



# 山门 状况评估

## Shanmen Condition Assessment



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### 室内彩画油饰 Interior Painted Surfaces

#### 彩画 Polychromed Painted Surfaces (*caihua*)

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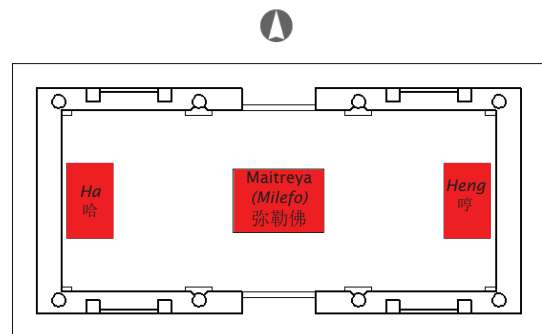
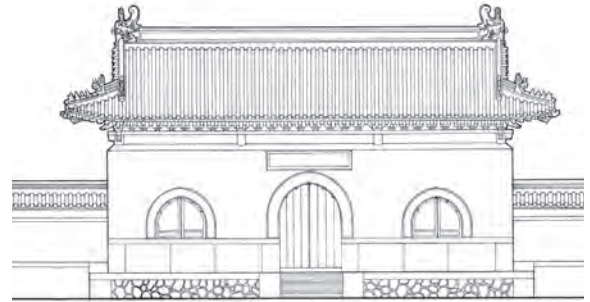


山门为长方形结构，面开三间，进深一间。山门内外木质构件上均有残留的彩画。

殿内东西侧有“哼”、“哈”二将彩塑泥像，原来置于天王殿内的弥勒佛像现端坐殿中。

Shanmen, or the gatehouse, is a simple rectangular structure, three bays wide and one bay deep. The gatehouse has surviving painted polychrome decoration on both exterior and interior architectural wooden surfaces.

Painted Temple Guardian statues, *Heng* and *Ha*, are located at the east and west ends of the gatehouse and the bronze-colored statue of Maitreya (*Milefo*), originally housed in Tianwang Hall, now resides in the center of the building.



山门室内总观，西向。  
General view of Shanmen interior looking west.



山门室内总观，东向。  
General view of Shanmen interior looking east.

山门室内外施“金线大点金烟琢墨旋子彩画”。枋心为“片金二龙戏珠加工王云”，找头为“旋子”的几种不同形式。这一“旋子”图案由牡丹母题发展而来，起源于宋、元，至明、清发展到顶点。盒子内为“片金宝相花”。斗拱蓝绿相间“平镏金”。

The exterior and interior paintings at Shanmen are decorated with "Jinxian dadian jinyanzhuomo xuanzi caihua". The main section is decorated with two dragons playing with pearl and variations on the whirling motif pattern. An example below shows a variation on the "one whole, two split" pattern. This motif grew out of the peony design, its origins in the Song and Yuan dynasty, reaching its apex of development in the Ming and Qing dynasty. The ends of the beams are decorated with the *baoxiang* flower motif. Brackets alternate green and blue and are decorated with a simple gold border.



“旋子”的几种不同形式

Variations of the whirling motif decoration

斗拱“蓝绿相间平镏金”

Brackets alternate green and blue with a simple gold border decoration

“二龙戏珠加工王云”

Two dragons playing with pearl and "王-shaped cloud"

“宝相花”母题

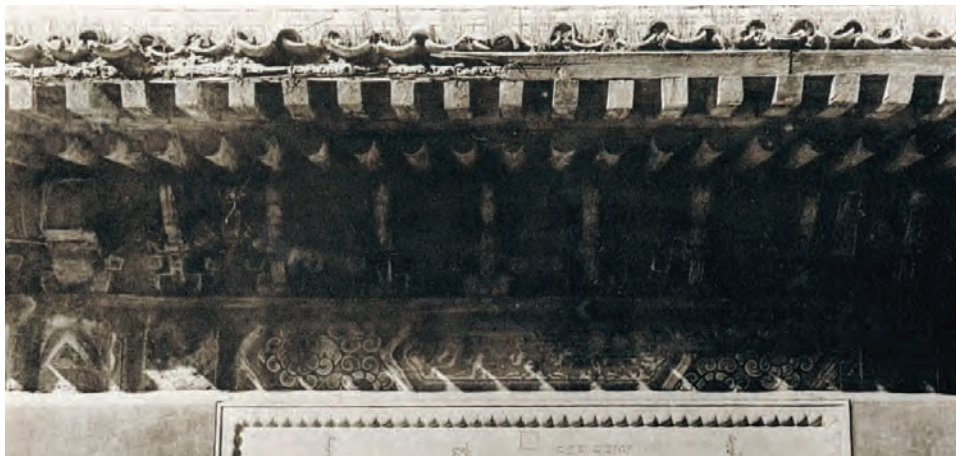
*Baoxiang* flower motif

有关山门过去的历史状况极少有文献记录。最早的记录提及，1805年（仅会乘殿1775年建成后的第30年），山门层进行落架大修（北京第一历史档案馆，工程档案第二卷）。此后没有进一步的记录，直到1950年记录提及山门后檐倒塌；倒塌的原因很可能由于对遗址的缺少维护。1959年3（或5）月18日文物局古建工程队开始对山门进行了一系列的一般性维修。1975年调查报告发现屋顶漏水，椽望腐朽及屋檐塌陷，因而对该建筑进行了进一步维修，包括大梁、斗拱系统、飞椽、连檐及瓦口的更换。

历史上没有对山门内外彩画、油饰进行过维修的文献证据。

Few records exist that document the physical history of Shanmen. The first records report that in 1805, Shanmen was dismantled and restored (second volume of the Gongcheng archives in the No 1 historical archives, Beijing) just 30 years after construction finished on Shuxiang Temple in 1775. No further records have been found until 1950 when it was noted that the rear (north) eave of Shanmen had collapsed most likely due to lack of maintenance to the site. A series of repairs followed, beginning in 1959 by the Ancient Architecture Construction Team of the Cultural Relics Bureau when unspecified repairs were made to Shanmen. Further repairs were made in August 1975, following a report which found a leaking roof, rot in the flying rafters and roof boards, and collapsing eaves. These repairs included replacement of the big beam, corbel bracket system, flying rafters, and flying rafter connectors to position the roof tiles (*wakou* and *li-anyan*).

