throat and wings of the bird. A fifth drawing attributed to Sydney Bird Painter of a Maned

or Wood Duck & Drake from *Collection of Australian bird illustrations, ca. 1792* (PXD 680 item 2) contains metallic media highlighting feathers in the wings. The metallic media in these drawings has been over painted with watercolour creating an iridescent appearance.
The use of metallic media in PXD 226 and PXD 680 raised questions regarding their attribution to artists in colonial Australia and the possibility that they were drawn at a later stage in India (*New South Wales Drawings* 2011; Neville 1997). Simultaneous watermark research found strong connections between these drawings and DL PXX 1 *Flora of Norfolk Island and New South Wales* a collection known to have been drawn on Norfolk Island in the 1790's (Hughes 2013).

Metallic media was also used in three drawings of fish from *Australian fishes, 1774-1794* acquired in 1911 (PXD 18 f1, f3 and f9). The eyes in PXD 18 f3 of a Leather Jacket and f9 of an Elephant Shark have been highlighted with a warm toned metallic media. PXD 18 f1 of a shark signed by George Raper also has a metallic highlight on the eye but it is grey in colour and dull in appearance.

The TAL and Dai-ichi Life Derby Collection of Natural History Watercolours (PXD 1098) contains two drawings with metallic highlights. A drawing of a Black-shouldered Kite from *Zoology of N. [New] Holland etc* (PXD 1098 v4 f35) has a metallic highlight in the eye. This drawing may have been drawn in colonial Australia as it is on paper stock also found in PXD 226 and DL PXX1 (Hughes 2013). Volume 1 of the Derby collection *New South Wales Drawings* (PXD 1098 v1) was made in London by a job artist hired by the collector Alymer Bourke Lambert to copy a collection of watercolours sent to him by Surgeon General John White. This original collection is now known as the Watling collection after the artist Thomas Watling and housed at the Natural History Museum in London. The drawing PXD1098 v1 f72 *Anus Australis* has been copied from PXD 680 item 2 and has a small amount of dull metallic media in corresponding areas (Anemaat 2014). See figure 3 for details of the two versions of the drake.

Metallic areas have also been observed in First Fleet collections at the National Library of Australia (NLA), The Alexander Turnbull Library (ATL) in New Zealand and the Natural History Museum (NHM) London. The NLA's Ducie Collection of First Fleet Art contains two drawings with metallic highlights: the Brush Bronzewing and Common Bronzewing. These two drawings match drawings of the same birds in PXD 226 with metallic details in the same locations. A third drawing of the common bronzewing with metallic highlights in the same location is in the ATL collection titled *[Lord Howe Island Pigeon or Common (Forest) bronzewing pigeon (Phaps elegans)*. Two other drawings in the ATL collection contain metallic highlights *Ardea [Jabiru (Xenorhynchus asiaticus)]* and *Pigeon of Norfolk Island* signed by George Raper and dated 1790. The NHM's collection of George Raper drawings includes three signed watercolours that appear to have metallic highlights *Pigeon of Port Jackson*, *Shark of Port Jackson* and *Fish of Port Jackson*, the last two sharing subjects with the drawings PXD 18 f1 and f9. The NHM's Watling collection contains two watercolours with possible metallic highlights *Ant, native name "Mong"* and *Auxillary Falcon* attributed to the Port Jackson Painter, a group of unidentified artists working in colonial Australia. *Auxillary Falcon* shares the same subject as PXD 1098 v4 f35. Of these collections there has only been the opportunity to study the NLA's Ducie collection in person.

X-RAY FLUORESCENCE ANALYSIS

The metallic highlights in the SLNSW's collection and the NLA's Ducie Collection were analysed using portable X-ray fluorescence. Analysis of SLNSW's collections was undertaken onsite using a Bruker Tracer III-SD. Analyses of the Ducie collection was undertaken at the National Museum of Australia with the assistance of David Hallam, NMA conservator Prue Castles and NLA conservator Susanne Wullen, using a Bruker Tracer III-V+. Each item was first analysed in an unpainted area of the paper support to enable a base comparison for the analysis of metallic areas. When the areas of metallic media were particularly small, such as when used to highlight eyes, multiple spectra were taken to ensure the accuracy of the data.
The metallic media across both the collections was identified as either gold, brass or silver. Gold was identified in all of the metallic highlights in the drawings in PXD 226 and PXD 680. Iron was also elevated in these areas, likely due to surrounding pigments such as iron oxide browns or Prussian blue/greens (West FitzHugh 1997). Smaller amounts of mercury, copper and arsenic were also identified and may be due to the use of pigments like mercury based vermilion, copper based verdigris and arsenic based orpiment (Roy 1993). Gold was also identified in the highlighted eye of PXD 1098 v4 f35.

