Portrait mummies from Roman Egypt: ongoing collaborative research on wood identification

CAROLINE CARTWRIGHT, LIN ROSA SPAABÆK AND MARIE SVOBODA

Summary The British Museum’s programme of wood identifications of mummy portraits from Roman Egypt has advanced with collaborative research undertaken with the Ny Carlsberg Glyptotek and National Museum of Denmark in Copenhagen and with the J. Paul Getty Museum at the Villa, Los Angeles. Not only has the number of wood identifications of mummy portraits increased significantly, with an additional 24 examples bringing the total to 118, but this research has also enabled comparisons to be made between the selection of wood for the portrait and the underlying mummy board onto which the individual represented in the portrait was laid out (Ny Carlsberg Glyptotek). Furthermore, also for the first time, it has been possible to sample for wood identification a portrait that remains in situ placed over the face of a mummy and within its wrappings (J. Paul Getty Museum). The results have important implications for the examples that cannot be sampled, of which there are two from Hawara in the British Museum collections: the mummy of a young boy with a portrait panel, dated to AD 100–120 (EA 13595) and the mummy of a Greek youth named Artemidorus with a portrait panel from the early second century AD (EA 21810). Variable pressure scanning electron microscopy of minute wood samples illustrates the key anatomical features observed amongst the woods selected. This continuing collaborative scientific research has provided new information regarding the technology, composition and history of these ancient portrait mummies, as well as adding to the growing number of wood species identifications.

INTRODUCTION

Mummy portraits found in Roman Egypt represent a fusion of Egyptian funerary practices, Greek cultural traditions and Roman artistic style. They are regarded as being the only survivors of the renowned Graeco-Roman painting tradition using tempera or wax (encaustic) techniques. Such influence is more than artistic style alone, as scientific investigation at the British Museum has shown that much of the wood selected for these mummy portraits is not local Egyptian timber but European (northern Mediterranean) and Levantine and is heavily reliant on lime wood [1].

In 2008 the British Museum published updated results from its programme of wood and pigment identifications of mummy portraits from Roman Egypt [2]. As a consequence of that publication, further collaborative research on wood type was undertaken with the Ny Carlsberg Glyptotek and National Museum of Denmark in Copenhagen and the J. Paul Getty Museum at the Villa, Los Angeles. The objectives were to characterize the selection of woods used for the portrait panels and to examine the rare occurrences of portrait mummies in which the portrait and mummies are still together.

WOOD IDENTIFICATION METHODOLOGY

Standard techniques of identification and terminology determined by the International Association of Wood Anatomists (IAWA) are usually adopted for the identification of modern wood [3]. For each sample, the key features are compared with reference collection specimens and textual descriptions. This IAWA protocol may be applied to archaeological or historical wood, providing it is modified to accommodate the effects of the conditions of preservation, such as charring or desiccation. In all cases, each sample is prepared to expose transverse, radial longitudinal and tangential longitudinal sections or surfaces for identification (TS, RLS and TLS respectively).
For modern and some types of archaeological wood, thin sections with an approximate thickness of 12–14 μm are cut on a base-sledge (or rotary) microtome, mounted on glass microscope slides and examined by transmitted light microscopy. A variation on these standard techniques was applied to the mummy portraits on account of the extremely small sample size permitted from such thin boards of wood. In order for wood identification to be carried out successfully, sampling had to take place in an unobtrusive area that was free from pigments, binding

### Table 1. Summary of identified wood from the mummy portraits in the Ny Carlsberg Glyptotek, National Museum of Denmark and J. Paul Getty Museum at the Villa, Los Angeles