There is no documentary evidence of past restoration of the exterior and interior painted decoration of Shanmen.

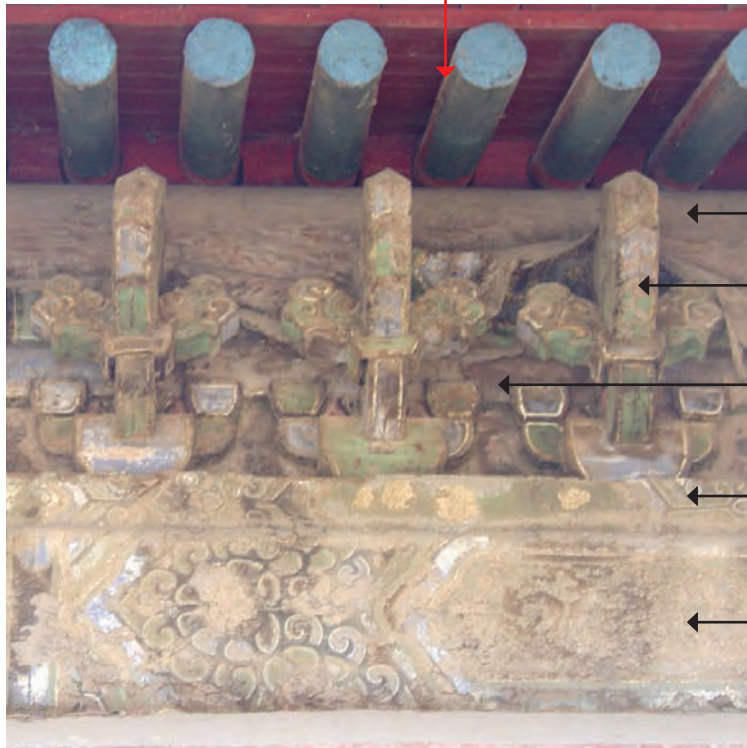
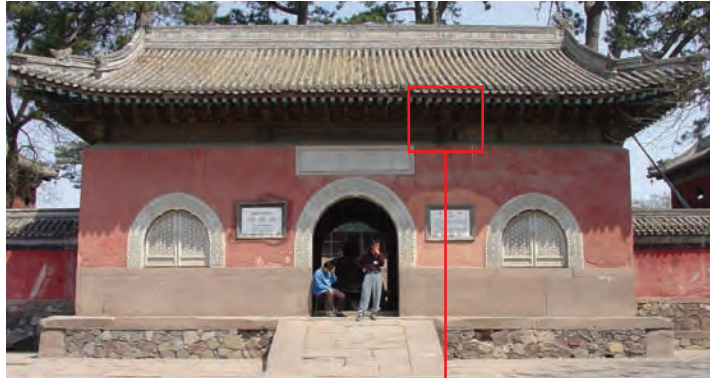


1933年关野贞所摄照片，及2004年5月南立面明间相同位置。彩画几乎全部脱落，屋顶结构全部更换过。

1933 Sekino photograph, of the gatehouse, south facade, center bay, and the same area in May 2004. Almost total loss of the painting has occurred and complete replacement of the roof structure.

山门 -  
彩绘相关构件专有词汇图释

Shanmen - Terminology of  
Painted Architectural Elements



- 挑檐檩 (*tiaoyan lin*)  
eave purlin
- 斗拱 (*dougong*)  
brackets ("block" and "arm")
- 垫拱板 (*diangong ban*)  
bracket-arm cushion board
- 平板枋 (*pingban fang*)  
flat tie-beam
- 额枋 (*e'fang*)  
architrave



- 转角 (包括转角铺作、角梁及霸王拳)  
*zhuanjiao* (*zhuanjiao puzuo, jiaoliang and bawangquan*)  
corner set (including corner beam, corner bracket set, and end of the greater architrave)
- 宝瓶 (*baoping*)  
vase-shaped wooden block
- 昂 (下昂及上昂) (*shang'ang and xia'ang*)  
cantilever or lever-arm
- 霸王拳 (*bawangquan*)  
end of the greater architrave

### 整体状况概述 Overall Condition Summary

山门室外彩画总体上残损严重。南北立面都存在大面积脱落。其中南立面有两个开间的彩画几乎全部脱落。在残存的彩画上存在水平裂缝及局部地仗空鼓。



南立面檐柱上的纵向裂缝，从木材直延伸到墙面抹灰，造成该部位画层的脱落。

Vertical crack on column of south facade extends from the wood column down to the wall plaster and contributed to the loss of painting in this area.

