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The fall and rise of a Roman statue: the Kew Gardens Hermes

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Summary The Kew Gardens Hermes is a larger than life-sized white marble statue that came from the Royal Botanic Gardens at Kew to the British Museum in the mid-twentieth century. Although the origin of this Roman statue remains unknown, there are several other ancient versions of the same type of figure, including the so-called Farnese Hermes in the British Museum collection.

The conservation process presented several problems, both physical and ethical, due to the fragmentary state of the sculpture. During the project, conservators and scientists learnt more about the sculpture's history, its previous restorations and the circumstances of its display. These discoveries influenced the reconstruction of the statue, offering challenges as well as potential explanations for its initial condition.

INTRODUCTION

In 1959 the British Museum (BM) sent several Roman sculptures on long-term loan to the Royal Botanic Gardens (RBG) at Kew to decorate their newly refurbished Orangery. In the same year a larger than life-sized Roman marble statue of a nude, male figure was delivered to the BM by its owners at Kew in a wrecked and ruined state. The statue had long been at Kew Gardens but they had sent it to the stonemasons' shop in the BM in the hope that it could be restored. In the report outlining this loan, dated 25 March 1959, Denys Haynes, Keeper of the Department of Greek and Roman Antiquities, described the broken statue and its condition, referring to it as:

> … an ancient but much restored marble figure of Hermes, which has been extensively dowelled with iron and is now in danger of disintegration. The restoration, which will involve the substitution of copper dowels for the iron, will be a difficult operation, but Mr Haynes is of the opinion that if the statue is brought to the Museum, the work could be done gradually as and when the opportunity arises, and would not seriously interfere with the routine duties of the Mason's shop [1].

Regrettably, the opportunity for working on the figure of Hermes seldom arose before 1976 when Brian Cook, then Keeper in the Department of Greek and Roman Antiquities, rediscovered the statue in the basements of the BM and remarked in a letter to Kew that the work would be expensive and not a high priority [2]. Rosemary Angel from the Museum Division at Kew replied, stating that having the statue restored would be an expensive project to fund and that it was not a matter of urgency for Kew [3]. These, and other brief notes about the statue that date to 1976, all concur in the opinion that the statue was a 'write-off' or ruin. Ironically, despite these negative views of the statue, work began, but with limited results, so that it was not until 2009, 50 years after entering the BM, that the 'remains' of the statue finally entered the stone, wall paintings and mosaics conservation studio.

THE STATUE TYPE

Even in its initial ruinous state it was obvious that the original parts of the statue dated to the Roman period, but that the type was based on a lost fourth-century BC Greek original, known from the more than 20 versions listed by Boehringer [4]. Most similar to the Kew Gardens Hermes are the Belvedere Antinous (or Hermes) in the Vatican Museums (No. 907), the Farnese Hermes in the BM (1864,1021.1) and a third version discovered on the Greek island of Andros, where it remains on display today. The exact identity of the original statue remains uncertain, although it is likely that it originated as a figure of Hermes

a

b

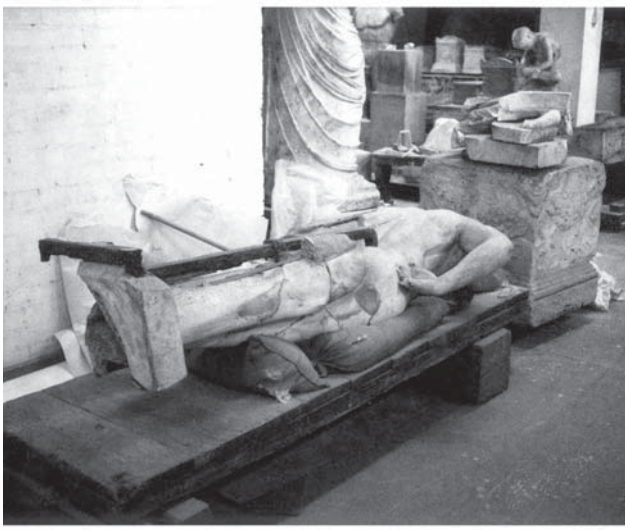

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FIGURE 1. The Kew Garden Hermes: three photographs of the sculpture taken in 1976. Images: courtesy of Royal Botanic Gardens, Kew

Psychopompos, the god who was thought to have led the souls to the underworld, as noted in Todisco [5]. The figure type was, however, also sometimes used in funerary portrait statues for wealthy young men. Although varying in their details, each of the relatively complete examples of the statue type has assisted in the reconstruction of the Kew Gardens version.

THE STATUE'S HISTORY AT KEW

How the Hermes came to be at Kew is still unknown, but this aspect of its history is currently being researched for a full publication of the statue. The sculpture might have formed part of the Royal Collection of ancient sculpture assembled by Charles I, which was later dispersed after the Civil War [6]. Some of these statues might have feasibly ended up at Kew Palace, although this has yet to be confirmed. Ancient and post-antique sculpture was used frequently at Kew to decorate and complement both the Gardens and some of the architectural follies that date to the late eighteenth century, many of which were built in the Classical style to the designs of the architect William Chambers.[1] As yet, the statue of Hermes has not been seen in any drawings, paintings or early photographs of the Gardens. It is not even clear whether the statue was displayed in the open air or inside a building, but it is likely that the statue was moved around the Gardens several times as they were landscaped and developed.

ASSESSMENT AND TREATMENT IN 2009–2012

Before any thought could be given to the future publication or display of the statue, a thorough conservation examination and assessment of the sculpture was needed to establish the viability of such plans. The first question was whether the statue could be reconstructed and, if so, what challenges would be presented by dealing with the previous attempts at restoration and what methods and materials would be needed for this new treatment. Secondly, it was important to investigate more fully the reasons why the statue had fallen into such a dilapidated state, so that the conservation treatment could be planned to minimize the risk of these recurring in the future. In considering each of these questions it was important to take into account the plans for future display of the statue at the British Museum and the manner and circumstances of its likely presentation when it returns to Kew.

