

## Surface coatings and decorative scheme

### E.1.1822 Inner Coffin Lid

#### General observations and conclusions of analysis

The inner lid is in good condition, with occasional splits and cracks in the wood and minor shallow paint losses. The composition is much more detailed and finely wrought than that of the outer coffin. The coffin is covered with a thin yellow paint layer, and the general palette is restricted to blues, greens and reds, with blacks used to paint in final details before varnishing. The lid is covered in a thick yellow layer of varnish, which was applied across the entire outer surface, unlike the selective application seen on the outer coffin.

The exterior of Nespawershefyt's inner coffin lid was covered in a layer of textile, found across the entire surface of the exterior, but not the face. This was covered with several layers of preparation layer, in which the uppermost layer is composed of calcite. This is in contrast to the inner coffin box, which appears to have only had a single preparation layer of calcite.

The figures and writing were drawn onto the preparation layer in red earth. The surface is covered with a thin wash of orpiment, which gives the inner coffin lid an overall golden colour, which is enhanced by the final varnish on the surface (which has also yellowed over time). The blues and greens on this object are built up proud of the surface, often into very three-dimensional figures. The blues are painted in Egyptian blue, the greens in Egyptian green. The final black drawing was probably painted with carbon black.

There is a layer of natural resin varnish covering the surface. This coating has turned a yellow colour with age, but does not appear to have been pigmented.

The underside (interior) of the lid is undecorated. It is covered with a pink paste layer, which is composed of red earth mixed with sparitic calcite. This paste is followed by a white preparation layer covering the surface and rim.

## Results

### Underside

A coarse pink paste was found in joints between wooden elements, presumably used to bulk out the form in these areas. PLM analysis found it to contain a mixture of red earth and calcite (PLM IL07, the mixture containing: irregular, high relief particles with strong birefringence masked by the orange red body colour consistent with red earth as well as transparent particles with variable relief and strong birefringence, which resemble calcite).

The inside and rim of the lid are covered with a white preparation layer. The surface is unpainted and unvarnished. This layer was sampled in PLM IL15: the white was found to be composed of sparitic-type calcite. In dispersion, the preparation layer particles were colourless and transparent, ~4 µm, and exhibit variable relief. In crossed polars, these particles exhibited strong white birefringence with yellow and pink anomalous colours, with straight extinction and no stationary crosses.

There are some varnish coated fingerprints under the rim on the proper right side where the lid was lifted whilst the varnish was wet.

#### PLM samples

IL07	PLM	pink	Red earth and calcite (sparite)
IL15	PLM	Preparation layer from underside of lid	Calcite (spartic type)

## Exterior:

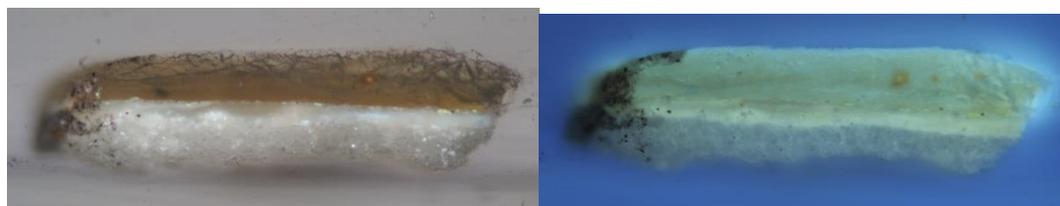
### Preparation layers

A textile layer was laid down across most of the surface, but not the face. This was covered with a series of different white preparation layers. The uppermost white preparation contains large, smooth/striated rhombic particles exhibiting variable relief characteristic of calcite (probably sparitic type, PLM IL09 (particles are present in aggregates, but are consistent in size and shape with sparitic type calcite; no stationary crosses present)).

The cross sections taken from the inner lid (IL11, 12, 14, 16 & 17) reveal the white preparation to be a multilayered structure. The evidence for this layering is most clear in cross section IL11 (from the yellow background, see Figure 1) and in IL14 (from the main figure's face, see Figure 2), which clearly show the three layers present in the preparation: a grey, transparent ground is covered in a brighter, crystalline ground, before a thinner layer of grey transparent ground. The brighter, crystalline ground in the middle fluoresces yellow when exposed to ultraviolet light whereas the thin and thick grey preparation layers do not appear to fluoresce at all. Cross sections IL16 and 17 show the transparent and bright crystalline ground, but not the thin grey transparent ground. The preparation layer on the inner lid is a different kind of application to the inner coffin box, which appears to have been prepared with a single calcite layer.