此外，残存彩画的外表风化严重。其上存在细小裂缝、起甲，彩绘层缺失，潮迹（黑迹），并有表面污垢和鸟粪。某些部位的彩画残损严重、肮脏，以至于图案难以辨认。

比起那些画在含有纤维层地仗上的彩画，斗拱上得彩画残留较多。这些斗拱彩画是画在不含纤维层的薄灰泥地仗上的。然而角科斗拱彩画，以及檩和枋这些包含纤维层的彩画则缺失较多。

在彩画缺失的部位，暴露的木材上经常可见裂缝，这些裂痕可能是导致彩画空鼓与最后脱落的原因。

The exterior painting of Shanmen is generally very deteriorated. Both the north and south facades exhibit large areas of loss. The painting in two of the bays on the south facade is almost completely lost. In the areas of surviving painting there is horizontal cracking, and areas of detached plaster.

In addition, the surviving paint surface is overall quite weathered in appearance. The surface has fine cracking, flaking, loss of the paint layer, moisture staining (darkening) and is covered with surface dirt and localized areas of bird droppings. In some areas the painting is so deteriorated and dirty that the *caihua* pattern is barely legible.

Traces of paint survives better on the brackets that are executed on a thin plaster skim without a fiber layer than areas that have the fiber layer present. The painting on the corner bracket sets and the architraves, which do contain a fiber layer, suffer extensive loss.

In areas where the painting is lost, the exposed wood is often cracking. This splitting of the wood may be responsible for the detachment and eventual loss of the painting in these areas.



彩画上的水平裂缝。

Horizontal cracking of the painting.



檩上的彩画剥离。

Detachment of painting from purlin.



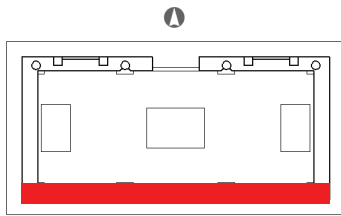
画面污点及变黑。

Staining/darkening of painting.



经受风化和磨损的彩画。

Weathered and abraded area of painting.



状况概述 Condition Summary

南立面面阔三间，彩画状况最差。西尽间及明间整体彩绘地仗全部脱落，而东尽间尚存的彩画残损严重，表面有污斑、撕破、脱落并呈悬挂状。角科斗拱和檐柱上的彩画通常空鼓或脱落。明间东侧檐柱暴露的木质上存在的垂直裂缝是造成彩画脱落的主要原因。在这一部位只有斗拱上留下了数量相当的彩画。



The south facade is three bays long and the painting is in the poorest condition here. There is almost total loss of the painted plaster on the entire west and center bays. Only very deteriorated painting survives on the east bay, where the painted plaster is very abraded, stained, torn and hanging off in places. Areas of painting on the corner sets and columns is often detached or lost. Vertical cracks are visible on the exposed wood of the column between the center and east bay contributing to the loss of painting in this area. Only the brackets retain a significant amount of paint.





明间额枋上的彩画完全脱落，木质表面有水平裂缝。

Horizontal cracking on main architrave beam in the center bay where all of the painting has been lost.



东尽间东部彩画保存最完好。彩画表层有污迹和风化现象。

Section of the east bay showing best preserved area of painting. Note still the staining and weathered condition of the painting.



明间东侧檐柱上的纵向裂缝从木构件一直延伸到墙面抹灰，可能是造成此处彩画脱落的原因。

Vertical crack on column between center and east bay extends from the wooden elements to the wall plaster and most likely contributed to the loss of painting in this area.



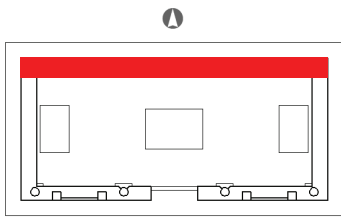
状况概述 Condition Summary

北立面面阔三间。虽然状况并不像南立面那样严重，但在明间及东尽间仍存在大面积的彩画缺失。西尽间彩画保存完整。没有看见大面积彩画空鼓（仅限于地面上的肉眼观察）。

彩画表面磨损，存在细小裂纹，及表面彩绘层脱落，并有污迹、变黑和局部的鸟粪。明间挑檐檩已被更换（并被漆为蓝/黑色），且有裂纹。

The north facade is three bays long. Though the condition is not as severe as the south facade there are major areas of loss of the painting on the east and center bays. The west bay painting survives in its entirety. No major areas of plaster detachment are visible (though this is based on a visual inspection from the ground only).

The painted surface is generally abraded with fine cracking and surface paint loss in addition to staining and blackening and bird excreta in areas. The center bay purlin was replaced (painted a dark blue) and has a crack running across it.





北墙彩画细部。挑檐檩上彩画大部分已经脱落。这里可见一小部分已剥离的彩画，被下面的斗拱挡住。

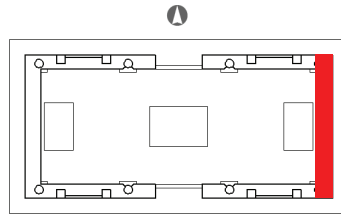
Details of painting on north facade. Most of the painted plaster on the purlin is lost. Here a small piece is detached and falling, supported in place by the brackets.



**状况概述 Condition Summary**

东立面面阔一间。与西立面不同，东立面的彩画几乎全部保存了下来，一些部位的图案仍然可见，尤其是北端。

额枋上的彩画有一条长达额枋2/3的大裂缝。临近裂缝部位的彩画剥离并下垂。檩上尚存彩绘，但位于其最上缘的已缺失。平间斗拱上彩画保存良好，但角科斗拱的彩绘已经脱落了。



彩绘层有污迹、细小裂缝、表面彩绘缺失以及表面污垢堆积（南端污垢较为严重）。

The east facade is only one bay long. Almost all of the painted plaster survives and unlike the west facade the decorative pattern is still legible in places, especially on the northern end.