In addition, it was hoped to shed light on the problem of which sections were original rather than restorations. The head and body were recognized through their stylistic qualities to be original Roman work, but the status of other parts of the sculpture remained an open question.

Condition

It was clear that the figure had undergone two main phases of restoration. The first, after excavation, is likely to have occurred in the eighteenth century or earlier, while the second was carried out by stonemasons at the BM in the twentieth century. As mentioned above, the stonemasons employed at the Museum in the late 1970s worked on the figure as a long-running project, but work ground to a

FIGURE 2. The collapsed sculpture on its arrival in the stone, wall paintings and mosaics conservation studio in 2009

halt at some stage and unfortunately there are no written records documenting their interventions. The images in Figure 1, which accompanied Brian Cook's letter to Kew in 1976, are therefore particularly helpful in understanding the sculpture's more recent history and its likely condition on arrival at the BM. From these photographs the sculpture appears to have remained deceptively intact, with just the plinth broken into four sections. One section of the plinth remained attached to the figure, the other three sat on top of an ancient altar close to the statue's head, Figures 1a and 1b.[2] It would be unusual for the plinth of a large sculpture to break without the statue sustaining damage. This posed a number of questions: how much further, unseen, damage had occurred; exactly how far had the stonemasons progressed with their work; and how would this affect the future reassembly of the pieces?

On its arrival in the studio in November 2009, the main bulk of the figure lay headless on an old wooden trolley with the remaining 18 pieces spread across two pallets and a tray, Figure 2. The pieces were studied individually and an assessment made about their condition and the viability of a reconstruction. This assessment also allowed for a closer investigation of the first restoration. Joins in the stone indicated that during this phase of work the sculpture consisted of 10 main parts. The head, torso, both arms (the left including drapery) and the plinth were separate pieces. The proper left (i.e. the figure's left) leg had been intact, with a separate foot, and the right leg with supporting tree stump was formed of three sections – the thigh, the shin with a section of tree stump and the foot with a section of tree stump and plinth.

Some of these main sections were easily identified as pieces that had been carved to fit into the original elements

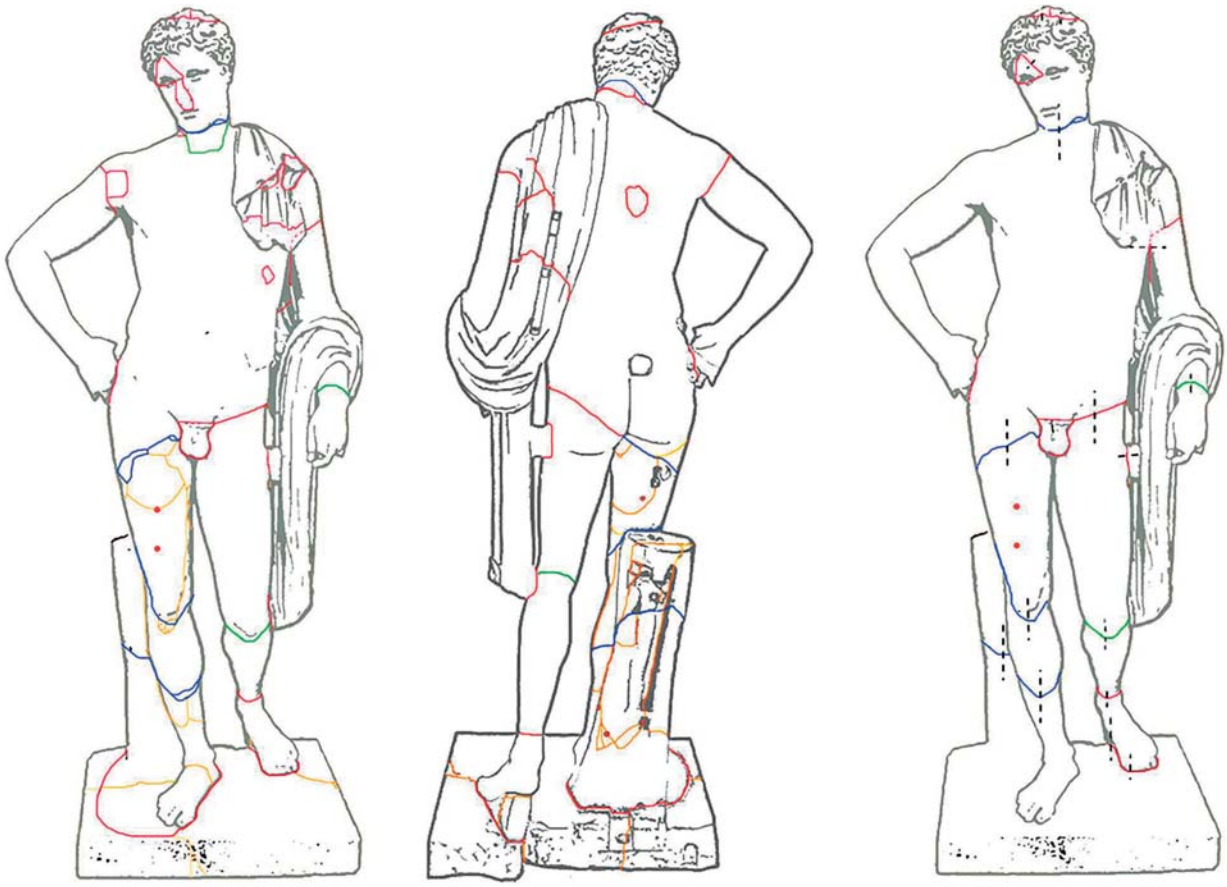

FIGURE 3. Diagrammatic representation of the phases of restoration: the blue lines represent ancient breaks that were adjusted, dowelled and bonded in the first restoration; the red lines indicate reworked surfaces and replicated pieces fitted in the first restoration; the yellow lines show breaks bonded by the stonemasons during the second restoration; the green lines indicate breaks that had not previously been bonded; and the black dashed lines show the locations of dowels and pins. Drawing (not to scale): Kathryn Oliver

of the sculpture at the time of the first restoration; the marble used in these parts differed from that of the original torso and the joins were very neat straight lines, unlike natural breaks that had been bonded [7]. However, for certain sections, such as the figure's left foot and the fragmented right leg and tree stump, it was only possible to determine if these elements were original through scientific analysis. As part of this analysis, the torso, which is a known original Roman piece, and the left leg, a known restoration, were also sampled for reference purposes.