<table>
<thead>
<tr>
<th>Collection</th>
<th>Accession No.</th>
<th>Brief description</th>
<th>Findspot</th>
<th>Date</th>
<th>Wood identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCG</td>
<td>ÆIN 680</td>
<td>Portrait of a man</td>
<td>er-Rubayat</td>
<td>AD 100–125</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 1426</td>
<td>Portrait of a man</td>
<td>Hawara</td>
<td>AD 100–125</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 1426</td>
<td>Mummy board under body associated with portrait</td>
<td>Hawara</td>
<td>AD 100–125</td>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 1473</td>
<td>Portrait of a man</td>
<td></td>
<td>AD 100–150</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 681</td>
<td>Portrait of a man</td>
<td>er-Rubayat</td>
<td>AD 125–150</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 683</td>
<td>Portrait of a woman</td>
<td>er-Rubayat</td>
<td>AD 125–150</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 682</td>
<td>Portrait of a woman</td>
<td>er-Rubayat</td>
<td>AD 140–160</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NCG</td>
<td>ÆIN 684</td>
<td>Portrait of a man</td>
<td>er-Rubayat</td>
<td>AD 140–200</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NMD</td>
<td>3840</td>
<td>Portrait of a young man</td>
<td>er-Rubayat</td>
<td>AD 150–200?</td>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
</tr>
<tr>
<td>NMD</td>
<td>3891</td>
<td>Portrait of a man with beard</td>
<td>er-Rubayat</td>
<td>AD 150–200?</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>NMD</td>
<td>3892</td>
<td>Portrait of a young woman</td>
<td>er-Rubayat</td>
<td>AD 150–200?</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>73.AP.91</td>
<td>Portrait of a woman</td>
<td>Hawara (?)</td>
<td>AD 75–100</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>81.AP.42</td>
<td>Portrait of a woman</td>
<td>Unknown</td>
<td>0.C.A.D. 100–110</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>71.AP.72</td>
<td>Portrait of a young man</td>
<td>Hawara (?)</td>
<td>AD 100–125</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>73.AP.94</td>
<td>Portrait of a bearded man</td>
<td>Unknown</td>
<td>AD 140–160</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>91.AP.6</td>
<td>Portrait of a young man on mummy of Herakleides</td>
<td>Unknown</td>
<td>0.C.A.D. 150</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>74.AP.11</td>
<td>Portrait of a bearded man</td>
<td>er-Rubayat (?)</td>
<td>0.C.A.D. 150–170</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>78.AP.262</td>
<td>Portrait of a young boy</td>
<td>Unknown</td>
<td>0.C.A.D. 150–200</td>
<td><em>Tilia sp.</em>, lime/linden</td>
</tr>
<tr>
<td>JPGM</td>
<td>81.AP.29</td>
<td>Portrait of a woman</td>
<td>Unknown</td>
<td>0.C.A.D. 170–200</td>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
</tr>
<tr>
<td>JPGM</td>
<td>79.AP.129</td>
<td>Portrait of a woman</td>
<td>er-Rubayat</td>
<td>0.C.A.D. 175–200</td>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
</tr>
<tr>
<td>JPGM</td>
<td>79.AP.129</td>
<td>One proper left dowel and one proper right dowel</td>
<td>er-Rubayat</td>
<td>0.C.A.D. 175–200</td>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
</tr>
<tr>
<td>JPGM</td>
<td>74.AP.20</td>
<td>Triptych panel with portrait of bearded man from shrine</td>
<td>Unknown</td>
<td>0.C.A.D. 180–200</td>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
</tr>
<tr>
<td>JPGM</td>
<td>74.AP.21</td>
<td>Triptych panel with painted image of Serapis</td>
<td>Unknown</td>
<td>0.C.A.D. 180–200</td>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
</tr>
<tr>
<td>JPGM</td>
<td>74.AP.21</td>
<td>Two dowels from Serapis triptych panel</td>
<td>Unknown</td>
<td>0.C.A.D. 180–200</td>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
</tr>
<tr>
<td>JPGM</td>
<td>74.AP.21</td>
<td>Batten from Serapis triptych panel</td>
<td>Unknown</td>
<td>0.C.A.D. 180–200</td>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
</tr>
<tr>
<td>JPGM</td>
<td>74.AP.22</td>
<td>Triptych panel with painted image of Isis</td>
<td>Unknown</td>
<td>0.C.A.D. 180–200</td>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
</tr>
<tr>
<td>JPGM</td>
<td>79.AP.142</td>
<td>Portrait of a man</td>
<td>er-Rubayat (?)</td>
<td>0.C.A.D. 220–250</td>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
</tr>
<tr>
<td>JPGM</td>
<td>79.AP.141</td>
<td>Portrait of a bearded man</td>
<td>Unknown</td>
<td>0.C.A.D. 225–250</td>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
</tr>
</tbody>
</table>