A large horizontal crack runs across two thirds of the main architrave painting. The painting in the area around this large crack is detached and sagging. The painting on the brackets is well preserved and the purlins retain paint, though there is some loss along the very top edge. The painting on the corner sets has been lost.

The paint layer exhibits staining, fine cracking, surface paint loss and surface dirt (with noticeably more dirt on the southern end).



额枋彩画上存在一条全长达额枋全长2/3的大裂缝。额枋北端表面存在较少污垢及更清晰的装饰图案。

A large horizontal crack runs along two thirds of the main architrave painting. There is less dirt on the northern end of the main architrave painting where the decorative pattern is most visible.



挑檐檩最上缘彩画脱落。

The painted plaster is lost on the top edge of the purlin.



东立面北端的装饰图形最为清晰。注意霸王拳上的裂缝，彩画在该处完全脱落。

The decorative motifs are most legible toward the northern end of the east facade. Note the cracking of the end of the greater architrave (at right) where all of the painting has been lost.

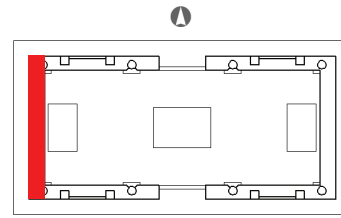
### 状况概述 Condition Summary

西立面面阔一间。彩画几乎全部存在且与其依附的木质表面结合良好（与会乘殿西立面不同）。西立面彩画明显较其他三个立面更为污浊。虽然大部分彩画尚存，但几乎没有任何能够辨认的色彩易，其图案也只能通过画层的表面凹凸进行辨认。彩绘层出现龟裂及一般性的风化。

挑檐檩北端彩画出现一些脱落，有一片彩画剥离并脱落于伸出的斗拱上。垫拱板上彩画几乎全部缺失。斗拱上尚有彩画残迹，但角科斗拱上的彩画几乎全部缺失。

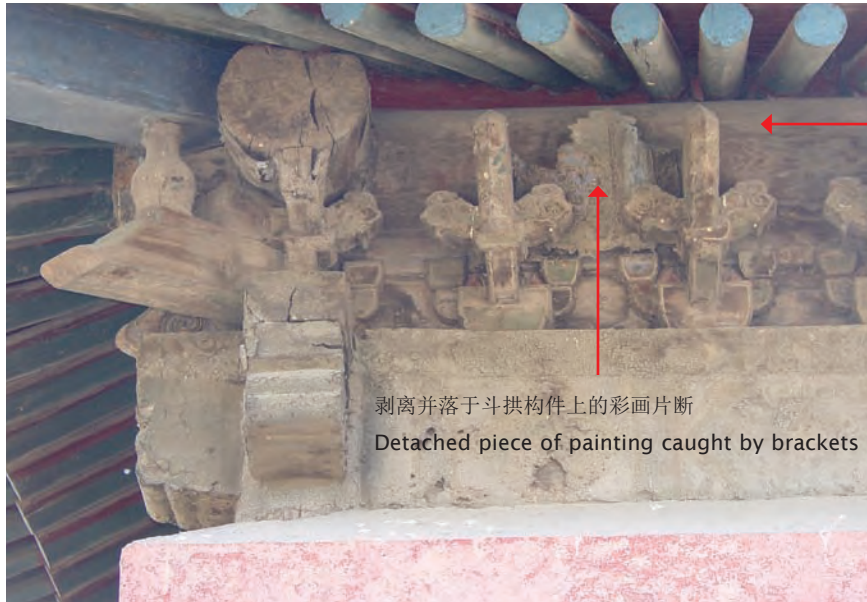
The west facade of the gatehouse is only one bay long. Almost all of the decorative painting survives here and remains attached to its underlying wooden support (unlike the west facade of Huicheng Hall). The west facade painting is noticeably dirtier than the other three facades. Though much of the painting survives, barely any color is decipherable and the decorative pattern can only be read by the surface topography of the paint layer. The paint layer exhibits cracking and general weathering.

There is some loss on the north end of the purlin where a piece of painting has fallen and is now supported by the brackets. The painting on the bracket-arm cushion boards is almost entirely gone. Traces of painting survive on the brackets but the painting on the corner sets is almost entirely lost.



山门西立面彩画几乎完整保存。

Nearly all of the painting survives on the west facade of the gatehouse.



虽然额枋上所有地仗尚存，但其表面相当污浊且风化严重。小面积缺失分布于整个表面。装饰图案难于辨认。

Though all of the plaster survives on the main architrave, the surface is extremely dirty and weathered. Small losses can be seen across the surface and the decorative pattern is difficult to decipher.



与室外相比，室内彩画的保存现状要好。

直接位于额枋下面的黄色抹灰墙上有流水痕迹，说明历史上屋顶曾经出现过问题，使大量雨水得以渗入建筑物内。这种状况持续多久并不清楚，但据档案记载，山门屋顶在1975年换过。

室内彩画总体上外观发暗，表面积灰严重。水平裂缝从一些梁中部通过，并在一些部位导致了彩画的全部缺失。西部彩画的剥离和缺失较为严重。

In comparison to the exterior, the interior painted architectural surfaces survive in better condition.

However, the yellow plaster walls directly below the painted architraves are stained with dripmarks indicating a past problem with the roof which allowed significant amounts of water to infiltrate into the building. It is unknown how long the building survived in this state but records show that the roof was replaced in 1975.