Smaller, separately carved marble elements had been used during the first restoration to fill damaged areas of the chest, back, neck, head or the drapery slung over the figure's shoulder and a few of the previously restored areas – particularly in the fingers and toes – had been lost subsequently, leaving holes in the stone from the lost dowels.

In 2009 substantial iron dowels from the first restoration remained in the shoulders, the left thigh and the bridge between the thigh and the adjacent drapery. Smaller iron dowels remained in the top of the head, securing a fissure running through the hair, and in recesses cut to house a restored eye and (now missing) nose fragments. The dowels within the figure's right arm remained sound and stable, but there was considerable movement in the left arm and thigh, which were structurally unsound.

It was clear that since the photographs in Figure 1 were taken, the stonemasons had carried out extensive work as part of the second main restoration. In these images a large iron cramp can be seen that ran from a hole in the back of the torso, down the tree stump, to the plinth where it divided to form a 'T-bar', Figures 1b and 1c. In Figure 1b a second, smaller cramp can be seen in the tree stump beneath the main cramp. The stonemasons had obviously removed both cramps, leaving staining from the corroded iron. Although, in the images, only one cramp can been seen on the back of the tree stump, the loss of stone in this area is quite extensive, perhaps because the bottom of the cramp had been fitted so deeply that the hole made for it joined with the central dowel hole. At the top of the cramp there are also three circular holes with diameters of 22 and 29 mm, the reason for which is no longer clear. The considerable losses of stone around the cramps seen in Figure 1 would have reduced the support offered by the tree stump and although it would undoubtedly still provide enough strength to the right leg when the figure was standing, when the sculpture was exposed to unusual

stresses it may not have been sufficient to save the leg from further damage.

Many of the parts of the sculpture that had been bonded as part of the first restoration were dismantled in the second, leaving just the arms and left thigh attached, Figure 2. Any dowels within the right leg had been removed and, although these areas are now covered in extensive surface dirt, none of the binding material used to hold the dowels remained.

The base had been bonded together using what is believed to be a mastic adhesive and a large area of the underside was covered with plaster of Paris, masking some of this work. The main focus of the second restoration had been the right leg and tree stump, which had been reassembled from 35 smaller fragments and bonded with mastic. Figure 3 shows the various joins and phases of restoration diagrammatically.

Overall, the marble pieces were found to be sound and stable. All had some superficial dirt and loss of surface due to erosion. There were some localized areas where what appeared to be sulphation had occurred and a black residue had built up in sheltered areas, particular in the recesses of the drapery.

Following assessment, and despite the major difficulties anticipated, it was felt that the figure could and should be reconstructed, for its own preservation, to aid research and for possible display. One potential difficulty lay in the main weight-bearing right leg and supporting tree stump. The joining surfaces of these ancient breaks had been largely reworked, leaving a combination of broken stone and prepared surfaces. Each of these breaks ran at an angle of approximately 47° to the vertical and this, when combined with the smooth surfaces of the reworked stone, would assist gravity to pull the upper sections down and forwards during any attempt to reassemble the sculpture. This was expected to pose a considerable physical handling problem, as the thigh and mid-shin fragments weighed approximately 56 kg.

In addition, there were three main locations on the statue where there was no evidence to indicate how the sections had been joined previously. These were: the position of the right foot within the base; the left foot on top of the base; and the point at which the legs met. A slight adjustment to any of these would greatly affect the overall angle of the sculpture, the clarity of its profile and the distribution of weight. It would therefore be essential to build the statue repeatedly without bonding, allowing the most appropriate positions for each of the pieces to be found through trial and error, and a versatile system would be required to support and manipulate the heavy individual sculpture fragments during this process.

Treatment

Following the assessment, a proposal for treatment was produced that received approval from the RBG, Kew, which also formally offered the statue on a long-term loan to the British Museum on completion of the conservation project.

After tests it was decided to give the surfaces a light initial clean using low-pressure steam, combined with swabs where necessary. This provided clean surfaces for handling and bonding. A Nd:YAG laser operating at a wavelength of 1064 nm was used to reduce areas of sulphation crust present on the face, drapery and torso [8]. A second clean would be carried out after bonding to give the statue an even appearance, see below.

In cleaning the fragments, the previous work carried out by the stonemasons was further exposed, in particular the bonded fragments forming the three sections of the right leg and tree stump, and the three bonds in the base. Many of the segments had been set with slight 'steps' between them, which had then been sanded back to provide a smooth profile. (Although no longer considered acceptable, this was a particularly common practice that is frequently encountered by conservators and leads to complications in later conservation treatments for many types of object.) As this procedure had changed the shape of the fragments, the original profile could never again be recovered in every area. In this instance, the sanded areas formed a band with a width of up to 25 mm either side of the join, which suggests that a large amount of material had been removed. This problem introduced by the twentieth-century restoration, combined with those previously discussed above, meant that only one of the eight joins from the plinth to the torso could be bonded in its original position without debate and that the figure could not, therefore, be completed without compromising some locations and join edges.