The metallic highlights in the two bronzewings from the Ducie however did not contain gold but copper and zinc were identified. Their occurrence together indicates that the metallic material in these drawings is brass, a copper zinc alloy. Brass leaf was commonly known as Dutch metal, Schlag metal or composition leaf and was a cheaper substitution for authentic gold leaf (Thornton 2000). Iron was also identified in these two areas possibly due to the surrounding brown being an iron oxide. The green associated with the brass highlights may be iron or copper based. Where the green watercolour has been used the verso of the paper has discoloured brown. This is likely due to the green being a copper based pigment such as verdigris or copper resinate which accelerates the deterioration of paper (Roy 1993). This green has only been used in the feathers with brass highlights on both the Common and Brush Bronzewings. Copper and zinc also occurred in the metallic media in PXD 18 f3 and f9 and PXD 1098 v1 f72 indicating that these areas also use brass for the metallic highlights.

The metallic media in PXD 18 f1 was found to contain silver, mercury and sulfur. Silver has been used in a leaf and powdered form to imitate gold since medieval times with a toning colour applied on top such as orpiment or other yellow colourant (Thompson 1956). The dull grey appearance of the metallic area would be due to the tarnishing of the silver evidenced by the elevated level of sulfur. Tarnishing of leaf and powdered silvers used in illumination have generally tarnished to a degree that they are no longer recognizable as silver (Thompson 1956). The mercury may be related to the red outline of the eye being cinnabar or vermillion (Roy 1993). See figure 4 for a breakdown of elements found in metallic highlights.

APPLICATION TECHNIQUE

The gold highlights in PXD 226 f46 Golden Cuckoo, f82 Common Bronzewing Pigeon, f83 Brush Bronzewing Pigeon, f84 Pigeon of Norfolk Island and PXD 680 item 2 Maned or Wood Duck & Drake have all been applied in a similar manner. Microscopic examination revealed the use of a layered application technique.

There is craquelure across the surface of the gold areas with small areas of loss showing the paper support. The craquelure is possibly caused by the differing expansion and contraction of the paper support and gold leaf on exposure to fluctuating environmental conditions. The uniformity of the layer of gold and its cracking indicate that it was applied as a leaf rather than a painted application of shell gold. The areas of loss show blank paper underneath indicating

that the gold was applied directly to the paper using a fine layer of clear adhesive (see Figure 5). Some areas of gold leaf loss have been over painted using the same technique as the painting on the gold leaf. This indicates the gold leaf had not adhered to these areas during the original application. This can be seen clearly in PXD 226 f84 with the watercolour application continuous over the gold leaf and small areas of paper support, see Figure 6. The watercolours have been applied on top of the gold in fine lines and stippling covering the entire surface of gold. The combined use of reds, greens and blues gives the gold an iridescent appearance.

The application of gold leaf onto paper for use with watercolours to create iridescent effects is described in Robert Dossie's *Handmaid to the Arts* published in 1764:

> The gilding proper to be ufed with water colours maybe either with the leaf gold, or powder. . . The leaf gold is neceffary in all cafes, where a metalline and fhining appearance is wanted: and it may be laid on the defignated ground, by means either of gum water, or ifinglafs fize. The gum water or fize fhould be of the weaker kind, and not laid too freely on the ground; and proper time fhould likewife be given for it to dry: the judgement on which muft be formed, in this café as in other kinds of gilding, by touching with the finger. The management of the gold alfo is much the fame in this as in the former: and where a polifhed appearance is want-ing, the dog's tooth or other kind of burnifher may be ufed. . . and where colours are to be laid on the gilding, the brufhing the gold over with the gall of any beaft will make it take them in a much more kindly manner.