The interior paintings are generally dark in appearance and very dusty. There is horizontal splitting in some areas of painting running along the middle of the beams which in some areas has led to loss. On the west end of Shanmen there is a particularly severe amount of detachment and loss of painting.



室内墙壁上雨水渗透的痕迹。

Evidence of rainwater infiltration on inner walls.



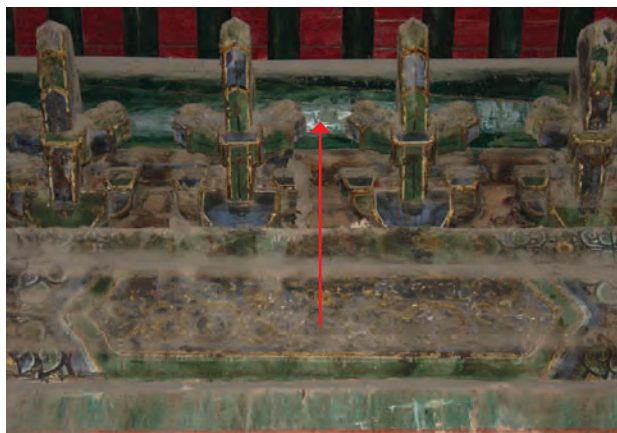
梁上画层的水平裂纹。

Horizontal cracking of painting along beam.



水平裂缝造成彩画完全脱落。

Horizontal cracks in the painting leading to loss.



被替换的檐檩（漆为绿色）。

Replaced purlin (painted green).



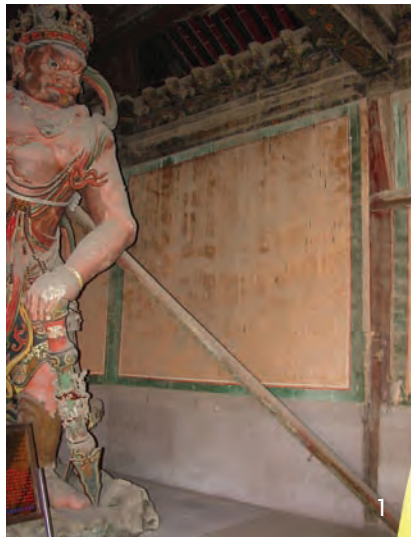
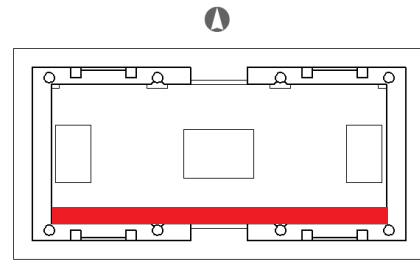
檐檩上的彩画缺失（明间南墙）。

Loss of painting on purlin (south wall, center bay).

**状况简述 Condition Summary**

山门面阔三间。虽然室内南壁较多抹灰及彩画尚存，但所有表面都积存大量灰尘，降低了彩绘的可见度。渗透的水流痕迹在黄色抹灰墙面上清晰可见，表示某一时期雨水渗透进入了这座建筑。

The interior south wall is three bays long. Much of the painting survives on this wall but is covered with a thick layer of dust that obscures much of the painted pattern. Past staining from water infiltration is clearly visible on the yellow plaster walls indicating that water, at one time, leaked into the building.



明间彩画细节，请注意檐檩上彩画的缺失  
Detail of center bay showing loss of painting on the purlin.





1. 东尽间 East Bay

东尽间：东尽间可见一些深色印迹（油漆），可能来源于1975年对屋顶的维修。较大水平裂缝贯穿额枋正中。

East Bay: paint drips, possibly from the 1975 repairs to the roof, are visible on the east bay. The main architrave has a large horizontal crack running across it.



2. 明间 Center Bay

明间：明间檐檩彩画中部缺失，但额枋、平板枋上彩画保存完整。

Center Bay: the middle portion of the painting on the center bay purlin is lost. The painting survives in entirety on the architrave.



3. 西尽间 West Bay

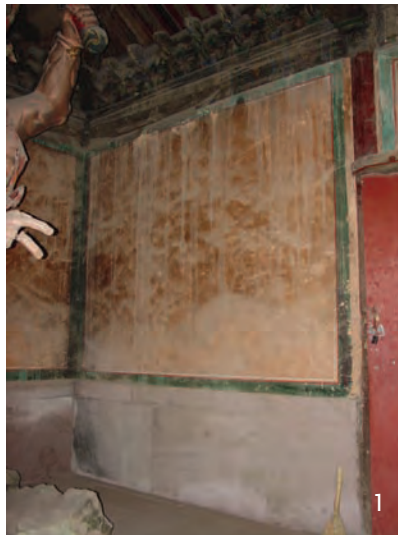
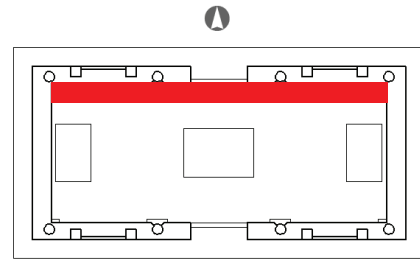
西尽间：西尽间彩画表面积灰较多，但保存状况较好。

West Bay: the west bay painting, though dusty, survives in good condition.