Cleaning the proper right leg and tree stump also exposed six small holes with diameters in the range 5–20 mm, some of which had been filled with mastic by the stonemasons. Traces of lead were present in some of the holes, but one clear hole could be seen to lead to the central dowel hole in the thigh created during the first restoration. Occasionally, in post-antique restorations the stone fragments were assembled with a loose dowel within and channels such as those represented by the six holes were used to pour molten lead into the space surrounding the dowel [9]; as the lead set, the pieces were fixed firmly in position. Since holes of this type were present in all three of the right leg and tree stump sections it is possible that each join had once been filled with lead that was subsequently removed by the stonemasons in the late 1970s.

Prior to reconstruction, the statue's structurally unsound left arm and left thigh had to be removed by cutting the iron dowels using a hacksaw blade and the iron core and surrounding organic resin removed from the dowel holes. Similarly, the iron dowel and lead in the neck were removed by drilling. It is reasonable to believe that the proper right arm would also have housed iron dowels within the shoulder and possibly the right hand. As this piece remained structurally sound and the iron dowels were stable, it was decided to leave them within the stone to avoid any unnecessary damage from further intervention to the arm. In the same way, no attempt was made to remove the dowels believed to be present in some, if not all, of the re-carved elements of

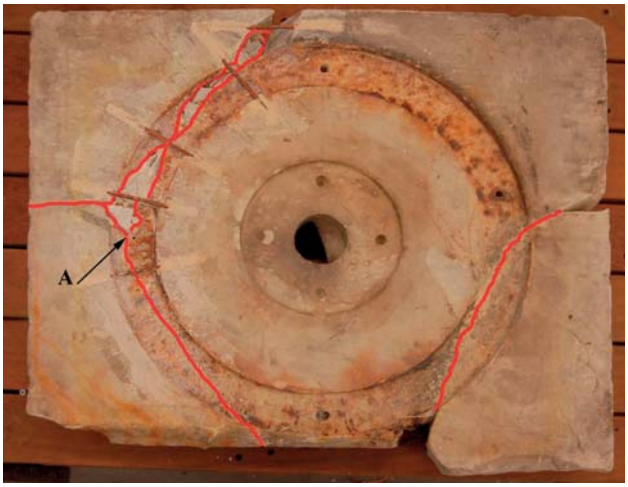

FIGURE 4. The underside of the plinth showing the recess carved to receive an iron turntable. The red lines indicate the joins that were bonded during the second restoration in the 1970s. The point 'A' beneath the right foot and tree stump at which three of these breaks meet is indicated by an arrow

the sculpture that remained intact from the first restoration. Although these could corrode in the future, the risk of this would be minimal if the sculpture is displayed indoors, as recommended.

Before any rebuilding was attempted, the plinth was inverted and the stonemasons' restorations investigated. As the plinth is fundamental to the stability of the whole statue, it was decided to remove the plaster that covered much of the twentieth-century work to allow the extent of restoration and its consequent stability to be assessed fully. This exposed a circular channel with a diameter of 505 mm cut into the stone to a depth of about 10 mm. There was also a smaller circular recess, measuring 65 mm in diameter, with a deep dowel hole at its centre, Figure 4. This unusual arrangement had accommodated a turntable. From the extensive iron staining and the sections of heavily corroded iron, it appears that the sculpture had been displayed in this manner for some considerable time, although there is no way of dating the turntable, which could have been a part of the first restoration or a later addition. In order to strengthen the twentieth-century restoration, the voids were filled using General polyester resin mixed with white sand and left flush with the marble. After much discussion it was decided that to provide further support for the base an 8 mm thick stainless steel plate would be bonded to the underside of the base using General epoxy resin; the plate was slightly smaller than the base to be less obtrusive. While it could be argued that the additional plate is unnecessary providing that the sculpture is always placed on a plinth with a flat upper surface to provide homogeneous contact and support, sculptures of this type are often positioned on small spacers or pads, which may fail to offer support beneath areas of weakness. In the case of the Hermes, uncertainties about its longer-term display and storage outside a museum context led to the decision to attach the plate to offer security and flexibility for its future display and handling.

A system was devised that would allow the repeated assembly and disassembly of the fragments without adhesive (i.e. dry built). A wooden frame was constructed that provided support to each fragment, allowing precise, individual adjustments to be made without hindering examination of the statue as work progressed, Figure 5. The framework structure began as a simple 'cube' with stabilizing braces running to the ground at each corner. From this basic structure, battens could be added that protruded inwards to hold the fragments in place. One side of the framework was detachable to allow any sections of the statue slung from the overhead gantry to be positioned without compromising the strength and support required for those already in position.

First the statue's right leg was constructed, then the torso was hoisted into position. The foot and stone beneath it was set into a large, uneven recess in the plinth that allowed some small movement. If this foot had been positioned wrongly, the torso would have been thrust too far forward or back. To achieve the correct overall presentation, it was necessary to dismantle and reassemble these pieces several times, making subtle adjustments each time. Once the position of the right leg was established, the left leg and foot were introduced simultaneously and the process repeated to provide neat joins.

Once the optimum alignment was decided for each piece, marker crosses were painted onto the stone, using a thick layer of 40% Paraloid B72 (ethyl methacrylate copolymer), applied in a 1:1 mixture of acetone and industrial methylated spirit, as a barrier layer. These crosses were accompanied with an 'F' meaning flush, 'P 1 mm' meaning proud 1 mm or 'S' for shallow. In the same way angles to the vertical and horizontal were measured using a spirit level and marked. The frame itself also required a number of labels as it was necessary to detach many of the batons as the various pieces of the statue were added or removed. With slight adjustments of the batons, or by the addition of wedges, the sections of the statue could be moved or twisted, improving alignments considerably.