*Figure 1: Cross section IL11, 20x, saturated with white spirit, in visible light (left) and ultraviolet light (right)*



*Figure 2: Cross section IL14, 20x, saturated with white spirit, in visible light (left) and ultraviolet light (right)*

### Red drawing

Samples from the red paint used for drawing (PLM, IL04) presented as fine, high-relief rounded deep red particles present in aggregates with varying colour and size but high birefringence masked by the red-orange body colour. These optical traits are characteristic of red earth, which was confirmed by XRF (ARTAX S55).

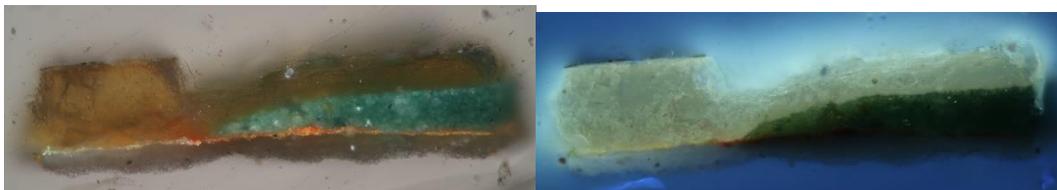
It is not clear from the cross sections whether the drawing took place on the coffin lid before or after the application of the yellow wash, but XRF results suggest that infilling of the blocked red areas (XRF S55) was undertaken after application of the yellow arsenic rich layer (see below). A cross section from an area of blue (IL12) showed red particles present in the yellow wash, but it is very difficult to see if they form a layer at all, nor where this would be located.

## Yellow

The entire surface of the inner coffin lid is yellow coloured. This is in stark contrast to the outer coffin, which is selectively coloured in yellow.

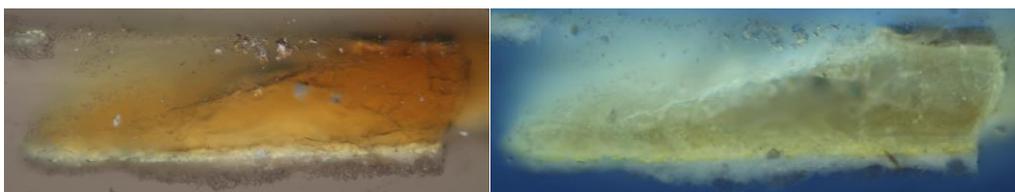
XRF analysis shows that the face (XRF S63) has a very high level of arsenic present. This suggests the presence of a reasonably substantial yellow orpiment layer in this area. Elsewhere the yellow parts of the coffin (XRF S50 53, 54, 56, 58, 61, 62) show significant arsenic levels that suggest a thin layer of orpiment across the surface. This is supported by cross sections IL11, IL12, IL14, IL16 and IL17, where the thin, washy layer of yellow paint was found lying directly on top of the preparation layer. It appears to be a dilute layer, sparsely populated with pale yellow particles and thinly applied. It is possibly a wash. The cross section shows the yellow particles in this layer to be oval, squashed, brightly coloured and opaque but pale yellow in colour. A PLM sample from the yellow in the background (IL09) showed medium-large particles of orpiment with angular and irregular habit and very little cross-hatching. The particles displayed the characteristic pink and green anomalous colours in crossed-polars, despite the particles being relatively finely ground (orpiment particles are usually found to be very coarse, >40  $\mu\text{m}$ ) (as seen on the outer coffin).

The orpiment may have degraded to  $\text{As}_2\text{O}_3$ , arsenolite, a common deterioration product. This is suggested by some of the cross sections, which show characteristic sparkle and particle shape, but lighter colour than expected for an orpiment layer. If this is the case, the yellow appearance may have more to do with the degradation of the natural resin varnish than the orpiment wash – although it is likely to be a combination of the two.