### 状况概述 Condition Summary

山门面阔三间。北壁状况较南壁差。彩画表面积灰严重，旧有雨水渗透沿壁下流的痕迹布满整个墙面。这些水流导致了部分区域抹灰的磨损。墙壁以上的木构件彩画大面积缺失，包括可能在1975年屋顶维修期间被替换并断白的明间檐檩。

The interior north wall is three bays long. The condition of the north wall is more severe than the south wall. The paintings are very dusty and past infiltration dripmarks have caused abrasions into the yellow wall plaster. There are large areas of painting loss on this wall including complete replacement of the center bay purlin possibly during the 1975 repair to the roof.



沿西尽间额枋上一水平裂缝出现的彩画缺失和剥离，局部彩画外翻下垂。

Area of loss and detached area of painting along a horizontal crack on the west bay with pieces hanging down.



明间经更换的檐檩（以绿色断白）。

Replaced purlin (painted green) on center bay.



1. 西尽间 West Bay

西尽间：西尽间西端彩画呈现剥离和缺失。

West Bay: there is detachment and loss of painting on the western end of the west bay.



2. 明间 Center Bay

明间：明间额枋的三分之一（东段）出现彩画缺失。明间檐檩经过替换且漆以绿色，断白不作装饰。

Center Bay: there is loss of painting on the eastern third of the center bay architrave. The center bay purlin has been completely replaced and is painted green.



3. 东尽间 East Bay

东尽间：抹灰表面磨损严重。东尽间西端彩画存在缺失。

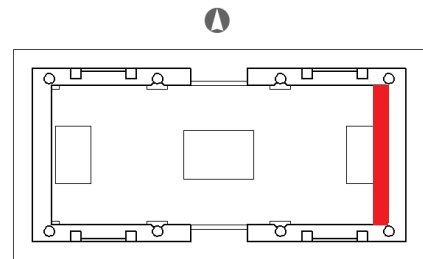
East Bay: the plaster surface is very abraded from moisture drips. The east bay painting is lost at the far western end.



状况概述 Condition Summary

东墙长一开间。其上水流痕迹较其它墙壁少。彩画积灰，檐檩彩画剥离且下垂，但是额枋、平板枋上的彩画保存状况较好。

The east wall is one bay wide. Fewer drip marks are visible on the east wall than on the other walls. The paintings are dusty and detached from the purlin but the painting on the architrave survives in good condition.



檐檩彩画剥离部位及下垂的片断。

Area of detached pieces of painting on purlin.



檐檩彩画缺失的部位。

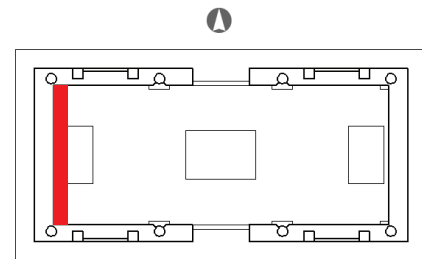
Area of loss of painting on purlin.



状况概述 Condition Summary

虽然小面积的彩画保留下来，但是西壁彩画大部分呈严重剥离状态。西北角彩画大面积缺失。

Despite small areas where the painting survives, the painted decoration on the west wall is severely detached. The painting in the northwest corner has extensive loss.



在哼哈二将中“哈”的塑像后可见的脱落彩画。  
Fallen piece of painting found on the ground behind the Temple Guardian *Ha*.



大额枋上剥离下垂的彩画局部。  
Detached and falling area of painting on the architrave.

**整体状况概述 Overall Condition Summary**

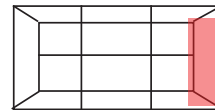
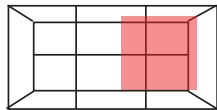
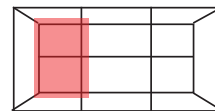
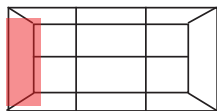
屋顶状况仅从地面进行了简略检查。由此这一评估仅基于对油饰表面的简要视觉观察。屋顶在1975年曾经更换。望板看起来已被完全更换并漆成红色，一些檐椽挑于室外的部分漆为深绿色，推测也已经更换。大量位于屋顶中部的椽子并非漆为此种深绿色，而存有一些绿色漆饰痕迹。由此认为这些椽子未经更换。

有彩画装饰的梁总体来说积灰非常严重，但原始彩画保存较多。同样这一区域也存在由于雨水渗透而造成的潮湿及水流痕迹。在一些局部，尤其是西端，梁上彩画剥离并存在大面积缺失。大部分剥离都由梁中部彩画裂缝开始的。

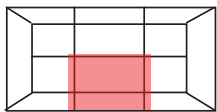
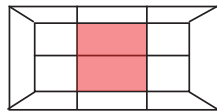
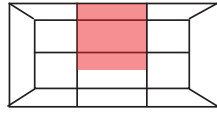
The condition assessment of the painted ceiling is based on a brief visual inspection undertaken from ground level.

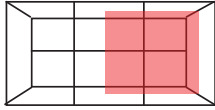
The roof was replaced in 1975. The ceiling boards appear to be completely replaced and painted red, and some of the eave rafters in the outer zones of the roof, painted a dark green, may have also been replaced. Many of the rafters in the central areas of the roof were not painted this dark green, and appear to have some traces of original green paint and are therefore thought to be historic.

The decorated ceiling beams are generally very dusty but much of the original painting survives. There is also staining and drip marks from past moisture infiltration. In some areas, in particular on the west end, the painting is detached and there are large areas of loss. Much of the detachment begins with splitting of the painting along the center of the beams.

**东区 Eastern Zone****西区 Western Zone**

中心区 Center Zone





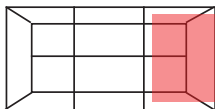
梁细部表现出积灰、水流痕迹及彩画上的污点。

View of east end of ceiling.