After many hours of adjusting and rebuilding, the favoured position of each marble section was decided. One final test remained, which would confirm the successful alignment of the pieces. This involved the two dowels in the left arm section, one at the shoulder and the other between the drapery and thigh. Before bonding any of the pieces, it had to be confirmed that these dowels aligned with the torso and leg respectively. Although the legs and torso appeared to be correctly located with respect to each other, a slight miscalculation would have meant that these two dowel holes were misaligned and the arm would have been left at an unsightly angle. Ideally, the correct alignment would have been confirmed by introducing the arm. Unfortunately, because the torso (which weighed approximately 280 kg) was too heavy to be supported entirely by the un-bonded legs, it had to remain suspended from the hoist by slings that obstructed the correct positioning of the left arm. The solution adopted was to cast rough plaster of Paris

replicas of the areas around the shoulder and thigh dowel holes and to join these two casts with a wooden bar to replicate their relative positions in the original arm and drapery section. The casts were easily held in position against the shoulder and the thigh, without interfering with the slings, and once these positions were confirmed, bonding could begin.

The choice of adhesive was based on a number of factors: strength (due to the angles of the bonds and stone losses internally and externally); longevity (as any creep or failure of the bonds could leave the structure unsound and unsafe); high viscosity (as many of the breaks had inconsistent contact); and a slow curing time (to allow handling and positioning of the fragments). These requirements led to the use of a slow-curing epoxy resin. There are drawbacks to using epoxy, as it is known to be considerably stronger than marble and it is difficult to reverse the treatment [10]. The use of Paraloid B72 as a barrier layer on stone surfaces before bonding using epoxy resin has been studied previously [11], so this option was considered and discussed carefully. It was decided that in this instance it would not be appropriate, since any creep or movement as a result of the ageing of the Paraloid B72 could leave the sculpture structurally unsound in the future.

The figure was again dismantled and each join was individually bonded using General epoxy resin and AISI type 312 stainless steel dowels. A range of dowel sizes was used, from 8 to 25 mm in diameter and from 80 to 286 mm in length, while smaller pins were used to attach fragments such as the hair and right eye. The dowel sizes were often dictated by the need to reuse old holes, many of which did not line up perfectly with each other. As each piece was bonded the remaining sections were dry built to ensure they were still correctly aligned.

After all the fragments had been bonded, and the markers removed with acetone, the figure was again cleaned, using low-pressure steam or deionized water applied with a swab to provide an even finish. Any exposed resin had already been cut back while still pliable and the remaining recesses at the joins were filled using glass microballoons mixed with 20% Paraloid B72 in a 50:50 solution of acetone and industrial methylated spirit. As the bonds from the second restoration were flush with the stone surface the fills in this treatment were also finished flush for consistency. The fills were then retouched using Cryla acrylic paints and the resin fills and bonds remaining from the stonemasons' work were also painted. It was decided to use retouching that matched the heterogeneous colour of the stone, rather than a more visible flat colour, for two main reasons. First, the gallery in which it was proposed that the sculpture be displayed after conservation contains several sculptures of a comparable date and style, most of which have been restored with carved additions and have fills that had been retouched in a similar manner. After consultation between the curator and conservator, it was decided that for consistency with the other sculptures in the gallery, none of which had been as extensively damaged as this figure of Hermes, it would not be appropriate to leave the fills clearly visible. However, the retouching remains visible when viewed closely and, as the finishing of fills of this nature is a much debated issue, all fill materials and paints should be reversible by dissolution in acetone if any future adjustments are thought desirable.

FIGURE 5. The sculpture dry built within the wooden frame during the course of the conservation treatment

Each prospective fill within the more substantial gaps in the sculpture was individually considered by both the conservator and the curator. Missing areas of the sculpture were replaced where no significant features were affected and where the loss was disruptive. Missing fingers and toes were left untouched but the larger fixing holes for cramps were filled and toned, leaving the level just below that of the original stone surface where appropriate.

The recess for a missing restored nose was particularly disruptive, but it was felt that it would be unnecessary to replace the whole nose. The cavity was filled flush to the surrounding stone and painted to appear as a broken surface.

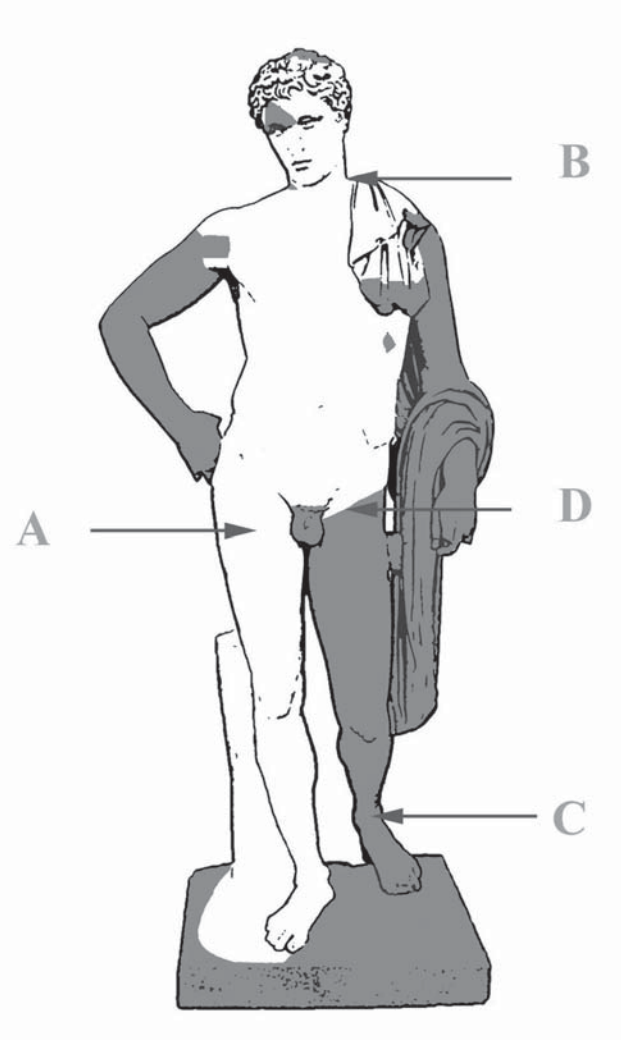

FIGURE 6. Diagrammatic representation of the sections of the sculpture that are original Roman marble (shown in white) or that were carved and attached as part of the first restoration (shown shaded grey). The arrows and labels indicate the locations from which the samples for stone analysis were taken. Drawing: Kathryn Oliver