**Note**

* NCG indicates the Ny Carlsberg Glyptotek, Copenhagen; NMD the National Museum of Denmark, Copenhagen; and JPGM the J. Paul Getty Museum at the Villa, Los Angeles.
media or any conservation consolidant, so that the fine
details of the cellular structure were not obscured. It was
not possible to remove the standard sample, measuring
25 × 25 × 50 mm, which is necessary for modern wood
thin sectioning. The tiny samples that could be taken were
treated as though they were charcoal fragments and were
examined using the Hitachi S-3700N variable pressure
scanning electron microscope (VP-SEM) to observe the
fine detail of the crucial diagnostic features under high
magnification. Charcoal samples are fractured by hand
to expose fresh TS, RLS and TLS for examination. Frac-
turing rather than cutting exposes the clearest view of the
cellular structure; cutting with a scalpel or microtome
blade creates fine debris that penetrates and fills the cells,
obscuring key anatomical structures. Fracturing was also
successful for the mummy portrait wood samples.

RESULTS

The results of the identifications from wood samples from
all three collections are summarized briefly here and are
given in full in Table 1, while the characteristic features used
to identify the three wood species present are provided in
the appendix.

Ny Carlsberg Glyptotek, Copenhagen

All of the main portrait panel wood samples (seven) from
the Ny Carlsberg Glyptotek collections (abbreviated to NCG
thereafter) were identified as the European imported wood
*Tilia* sp., lime/linden, based on the anatomical features for
that species listed in the appendix. These mummy portraits
made of lime wood are labelled ÆIN 680–ÆIN 684, ÆIN
1426 and ÆIN 1473 in Table 1. A TLS of lime wood,
showing the characteristic helical thickening in the vessels,
is shown in Figure 1.

The wooden board underneath the mummy associated
with portrait ÆIN 1426 from Hawara was identified as
the imported Levantine softwood *Cedrus libani*, cedar of
Lebanon, on the basis of the anatomical features listed for
that species in the appendix.

National Museum of Denmark, Copenhagen

Three wooden portrait panels were sampled in the collec-
tions of the National Museum of Denmark (abbreviated to
NMD hereafter). On the basis of the anatomical features
for the species given in the appendix, one main portrait
panel (3840), from er-Rubayat, was identified as the native
Egyptian wood *Ficus sycomorus*, sycomore fig, while the
other two panels (3891 and 3892), also from er-Rubayat,
were identified as the European imported wood *Tilia* sp.,
lime/linden, Table 1.

*J. Paul Getty Museum at the Villa, Los Angeles*

Table 1 summarizes the results of the wood identifications
for the 14 samples of main portrait panel wood that were
taken from objects in the J. Paul Getty Museum at the Villa,
Los Angeles collections (abbreviated to JPGM hereafter),
and for additional samples taken from four dowels and one
batten.

Half the main portrait panels (i.e. seven) were identi-
fied as the European imported wood *Tilia* sp., lime/linden,
from diagnostic anatomical features listed in the appendix.
These mummy portraits made of lime wood, which appear
to group together chronologically as early examples, are
73.AP.91, 73.AP.94, 81.AP.42, 71.AP.72, 91.AP.6, 74.AP.11
and 78.AP.262. Four portrait panels (81.AP.29, 74.AP.20,
74.AP.21 and 74.AP.22) were identified as the indige-
nous Egyptian *Ficus sycomorus*, sycomore fig, and three
portrait panels (79.AP.129, 79.AP.141 and 79.AP.142) as the
imported softwood (coniferous wood) *Cedrus libani*, cedar
of Lebanon.

One proper left dowel and one proper right dowel from
portrait 79.AP.129 were identified as cedar of Lebanon. The
two dowels from portrait 74.AP.21 were also identified as
cedar of Lebanon while the batten from the same portrait
was found to be made from sycomore fig wood.