梁细部表现出积灰、水流痕迹及彩画上的污点。

Detail of painted decoration showing dust, drip marks, staining and areas of detachment of the painted plaster.



东尽头屋顶区域，可见踩步金上的彩画缺失。

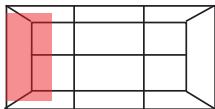
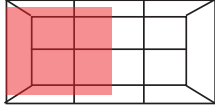
Far eastern area of the ceiling showing loss of the painting on one of the beams.



局部照片，可见踩步金上的彩画缺失及暴露木材上的水迹。

Detail showing loss of the painting on one of the beams and areas of moisture staining on the exposed wood.





西段屋顶可见大面积地仗层缺失和剥离。请注意暴露的木梁表面的水迹。

Large areas of plaster loss and detachment are visible on the west end ceiling. Note the moisture staining on the exposed wooden beam.



屋顶西北角可见不存油饰的角梁及椽，说明这一部位全部彩画缺失或部分梁构件的更换。

Northwest corner of ceiling showing unpainted beams. Indicating complete loss of painting or replacement of some of the beams.



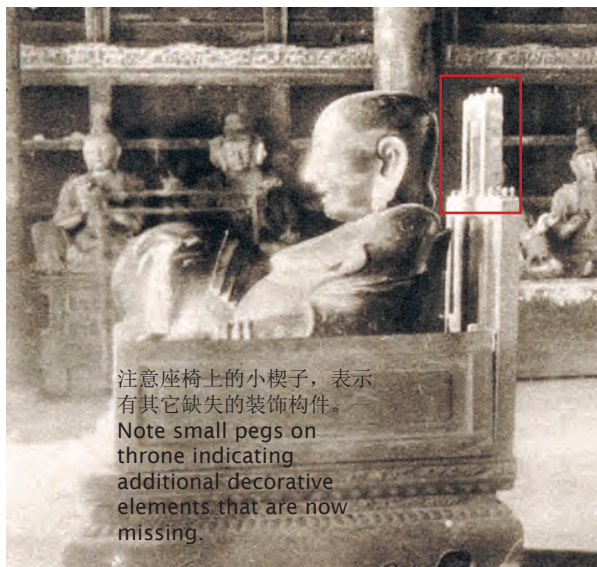
**状况概述 Condition Summary**

弥勒佛像本位于现已不存的天王殿，于1933年之前移至会乘殿，之后移至目前所居的山门。

塑像现缺座椅的靠背及扶手，所保留的基座面积为175x155厘米。塑像保存状况良好，但有少量的缺失、开裂和腊垢。弥勒塑像表面涂有仿铜漆，并且使用与韦陀像类似的大漆贴金工艺。

Maitreya (*Milefo*) was originally housed in Tianwang Hall (Heavenly King Hall), no longer extant at Shuxiang Temple. The statue was moved, prior to 1933, to Huicheng Hall, then later to its current location in the gatehouse.

The sculpture of Maitreya is now missing the back and arms of the throne (the remaining base measures 175 x 155 cm) but despite small losses, cracks and wax stains the sculpture is overall in good condition. The Maitreya sculpture is finished to resemble bronze using a lacquered gilt technique similar to *Weituo*.



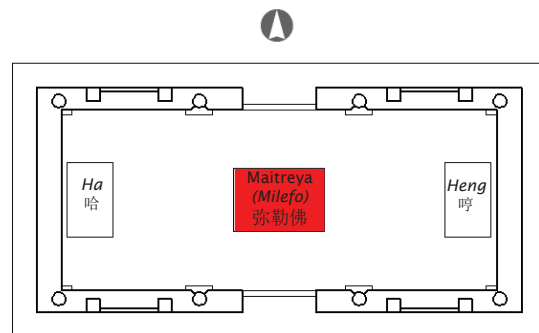
1933年关野贞所摄照片，可见座椅。

1933 Sekino photograph of Maitreya and his throne.



现今的弥勒像和座椅所留存下来的部分。

Maitreya today showing what remains of the throne.



请注意塑像底座的小面积缺失。

Note small losses in the sculpture base.



弥勒佛像左臂大面积的缺失。  
Large loss on left arm of Maitreya.



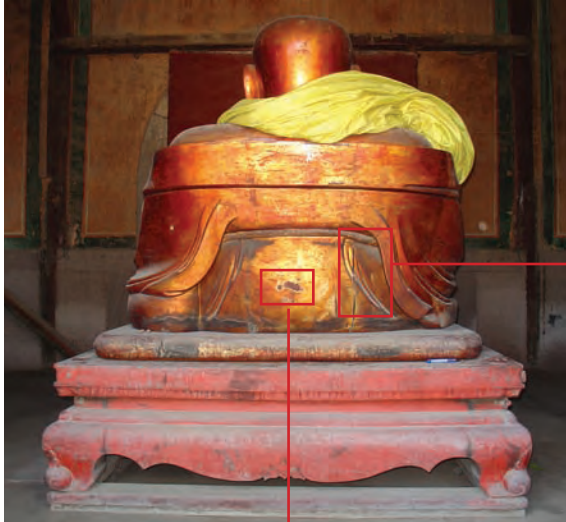
塑像底部细节显示缺失部分以及近期所沾上的蜡滴和污迹, 推测应是由座椅底部所放置的蜡烛造成的。

Detail of sculpture base showing a loss and recent wax drips and staining, presumably from the positioning of candles on the throne base.