SCIENTIFIC INVESTIGATION

As outlined above, scientific analysis of some parts of the statue was undertaken where the nature of the earlier restoration led to doubt about which parts of the statue were original and which restored. Using a small chisel, four samples less than 1 cm^3 in size were taken in unobtrusive areas, to avoid visible damage. They were taken from the join surface at the top of the right thigh (sample A), from the break surface at the neck of the torso (sample B), from the left foot, adjacent to the ankle dowel hole (sample C) and from the dowel hole in the left thigh (sample D), Figure 6.

As indicated earlier, the torso is definitely Roman in date and the left thigh is a known later restoration, but the other two samples were taken from areas of the statue that were more problematic. The right leg and tree stump were thought to be part of the original statue, but reworked at some point. It was therefore expected that sample A would match the torso, but it was not certain whether the left foot was original or a restoration, a question that it was hoped could be resolved by a comparison of sample C with both samples B and D.

Methods

The four marble samples were prepared in thin-section and were examined by polarized light microscopy (Leica DMRX [12]) and using a Hitachi S-3700N variable pressure scanning electron microscope in combination with an Oxford Instruments INCA energy dispersive X-ray analyser (SEM-EDX). The SEM was used at a vacuum of 30 Pa with a 20 kV accelerating voltage and the samples were analysed uncoated.

Results

In the thin-section, samples A and B are very similar; they exhibit polygonal large calcite crystals of similar sizes (up to 0.3 × 0.3 mm) and a heteroblastic texture with layers and lenses of fine-grained dolomite within a groundmass of coarse-grained calcite with recrystallization at the calcite grain boundaries, Figures 7a and 7b.

Samples C and D are similar; they have a groundmass of coarse-grained calcite crystals (0.2 × 0.2 mm) that show bright colours typical of the high birefringence of calcite under cross-polarized light, occasional muscovite and no dolomite, Figures 7c and 7d.

Multiple bulk SEM-EDX analyses were carried out on each sample at a magnification of ×100 (giving sample areas of *c.*1.5 × 1.1 mm); these are reported in Table 1. The results for 11 elements (Na, Mg, Al, Si, K, Fe, Mn, Ti, Ca, S, P) were converted into oxide percentages. These percentages were normalized (oxygen by stoichiometry) to take into account the fact that oxygen and carbon are not measured and should, therefore, be regarded as semi-quantitative; for more details see [13; pp. 256–257].

In the SEM, samples A and B have a microstructure similar to dolomitic marble (see MgO content in Table 1) with small inclusions such as apatite and low concentrations of fluorine. In contrast, samples C and D are mainly composed of calcite (*c.*98% in Table 1) with no dolomitic phases, although the samples also contain occasional micas and very occasional apatite (sample C), titanium dioxide (sample D) and iron sulphide (samples C and D).

DISCUSSION

The scientific analyses indicated which major elements of the sculpture were original and which later additions. The results of petrographic and chemical analysis suggested that the right leg and tree stump were carved from the same stone as the dolomitic marble torso. This was expected

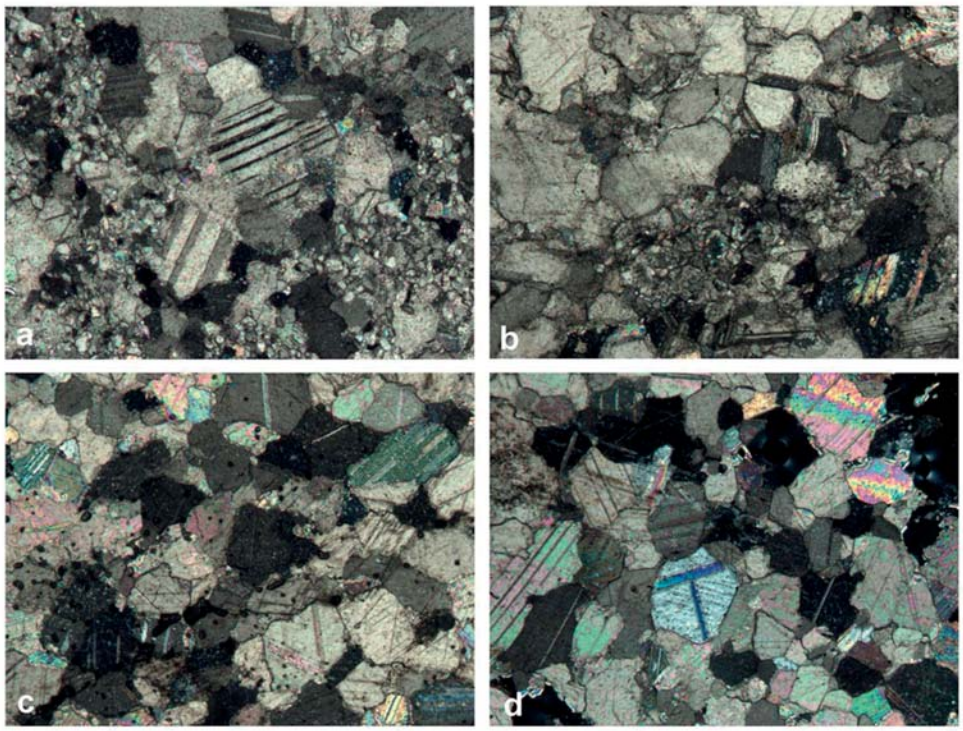

FIGURE 7. Photomicrographs of thin-sections made from the four stone samples, viewed under cross-polarized light: (a) dolomitic marble sample A; (b) dolomitic marble sample B; (c) calcitic marble sample C; and (d) calcitic marble sample D. Field of view 1.74 mm

and implies that they are original. The results also indicated that the left thigh and left foot were made from the same calcitic marble, which differs from the stone used for the torso, suggesting that these are both later restorations. These results, combined with observations made during the conservation process, have been used to produce Figure 6, which shows the original and later elements of the sculpture.