This description by Dossie reinforces the techniques observed under microscopy. This same technique is described in later editions of the same volume and has been copied in full in other artist manuals such as The Golden Cabinet and The Art of Drawing in Watercolours. The application of gold leaf and watercolour has been performed to a very fine standard in the Sydney Bird Painter drawings. The gold has been applied precisely to the highlighted areas, has adhered well to the paper support and watercolour has been applied on top of the gold to achieve subtle gradated effects.

Not all the applications of metallic media have been as refined and successful. The brass highlights in the Ducie collection also appear to have been applied as a leaf but do not form a continuous surface area. The surface is broken and formed by small flakes. The surface of the larger areas of brass leaf appear wrinkled, this is typical of aged brass leaf as the metal cannot be beaten as thinly as gold and therefore cannot be laid as flat as gold (Thornton 2000). The gaps between the flakes of brass leaf have mostly been coloured with green watercolour indicating that the brass leaf failed to adhere to these areas during the original application. The green and a red watercolour have been applied to the surface of the brass leaf in a stippled application. In some areas the brass leaf has not been painted over, either due to the artist's intent or the brass in part resisting the media. Small areas of blank paper support indicate that some brass leaf has detached after the drawing was completed. These losses of brass leaf are more extensive than the losses observed in the gold leaf in the Sydney Bird Painter drawings.

The brass leaf used in the eyes in PXD 18 f3 and f9 has also been applied prior to the watercolour application. The surface of the brass leaf shows similar wrinkling to the brass leaf in the Ducie collection. The brass leaf appears duller and much warmer in tone than the gold leaf used by Sydney Bird Painter. The eyes have been painted with yellow, red, blue and black over the brass leaf. The colours are clearest where the brass leaf failed to adhere to the paper

and have not been readily received by the brass. Areas of loss reveal the blank paper support and are most extensive in the blue ring of PXD 18 f9 (see Figure 7).

The silver used on the shark's eye in PXD 18 f1 covers the eye entirely except for a few small losses. There are small areas which evidently have a yellow colourant applied over the silver but it is not uniform and only visible under magnification. The colouring layer may have faded or discoloured over time or be less visible due to the tarnishing of the silver by the formation of silver sulphide (see Figure 8).

The gold media applied to PXD 1098 v4 f35 has been almost entirely painted over with an organic red colourant. There are no losses of media from this area. The texture of the paper fibers is evident through the gold media showing how thin the layer of gold is.

It appears that PXD 1098 v1 f72 has been copied from PXD 680 item 2 and shows that the artist observed the use of gold leaf in the Sydney Bird Painter's work but did not have the skills or material to replicate the technique (Anemaat 2014). The feathers with brass highlights have been painted a flat green with fine black lines indicating feathers. On top of this, brass powder has been applied in in a stippled manner. Brass powder mixed with gum arabic or honey and sold dried in mussel shells was known as shell bronze. All copper alloys including brass were described as bronze at the time (Thornton 2000). Its use was not recommended in artist manuals at the time due to its tendency to dull and turn green (The Art of Drawing and Painting in Watercolours ca. 1795).

MATERIAL AVAILABILITY

The manufacture of gold, brass and silver leaf in Europe has been documented as early as the 12th Century along with the method of grinding them into a powder form (Thornton 2000). Their sale in Britain was constant throughout the 18th century and into the 19th Century, with many advertisements for their sale published and reference made to them in contemporary art and gilding manuals. Early brass powders were manufactured in Germany but by the 18th Century English manufacturers had devised their own techniques (Thornton 2000).

The variety of metallic media used in these collections may be explained by the limited resources available in the early years of the colony. Re-supply ships were infrequent and trades that required gold and brass leaf such as frame and furniture manufacture had not yet emerged. Traditional artist suppliers such as chemists and colourmen were not yet in the colony, so artists had limited sources of material. Artists themselves were the main suppliers of art materials in the early years of the colony bringing materials in bulk for their own use and selling to other artists. The first published advertisement for art materials in the colonies was in the Sydney Gazette in 1804, its second year of publishing (Burgess & Dredge 1998). The availability and shortages of all art materials would have decided the choice of metallic media by artists working in the colony (Wilson 2012).