DISCUSSION

All seven portraits from the NCG collections were identified
as the European imported wood *Tilia* sp., lime/linden, Table
1. Five were from er-Rubayat (ÆIN 680, ÆIN 681, ÆIN 682,
ÆIN 683 and ÆIN 684), one from Hawara (ÆIN 1426) and
one from an unknown context (ÆIN 1473). This group of
portraits has been the subject of recent investigative conser-
vation [4, 5]. The preferential selection of *Tilia* sp. wood for
mummy portrait panels has been well discussed previously [1, 2], but the salient points are summarized here. The wide distribution of lime across Europe makes it a ready source of timber. As specimens of *Tilia* often reach heights of 30 m (100 feet), with a diameter of 1.3 m (4 feet) and with a clear bole for 15 m (50 feet), they yield good straight-grown timber for boards and planks. The sapwood of *Tilia* is indistinguishable from its white to pale yellow heartwood, whose fine, even texture turns pale brown on exposure to air. *Tilia* planks benefit from being seasoned before use in order to maximize mechanical and working properties and minimize susceptibility to insect attack, permeability or reduced durability. Important for making portrait panels, *Tilia* wood performs satisfactorily when sawn or cross-cut, and behaves well when
glued, stained or polished. *Tilia* was clearly a very useful timber for creating the fine, thin light panels for the mummy portraits. The radial longitudinal plane of lime wood was most often selected for the prepared surface onto which the ground and paint layers were applied; all of the NCG portraits panels were cut on the radial longitudinal plane.

The well-known artistic qualities and allure of mummy portrait panels have, unfortunately, resulted in many being separated upon discovery from the mummy on which they were originally placed. Examples of intact portrait panels on mummies, by comparison with separated panels, are relatively few and it is rare to find an example where the wooden mummy board is accessible for identification and can be compared to the wood of its portrait panel, Figure 2. ÆIN 1426 from Hawara is one of these rare examples and has yielded the extremely interesting identification of different woods for the mummy board and portrait; the board is made from *Cedrus libani*, cedar of Lebanon, while the portrait panel is of *Tilia* sp., lime/linden, Figure 3. The identification of *Cedrus libani* provokes several crucial questions. This imported timber has a long history of having been traded into Egypt for high-status coffins and funerary artefacts, particularly in the Middle Kingdom. Is its usage to be interpreted as a continuation of this Egyptian funerary tradition, or as another instance of the preferential selection of European and Levantine woods over those that are indigenous to Egypt? This issue is raised again in a later section in the context of the findings from the JPGM collections.

In the NMD collections one portrait panel from er-Rubayat (3840) was identified as the native Egyptian *Ficus sycomorus*. The choice of this indigenous timber is somewhat paradoxical. Although much used for coffin wood in Egypt, particularly in the Middle Kingdom, sycomore fig wood is light, not of high quality and is prone to insect attack. The thick layers of gesso and pigments that cover coffin wood planks reduce these drawbacks and *Ficus sycomorus* is one of the relatively few local trees that grow tall enough to yield long lengths of timber suitable for such coffin planks. In the Middle Kingdom *Ficus sycomorus* also

![Figure 4. Back of the thin panel of lime wood used for the portrait of a young man (71.AP.72). The curvature of the panel assisted in fitting over the mummy head when the portrait was in situ. Image: Caroline Cartwright. Collection: The J. Paul Getty Museum, Villa Collection, Malibu, California](image)

![Figure 5. Mummy of a Greek youth named Artemidorus in a cartonage body-case with mythological decoration in gold leaf and a Greek inscription (EA 21810). The face is covered by a portrait panel painted in encaustic](image)
had considerable religious significance, when it, and its fruits in particular, were associated with the goddess Nut. Being such an important tree in Egyptian funerary practices of earlier periods, its use for mummy portrait panels could be explained in terms of a fusion of old and new traditions in Roman Egypt. However, while Middle Kingdom carpenters manufacturing coffins could use *Ficus sycomorus* wood to its best advantage, carpenters preparing portrait panels in the Roman period faced a greater problem; as panels made from sycomore fig needed to be much thicker than those of other woods, notably *Tilia*, they could not easily be induced to curve snugly over the mummy head in the same manner as a thin lime wood panel. There may be no single reason for the choice of *Ficus sycomorus* wood for portrait panels and selection may have been reliant on money and status, or whether the panel was used as a portrait in the individual’s house before death, as discussed below.