The main damage to the sculpture after the first restoration was centred on the proper right leg, tree stump and plinth, which were broken into at least 39 fragments, Figure 3. The discovery of the channels for a turntable on the underside of the plinth raised questions about its structure and stability following this adaptation. At the end of the first restoration the foot and the base of the tree stump were still a single piece of stone that also included a large portion of the original plinth; this was then inserted into a new plinth. Although uneven, the original part is nearly as deep as the restoration in which it is housed, with only 25 mm of stone beneath it in places. In one such area the 10 mm deep recess for the turntable further reduced the

TABLE 1. SEM-EDX results of bulk analyses of marble samples A, B, C and D showing the significant oxides present

Sample	Analysis	Na_2O	MgO	Al_2O_3	SiO_2	CaO	MnO	FeO
A	First bulk	0.1	23.9	0.8	0.2	74.8	0.1	0.0
A	Small bulk on calcite-rich area	0.0	4.0	0.4	0.3	95.1	0.0	0.0
A	Small bulk on dolomite-rich area	0.0	42.4	0.7	0.3	56.3	0.2	0.2
B	First bulk on calcite-rich area	0.0	8.8	0.4	0.4	89.1	0.0	0.0
B	Second bulk on calcite-rich area	0.0	7.3	0.5	0.2	90.8	0.0	0.0
B	Bulk on dolomite-rich area	0.0	39.0	0.6	0.2	60.0	0.0	0.2
C	First bulk	0.0	1.6	0.2	0.4	97.7	0.0	0.0
C	Second bulk	0.0	1.6	0.3	0.3	97.8	0.0	0.0
D	First bulk	0.0	1.5	0.3	0.4	97.8	0.0	0.0
D	Second bulk	0.0	1.7	0.3	0.3	97.8	0.0	0.0

Note: each bulk analysis at ×100 covers an area of *c*.1.5 × 1.1 mm. The results are reported as normalized % oxides.