CONCLUSION

The use of metallic media was limited to a few drawings but spread across a variety of artists working in colonial Australia including George Raper, artists who are known under the umbrella terms Sydney Bird Painter and Port Jackson Painter and other unidentified artists. Metallic media's main use in these watercolours is to highlight iridescent feathers and eyes. Metallic media has frequently been used in multiple versions of the same subjects to highlight

the same areas. The decision to use gold, brass or silver would have been driven by the scarcity of materials in the early years of the colony with artists utilising whichever was available. The media has then been applied with varying levels of skill using documented techniques of the time. The Sydney Bird Painter drawings show the highest level of proficiency with the technique, and use the best quality of materials with only authentic gold leaf found in their drawings. That metallic media was used in colonial Australia was clear, but why artists chose to use this expensive material and how they received their supplies is still uncertain.

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FIGURES
Figure 1

PXD 226 f83 Brush Bronzewing, image courtesy of the State Library of New South Wales

Figure 2

PXD 226 f84 Pigeon of Norfolk Island, image courtesy of the State Library of New South Wales

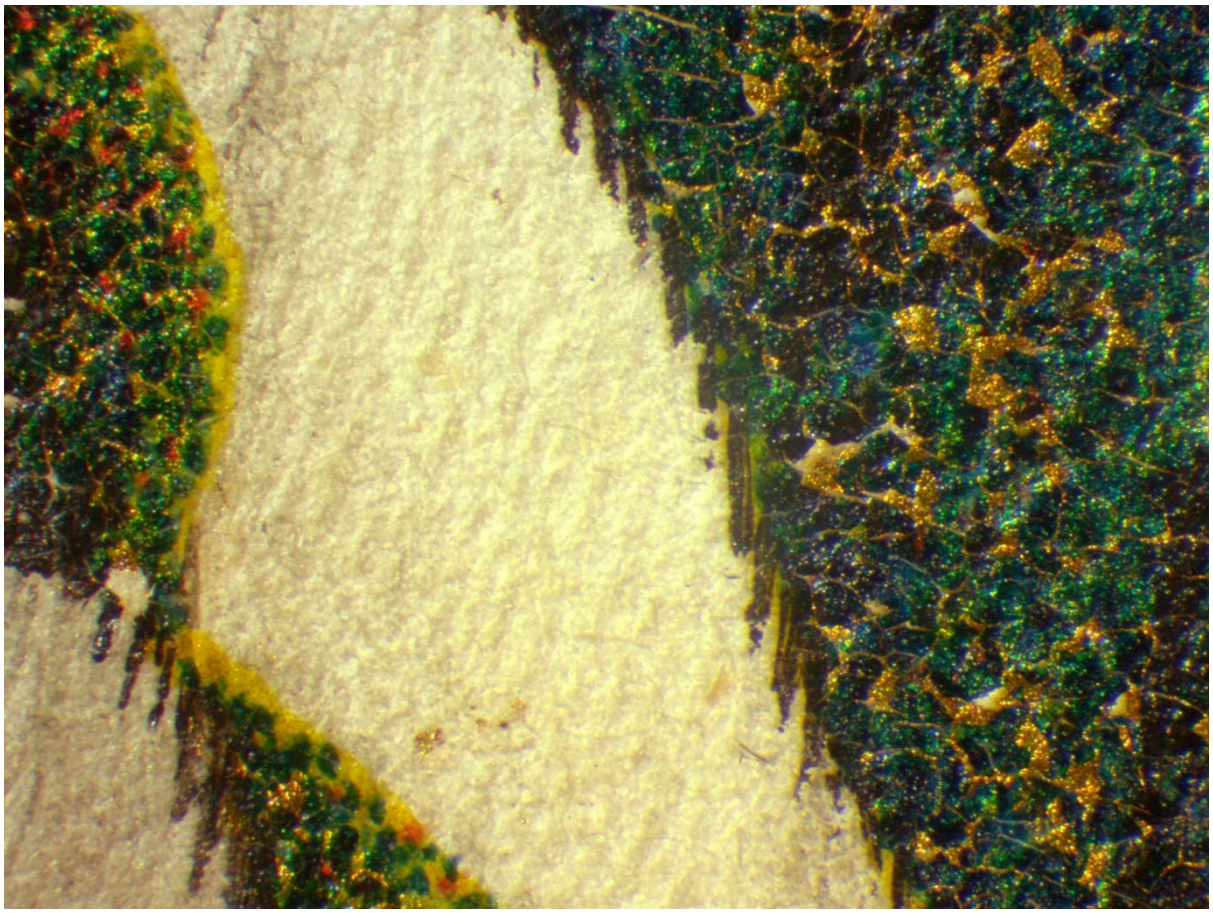
Figure 3

PXD 680 item 2 detail and PXD 109 v1 f72 detail, image courtesy of the State Library of New South Wales