The remaining two portraits in the NMD collections (3891 and 3892), also from er-Rubayat, were identified as the European imported wood *Tilia* sp., lime, Table 1. The seven main portrait panels in the JPGM collections that were identified as lime wood from *Tilia* sp. – possibly imported from the northern Mediterranean – also appear to cluster together chronologically as early examples, Table 1. It will prove interesting to see whether this will still hold true as information is gathered from a wider corpus of material, but as the precise dating of these portraits is still rather elusive, it may be too soon to attempt to match wood species, pigments, paint media, findspots and chronology.

As mentioned earlier, some panels were very thin indeed, which clearly demonstrates the potential to curve lime wood panels, as exemplified by portrait panel 71.AP.72 from this group at the JPGM, Figure 4.

One of the most exciting opportunities in this present study was the possibility to sample the wood of a portrait still in situ on the mummy of Herakleides (91.AP.6) in the JPGM collections. This mummy has been the subject of recent scientific investigation [6, 7], which has paved the way for comparing these results with data obtained from similar red-shrouded portrait mummies in collections worldwide. In many instances, intact portrait mummies do not offer opportunities for wood sampling as there is no suitable sampling spot available because the panel is tightly wrapped in linen. There are two such examples from Hawara in the British Museum collections: the mummy of a young boy dated to AD 100–120 (EA 13595) and the mummy of a Greek youth named Artemidorus (EA 21810) from the early second century AD, Figure 5. In the case of the Herakleides mummy, it was extremely fortunate that one minute sampling location...
was available inside a split in the panel (Figure 6), so that an unequivocal identification of imported *Tilia* sp. wood could be made. The full body computed tomography scans of Herakleides were extremely informative [6, 7], but unfortunately were not sufficiently detailed to permit identification of the mummy board wood.

Also in the JPGM collections are three portrait panels that were identified as the imported coniferous wood *Cedrus libani*, cedar of Lebanon: 79.AP.129 (er-Rubayat), 79.AP.141 (unknown findspot) and 79.AP.142 (possibly er-Rubayat). Two dowels in 79.AP.129 were also of cedar of Lebanon. The features that were crucially diagnostic in the identification of this species – scalloped torus margins on bordered pits in tracheid radial walls (see appendix) – can clearly be seen in the VP-SEM image, Figure 7.

As discussed above, *Cedrus libani* had been imported into Egypt for high-status funerary coffins and associated funerary objects from the Middle Kingdom onwards, so these present findings again raise the question of whether its selection for Roman period mummy portraits is a...
continuation of that Egyptian preference, or should be interpreted as an indicator of the Graeco-Roman trend towards favouring timbers that can be split easily along the radial longitudinal plane to provide thin panels with an even, fine-grained surface for painting. Clearly if there were comparable Graeco-Roman wood panel paintings surviving from Europe, more conclusive interpretation might be possible.

There is an unusual group of three portrait panels in the JPGM collections, sometimes described as a triptych or shrine (74.AP.20–74.AP.22). The fact that each is executed on a sycomore fig panel, with 74.AP.21 having a sycomore fig batten and two cedar of Lebanon dowels (Figure 8), seems to suggest their association to one another and also resurrects the debate over whether some portraits, particularly those made from *Ficus sycomorus*, were intended for use in the home and then may (or may not) have been placed over the mummy in the funerary rite [1, 2]. In the British Museum collections is an example of a small portrait painted on sycomore fig encased in a frame made from wood of the same species (GRA 1889,1018.1), although the frame and panel do not originate from the same piece of wood [1]. This portrait, in common with an increasing number of portrait panels that have been examined in detail, has dowels. The presence of dowels and battens in mummy portraits may imply that the wooden panel had some other primary function before it was employed for the mummy portrait or that the portrait was painted for some other purpose and reused in the funerary rites on the death of the sitter.