*Figure 3: Cross section IL17, 20x, saturated with white spirit, in visible light (left) and ultraviolet light (right)*

The entire surface of the coffin is covered in a degraded organic coating that was applied after all of the paint layers. This layer is consistent in texture, UV fluorescence and colour (yellow) with a degraded natural resin varnish, which probably contributes towards the yellow appearance of the passages (see cross sections IL11, IL12, IL13, IL14, IL16 and IL17 (see Figure 3)). It is probable that this layer is at least partially contributing to the overall yellow colour of the coffin. There is no orpiment present in the varnish layer, as verified by SEM/EDX on IL16 (01.05.2015, Spike Bucklow) (for cross section, see Figure 4).



*Figure 4: Cross section IL16, 20x, saturated with white spirit, in visible light (left) and ultraviolet light (right)*

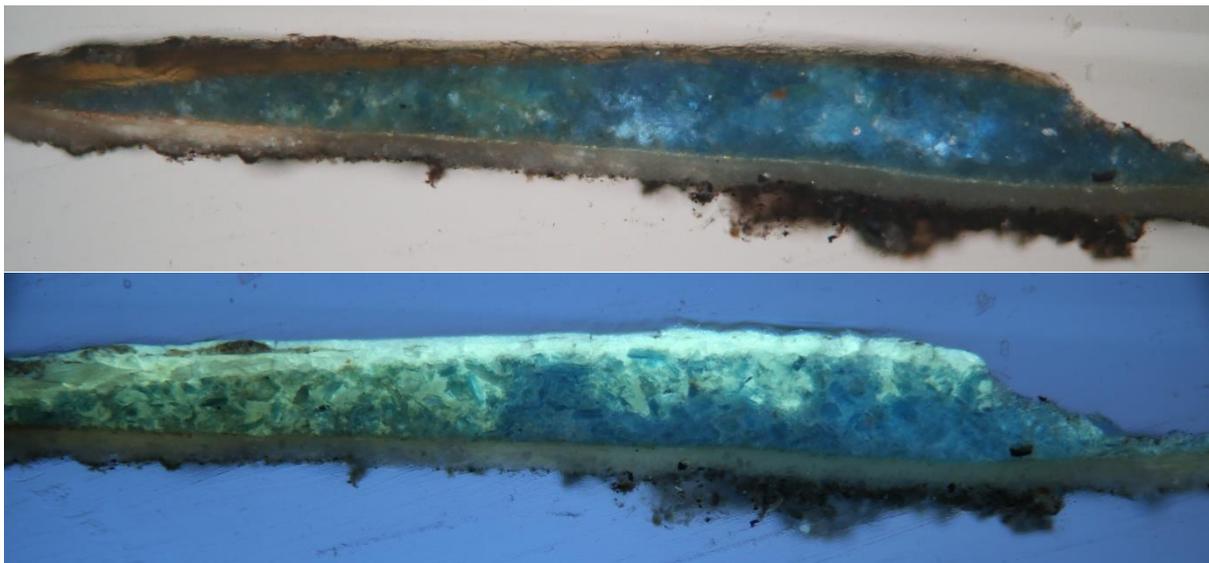
There may be a later addition of natural resin varnish, as cross section IL12 shows a layer of dirt in between the upper strata of varnish.

### Other pigments

Samples taken from the blue decoration were characteristic of Egyptian Blue (smooth, low-relief platy particles with good blue colour and moderate pale blue birefringence, PLM IL08).

A cross section was taken from a green looking feather across the chest of the main figure (X IL12, see Figure 5). This sample showed a thick layer of Egyptian blue followed by a thick, discoloured natural resin varnish. The photograph of this cross section in ultraviolet light reveals the considerable penetration of the degraded varnish into the porous Egyptian blue layer, which helps to explain the green colour of this passage.

This same sample showed some other interesting features in the cross section. Dirt was found underneath the ground, which was a possible artefact from sampling next to a 'dirty' crack. The white, crystalline ground was followed by a thin layer of yellow particles (as described above), with occasional red particles. These red particles may be features of the underdrawing, although this orange-red may be an Egyptian blue discolouration as was observed on the Nespawershefyt Outer Base and Inner Base.