Figure 4 Table

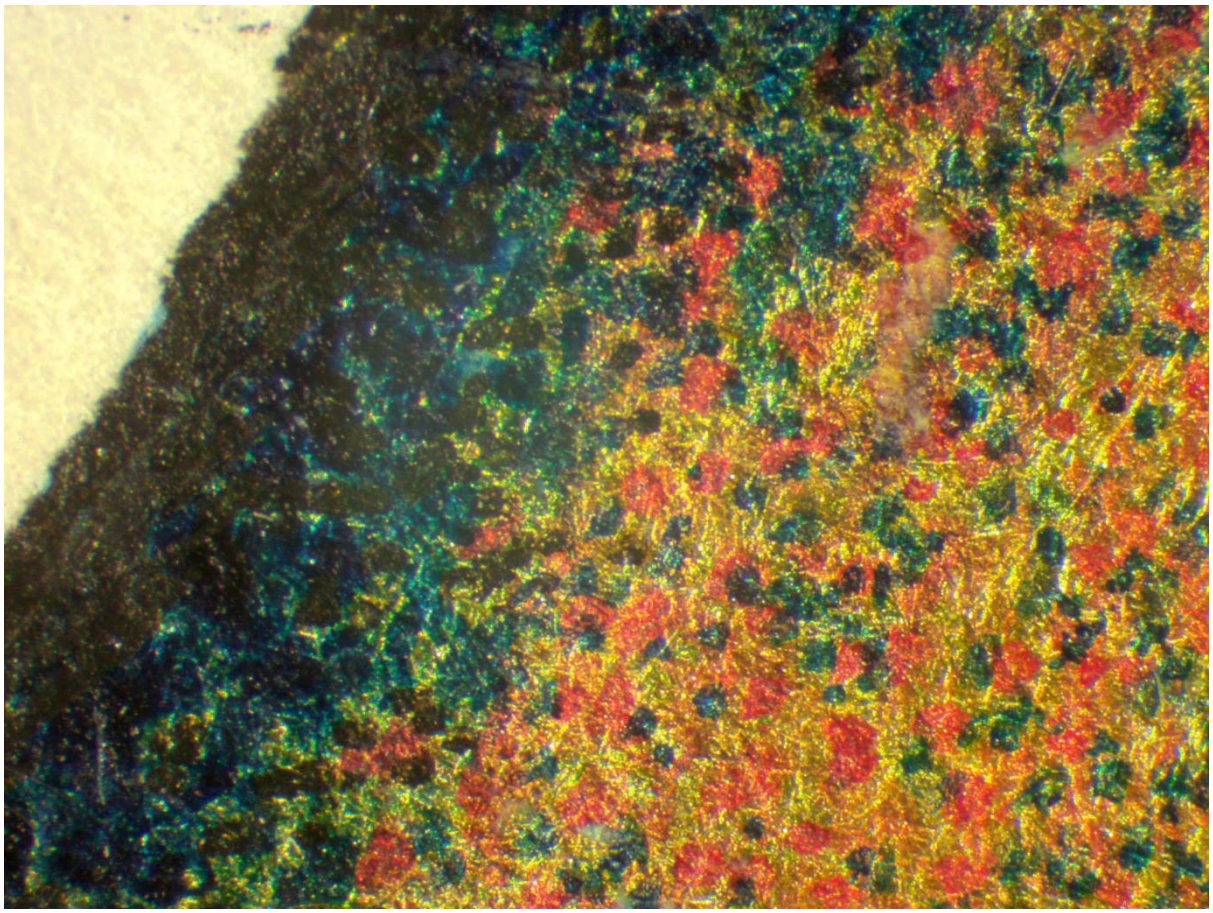
Call No.	Analysis location	Elements identified	Metallic material
PXD 18 f1	Eye	Ag , Hg, S	Silver
PXD 18 f3	Eye	Ca, Cu, Fe, Sn, Zn	Brass
PXD 18 f9	Eye	Ca, Cu, Fe, Pb, Sn, Zn	Brass
PXD 226 f46	Bird 1 back	Fe, Hg, Au	Gold
PXD 226 f46	Bird 2 wing	Fe, Cu, Hg, Au, As	Gold
PXD 226 f82	Feather	Ca, K, Fe, Cu, Hg, Au	Gold
PXD 226 f83	Feather	Ca, Mn, Fe, Au	Gold
PXD 226 f84	Neck	Fe, Au	Gold
PXD 680 item 2	Duck’s feather	Fe, Au	Gold
PXD 680 item 2	Drake’s feather	Fe, Au	Gold
PXD 1098 v1 f72	Feather	Cu, Fe, Pb, Zn	Brass
PXD 1098 v4 f35	Eye	Au, Ca, S	Gold
NLA PIC/9838/3 Brush Bronzewing	Feather	Ca, Cu, Zn	Brass
NLAPIC/9838/11 Common Bronzewing	Feather	Cu, Fe, Mn, Zn	Brass