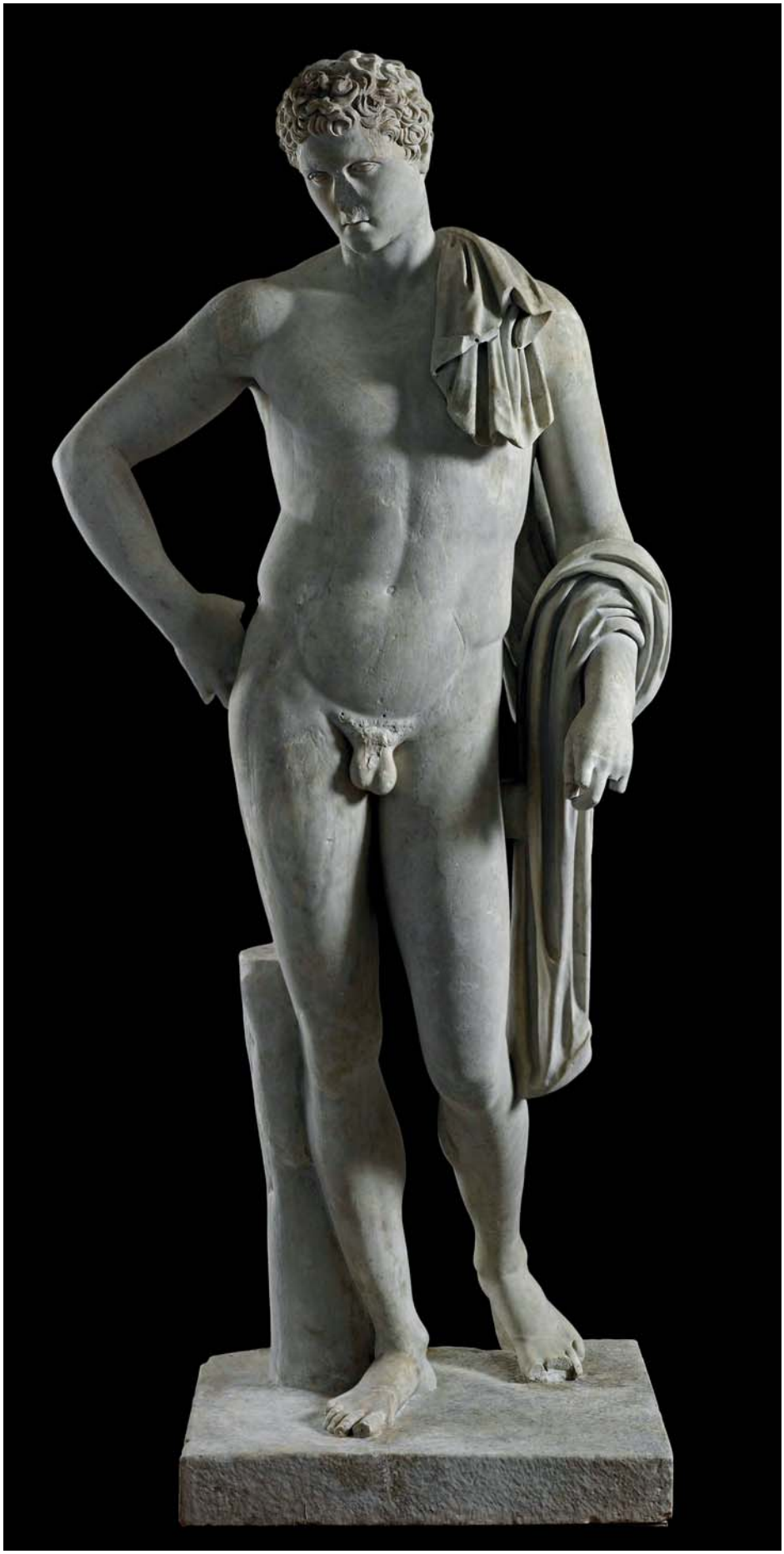

FIGURE 8. The Kew Garden Hermes after conservation

depth of the stone beneath the original elements to 15 mm and, unsurprisingly, it is here that the three main breaks to the plinth all meet, point A on Figure 4. One theory is that as the turntable corroded – evident from the extensive staining and fragments of highly corroded friable iron – the thin layer of stone beneath the load-bearing right leg was left unsupported and the plinth cracked and eventually broke. The large iron T-bar bracing the plinth across one of these breaks suggests that a crack may have been present for some time, although as no attempt had been made to brace the side or front, these breaks may have developed later. It seems likely that as the base broke the weight of the sculpture caused it to become unstable until the proper right leg and tree stump dropped as the base separated.

In addition, the central lead core to the leg (and possibly the tree stump) may have moved slightly over time if the sculpture was exposed to fluctuating temperatures. A slight softening of the lead in response to warm conditions could allow a shift in the positions of the dowels in the legs, which due to pressure from the weight of the upper elements of the statue might cause cracks and breakages throughout the surrounding stone. The tree stump had obviously been weakened by the corrosion of the iron cramps and dowels and had broken into several pieces, separating from the leg between the knee and the mid-shin and splitting through the dowel hole, which caused the back and front of the tree stump to separate. Whether the reason for these breaks was movement in the lead or the result of the failure of the base, they would have undermined the tree stump's ability to support the right leg when under strain.

It is also possible that damage occurred through handling, or as a result of an impact that subjected the leg to a bending force. No damage consistent with a forceful impact was found on the sculpture, but the break running through the bridge of the foot and across the original plinth suggests a substantial pressure forcing the leg forward. The true cause of the sculpture's collapse may lie in a combination of factors: mishandling, movement in the dowels of the right leg and tree stump and a weakened, under-supported plinth.

The nature of the breaks posed difficulties in the rebuilding process and in this the wooden frame proved an invaluable tool. Francis Toohey at Plowden and Smith Ltd. developed the use of such a frame and he has used the system in numerous projects. Its limitations became evident as the fragments became heavier since the wood retained some flexibility and additional restraints were required in the form of strategically positioned ratchet straps and weights.

This type of conservation and restoration project is unusual for the Museum as there are few sculptures in the collection in such a fragmented state. Internationally, there are many ongoing projects in which more easily reversible systems for joining sculptural elements are being investigated [14], but in this instance it was felt that the structural stability of the figure was best served by the use of an epoxy resin. Before the stonemasons' work, the sculpture had been in over 50 pieces, 35 of which were in Hermes's load-bearing right leg, with many hollows and gaps remaining. A sound core to this leg was considered essential for the long-term security of the completed piece and it was believed only in such a finished state could the figure be fully appreciated and studied.

CONCLUSIONS

Despite the initial complications and reservations, the conservation of the Hermes sculpture has been judged a great success and has certainly 'revived' a statue worthy of further research and display. The project has been significant for the Museum, not only because of the condition of the statue and the consequent challenges, but also for the opportunity it has provided to work with RBG, Kew and its staff, reviewing this sculpture and others in their collection. Collaboration and discussion between curators, conservators and scientists created clear objectives from the start of the project and these have mostly been achieved, providing evidence of past restorations and a possible explanation of why the figure collapsed before its arrival at the Museum. The presence of a turntable suggests that the sculpture had been considered a treasured piece in the past, as it is once again. Research into the provenance, collection history and past display of the sculpture will continue and the possibility of further scientific investigation, for example stable isotope analysis (^{13}C and ^{18}O) to address the provenance of original and restored components, will be considered.

Now measuring a towering 2.1 m (Figure 8), the sculpture will once again be set up on its ancient altar base and go on display at the British Museum on long-term loan in a gallery that highlights the reception and development of Greek sculptural types in the Roman period.

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MATERIALS AND SUPPLIERS

- General epoxy resin (two-part mixed in a 1:1 ratio) and General polyester resin: Pisani plc, Unit 2A, Plane Tree Crescent, Feltham, Middlesex TW13 7AL, UK, sales@pisani.co.uk

- Paraloid B72 and glass microballoons: Conservation Resources (UK) Ltd., Unit 2, Ashville Way, Off Watlington Road, Cowley, Oxford OX4 6TU, UK, www.conservationresources.com
- Stainless steel plate: Parker Steel, Vauxhall Road, Canterbury, Kent CT1 1HD, UK.

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NOTES

1. Sir William Chambers (1723–1796). Some of his architectural follies survive to this day including the Ruined Arch, Pagoda, Orangery, Temple of Bellona and Temple of Aeolus.
2. This is a Hellenistic Greek altar decorated with garlands and *boukrania* that also came from Kew. It is now clear that it had been used there to support the statue of Hermes as it has a cutting in its upper surface to receive a metal turntable. Such ancient objects were frequently used to support Classical statues in English country house and private collections. The altar base will be published in full in a forthcoming article on the history of the Kew Hermes.