The use of different timbers for dowels, battens and other forms of connective carpentry has been covered in detail, for example in [1]. From the Middle Kingdom onwards, carpenters tended to make use of off-cuts of high quality wood, such as cedar of Lebanon, and also often specifically chose woods that were not of the same species as that used for the main part of the artefact. This works well when the different properties of the various species selected respond in a way that creates a tight fit, locking the components together. It also enables hard dense woods such as acacia (*Acacia* spp.) and Christ's thorn (*Ziziphus spina-christi*), which are normally only available as short lengths of timber, to be used to their maximum effectiveness.

This triptych is not the only example of the use of *Ficus sycomorus* in the JPGM collections as the tempera portrait of a woman from an unknown findspot (81.AP.29: Figure 9) was also executed on a sycomore fig panel, Figure 10.

The results of 94 wood identifications from mummy portrait panels were published by the British Museum in 2008 [2], but this present collaborative research undertaken with the NCG, NMD and the JPGM has added a further 24 identifications of portrait panel wood, bringing the total number of wood identifications on portrait panels to 118. In addition, wood identifications were made of one associated mummy board, four dowels and a batten. The results for all the portrait panels so far examined are summarized in Table 2. Unsurprisingly, imported *Tilia* sp. continues to predominate (86 examples of a total of 118). The indigenous *Ficus sycomorus* lies second (16 out of 118), followed by *Quercus* sp. (oak: 8), *Cedrus libani* (3), *Taxus baccata* (yew: 2), *Abies* sp. (fir: 2) and indeterminate (1).

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of examples identified</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tilia</em> sp., lime/linden</td>
<td>86</td>
</tr>
<tr>
<td><em>Ficus sycomorus</em>, sycomore fig</td>
<td>16</td>
</tr>
<tr>
<td><em>Quercus</em> sp., oak</td>
<td>8</td>
</tr>
<tr>
<td><em>Cedrus libani</em>, cedar of Lebanon</td>
<td>3</td>
</tr>
<tr>
<td><em>Taxus baccata</em>, yew</td>
<td>2</td>
</tr>
<tr>
<td><em>Abies</em> sp., fir</td>
<td>2</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>1</td>
</tr>
</tbody>
</table>

TABLE 2. Summary of all 118 mummy portrait panel wood identifications carried out by the British Museum to date

*Figure 10. VP-SEM image showing the TS of *Ficus sycomorus*, sycomore fig, with its characteristic structure of wide-banded fibres and axial parenchyma, mutiseriate rays and large vessels (sometimes in clusters).*
CONCLUSIONS

In previous publications one of the authors (CRC) has argued why the properties of *Tilia* species clearly make it a very useful timber for creating the fine, thin light panels for mummy portraits. The radial longitudinal plane of lime wood was most often selected for the prepared surface onto which the ground and paint layers were applied. There are clear anatomical reasons why this was an informed choice: the even nature of the ray parenchyma cells in their characteristic brick-like arrangement oriented at right angles to the equally evenly distributed vessels, fibres and axial parenchyma cells results in a highly consistent and uniform cellular structure that will perform predictably and reliably when sawn, split or carved. Cedar of Lebanon wood was also very suitable for splitting along the rays into thin sheets to be used for portrait panels. The use of cedar of Lebanon provokes an interesting debate. On the one hand, from the NCG mummy board, it could be argued that its use here merely extends the traditional and long-established import into Egypt (from Lebanon and Syria) of this prized, aromatic timber for prestige coffins and funerary artefacts from the Middle Kingdom onwards. While its use could simply be interpreted as a marker of high status, the results from the JPGM suggest that this species – in common with lime, fir, yew and oak – was part of the trend of preferred use of European and Levantine wood by mummy portrait craftsmen arising from their familiarity with the properties of such materials.

It is clear that the properties of lime wood are ideal for portrait boards and that *Tilia* species were readily available in Europe including Greece and Italy, but are these the main reasons for preferring *Tilia* above other woods for mummy portraits? This may be the case, but the JPGM results strongly infer that the story may be rather more complicated. It is possible that further consideration should be given to the likelihood of discrete centres of production of mummy portraits within which the craftsmen preferred specific woods. There are hints of that possibility already in this study, to which should be added the observation that very different methods were used for the painted surfaces, including encaustic, tempera and the application of gold leaf for decorative emphasis. It may not simply be an issue of some families being able to afford more expensive mummy portraits than others, but that certain workshops had their own distinctive preferences for wood type, method of painting, style and execution, from which their clients might choose.