Figure 5



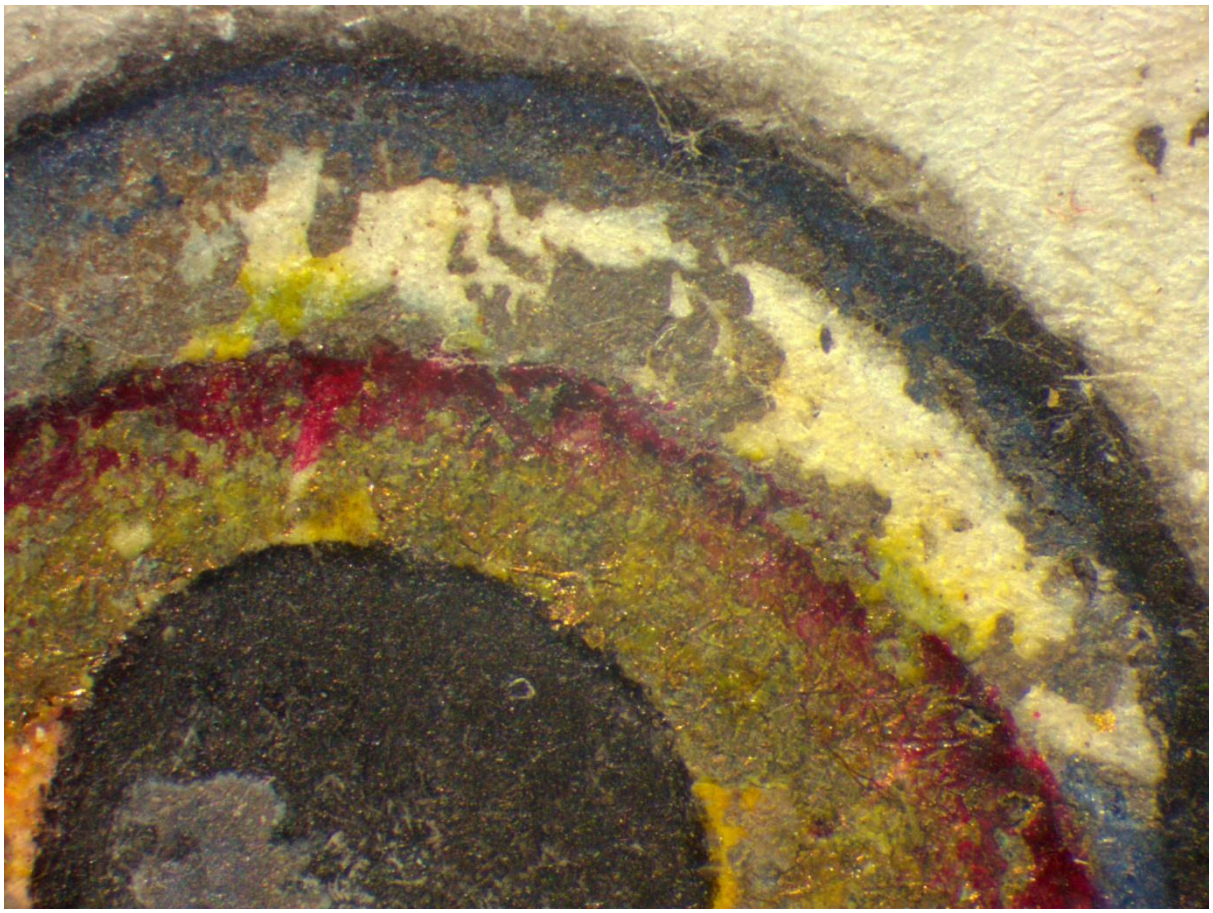
PXD 680 item 2 micrograph of drake's wing