*Figure 5: Cross section IL12, 10x, saturated with white spirit, in visible light (above) and ultraviolet light (below)*

VIL images of the surface helped to confirm the identification of Egyptian blue in PLM and cross section samples described above.

XRF (S51,52) indicates that the Egyptian blue pigment contains a small amount of lead and tin, alongside the expected copper. This is likely to have come from the copper source that was used to make the pigment. There are very low levels of arsenic in the Egyptian Blue areas. Although this might suggest the yellow orpiment layer does not continue under these areas, it may be that the thickly applied copper pigment is preventing penetration of the X-rays in these locations. No green areas were sampled with XRF.

A sample of green pigment taken from a hieroglyph (PLM IL10) was tentatively identified as Egyptian green. It contained low-relief polycrystalline aggregates with unusually good green colour for Egyptian green with some small blackish inclusions and weak green birefringence. Calcite particles are present in this sample, probably from the ground.

An area of black was sampled for PLM (IL05) but the results were inconclusive. It is probable that this paint was carbon black, but the sample may also reflect the build up of dirt on the surface. XRF results (S57) support the use of carbon black rather than manganese black.

### Restoration

When the object was first sampled at the Fitzwilliam, there were questions about the authenticity of the wig passage – its appearance suggested that some areas had been re-modelled by a later hand and repainted, in addition to some original passages that had been overpainted. The evidence provided by the cross sections (ILK, J, N & P) and PLM samples (IL1, 2, 3) in this area showed that much of this area was not original, and the later restorations have since been removed.

Cross sections show the substantial reworking, and PLM samples (IL1, 2, 3) indicated that the new paint was a mixture of Egyptian blue with synthetic ultramarine. The identification of the synthetic ultramarine dates this reworking of the wig to the mid-19<sup>th</sup> century onwards.

### Notes on Inner Lid Treatment and Sampling History

The sampling of the outside of the inner coffin lid took place in a few separate campaigns:

1. The first involved the extensive sampling and examination of a fragment which was initially not understood to be part of the Nespawershefyt coffins and was accessioned under a different number. Later examination showed it to be a fragment from the proper left hand side of the E.1.1822 inner coffin lid, under the figure's elbow. This piece had 11 PLM and 2 XRD samples taken in that earlier sampling campaign. All of these samples have since been labelled with the E.1.1822 accession number and are numbered IL00-10.
2. A number of samples (ILJ, K, N, P) were taken from the reworked wig, prior to the inner coffin's restoration – the results from this analysis are explored in the 'Restoration' section at the end of this report.
3. Samples coming from the rest of the lid (IL11-15) were collected in November 2014.

### Cross Section samples

Pre-conservation

ILJ	X	Blue	front
ILK	X	Blue	front
ILN	X	Blue	front
ILP	X	blue	Not marked

November 2014

IL11	X	White background with varnish
IL12	X	Green feather from wing, proper right hand side, centre

IL13	X	Raised area between feathers on wing, proper left hand side
IL14	X	Flesh from face, proper left side of mouth
IL16	X	Background sample (fragment)
IL17	X	Green hieroglyph (fragment)

**PLM samples x 11**

IL00 (not numbered on sheet)	PLM	Reconstruction wig	French Ultramarine (+others)	front
IL1	PLM	blue/black	Egyptian Blue (+ red/yellow earth + French Ultramarine)	front
IL2	PLM	B/w wig on wood	Red earth (under reconstructed wig)	front
IL3	PLM	Back of head	French Ultramarine	front
IL04	PLM	red	Red earth (underdrawing)	front
IL05	PLM	black	Carbon black	front
IL06	PLM	yellow	Orpiment	front
IL08	PLM	blue	Egyptian Blue	front
IL9	PLM	white	Calcite (not micritic)	front
IL10	PLM	green	Egyptian Green	front

**SEM results, May 1st, 2015.****Copied from Spike Bucklow's 2015 report**

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**IL16 Varnish over yellow layer - there is no orpiment in varnish**

Spectrum 1	Mg Ca As S	paint layer	extender and orpiment
Spectrum 2	(Ca)	varnish layer	only traces of inorganic

There is no intentional orpiment in the varnish of IL16.