APPENDIX

**Characteristic anatomical features of *Tilia* sp. (lime/linden)**

Distinct growth ring boundaries marked by two to three rows of thick-walled, radially flattened cells and distinctly flaring rays; diffuse to semi ring porous wood; vessels in multiples – mostly radial rows but sometimes in clusters; angular or polygonal vessel outline; simple perforation plates; alternate intervessel pits; vessel-ray pits with distinct borders (similar to intervessel pits); crossfield pits much smaller than intervessel pits; conspicuous spiral (helical) thickenings present in narrow and wide vessel elements (Figure 1); very thin-walled fibres or fibres of medium wall thickness; libriform fibres non-septate; distinctly bordered fibre pits common in both radial and tangential walls; banded axial parenchyma present in short, uniseriate, oblique-to-tangential bands (often also marginal or terminal up to three cells wide); apotracheal axial parenchyma present in diffuse and diffuse-in-aggregates distribution; axial parenchyma as strands; multisierate rays (one to five cells wide); rays of two distinct sizes; mainly homocellular rays with procumbent cells; storied structure present (axial parenchyma, vessel elements, some rays and some fibres).

**Characteristic anatomical features of *Cedrus libani* (cedar of Lebanon)**

Distinct growth rings; a gradual change from early wood to late wood tracheids; one traumatic vertical resin canal; scalloped torus margins on bordered pits in tracheid radial walls; cupressoid, piceoid and taxodioid ray to tracheid crossfield pitting; tracheids usually with a single row of bordered pits, rarely biseriate and alternate; uniseriate rays; nodular end walls of axial parenchyma cells; horizontal walls pitted in axial parenchyma only in growth ring boundary; in rays, end walls nodular with indentures; horizontal walls pitted in rays; marginal ray tracheids present.

**Characteristic anatomical features of *Ficus sycomorus* (sycomore fig)**

Indistinct growth ring boundaries; diffuse-porous wood; vessels in multiples – in short radial rows or small clusters; thin-walled tyloses present in some vessels; simple perforation plates; alternate non-vestured intervessel pits; vessel-ray pits simple or with reduced borders; some lacticifers present; septate and non-septate fibres of medium wall thickness; fibre pits simple to finely bordered; multisierate rays of two distinct widths; some rays 4–10 seriate; some rays greater than 10 seriate; heterocellular rays with square and upright cells only on marginal rows; sheath cells present; banded axial parenchyma with most bands greater than four seriate; scanty paratracheal or vasicentric axial parenchyma; fusiform cells common; prismatic calcium oxalate crystals occasionally present in chambered cells in axial parenchyma and in ordinary cells in ray parenchyma; no silica crystals observed.
ACKNOWLEDGEMENTS

Thanks are due to: the Ny Carlsberg Glyptotek for funding the visit to Copenhagen by Caroline Cartwright and for access to collections, especially Mogens Jørgensen; the National Museum of Denmark for access to collections by Caroline Cartwright and Lin Rosa Spaabæk; and the J. Paul Getty Museum at the Villa, Los Angeles, for funding the visit by Caroline Cartwright and for access to collections, especially Jerry Podany. All three institutions are also thanked for kind permission to take wood samples for examination.

AUTHORS

Caroline Cartwright (ccartwright@thebritishmuseum.ac.uk) is a scientist in the Department of Conservation and Scientific Research at the British Museum. Lin Rosa Spaabæk (lin@email.dk) is a conservator at the Ny Carlsberg Glyptotek and National Museum of Denmark, both in Copenhagen. Marie Svoboda (MSvoboda@getty.edu) is associate conservator in the Antiquities Conservation Department at the J. Paul Getty Museum at the Villa, Los Angeles.

REFERENCES


NOTE

1. The taxon Ficus sycomorus is rather confusing and is frequently misspelled and misused. Ficus sycomorus is a fig tree from the Moraceae family and is totally unrelated to the European sycamore or field maple, which belongs to the genus Acer from the Sapindaceae family (formerly in the Aceraceae family).