Figure 6



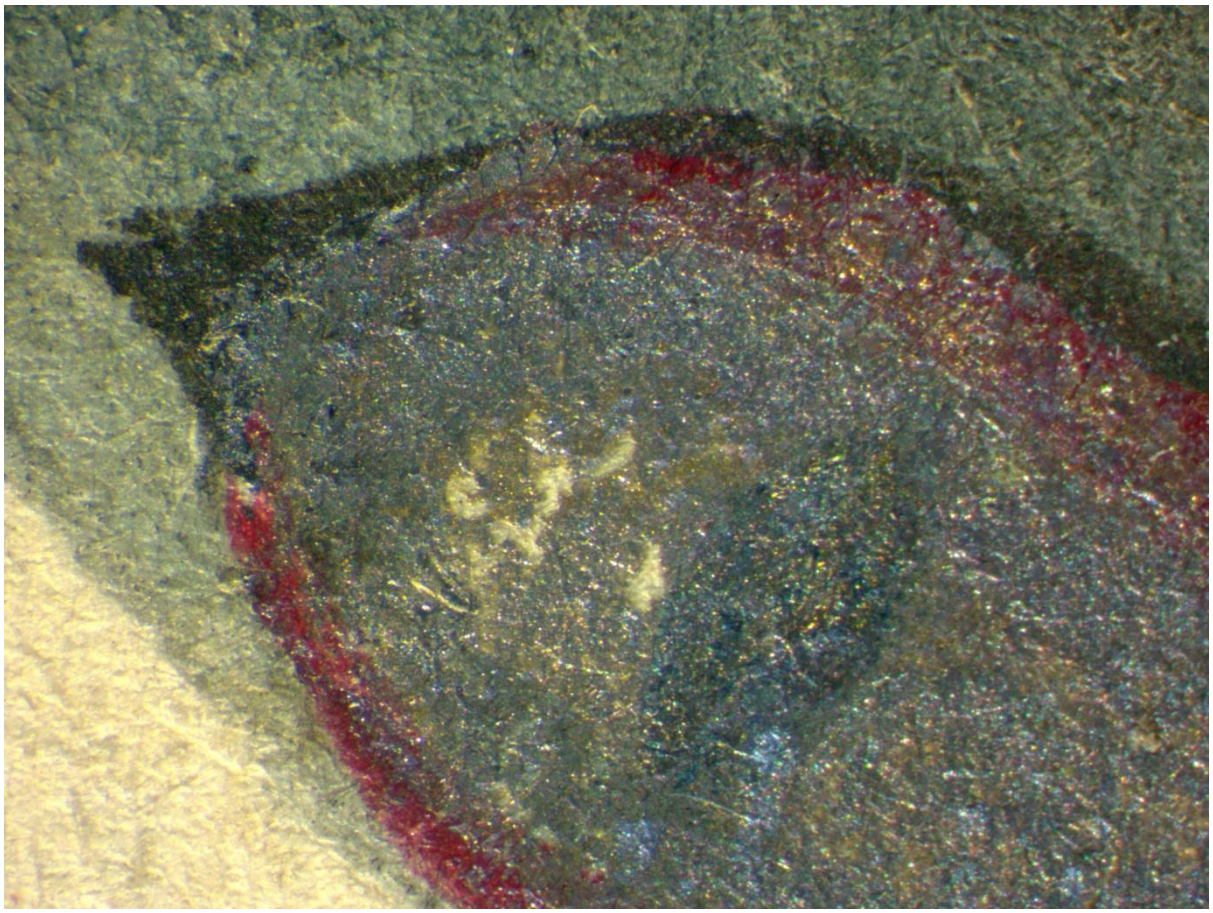
PXD 226 f84 micrograph of base of neck

Figure 7



PXD 18 f9 micrograph of eye

Figure 8



PXD 18 f1 micrograph of silver in eye