座椅底部西面的缺失。所施工艺可见为在地仗层上覆盖一层纺织品, 再加一层厚地仗层并在表面油漆。

West side of throne base showing a loss. The technique of execution is visible here showing a plaster layer covered with textile and finished with a thick layer of plaster which is then painted.



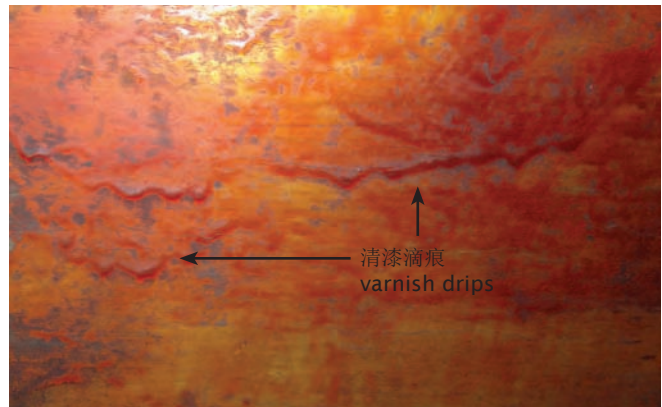
塑像背面细部显示表面镀金与清漆的摩擦与缺失。  
Detail from back of sculpture showing abrasion and loss of the upper gilding and varnish layer.



塑像背面细部显示表面一条大裂缝和较粗糙的清漆施工工艺。  
Detail from back of sculpture showing large crack and sloppy application of varnish.



座椅底座东南角用以衔接现已遗失的座椅扶手的凹槽。  
Southeast corner of throne base showing grooves for insertion of missing throne arms.



清漆层的滴痕。将清漆施加于镀金面上，使塑像表面呈现红色金属的效果。  
Dried drips of varnish applied over a layer of gilding to give the sculpture a reddish metallic appearance.

状况概述 **Condition Summary**

山门内的东端为护法神“哼”将。塑像前倾，有两根木柱支撑。目前不清楚在多大的程度上这两根木柱支撑着塑像。

“哼”将高举右臂，手中大约曾经握有兵器，左臂持锤，立于象征青草覆盖着的山石之上。

塑像全身落满了厚厚的一层灰。背上有一个不明用途的大洞，可能原来是用作支持塑像的。

塑像的肢体部位的彩绘首先出现了裂缝，某些部位的彩绘已经完全脱落。上层地仗及其下纤维层之间经常出现明显的分离。主要脱落特别出现在腿和臂膀部位。

服饰的突出部位出现了裂缝和缺失，尤其是精致的装饰部分，例如飘带以及在铁丝骨架上构造的球形装饰。

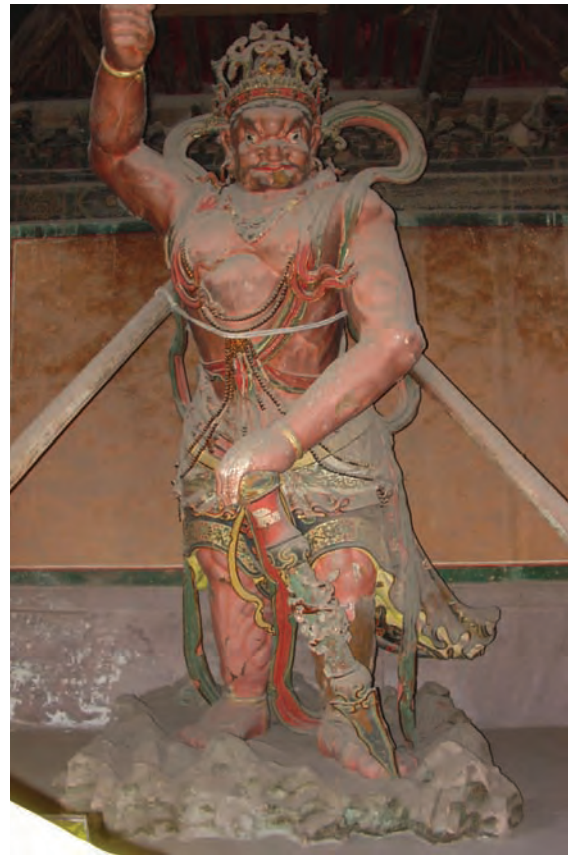
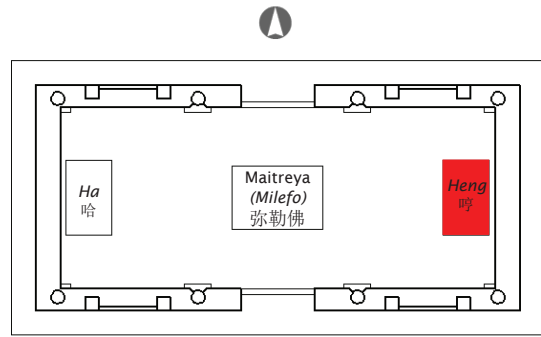
The Temple Guardian *Heng* is situated at the east end of Shanmen. *Heng* leans forward and is currently held up by two wooden posts, though it is unclear how much of a supporting role the posts are actually playing.

*Heng's* right arm is raised, presumably at one time holding a weapon; his left arm supports a scepter pointed downwards. *Heng* stands on a square base designed to resemble a grass-covered terrain.

*Heng* is covered in a thick layer of dust and has a large hole in his back which perhaps served as a means to originally anchor and support the statue.

The areas of painted flesh seem to be preferentially cracking and in many areas are completely lost. There is often a clean separation of the painted upper plaster layer from the textile layer below. In particular, major losses have occurred on the legs and arms.

Protruding areas of the ornate costume show cracking and loss, in particular to delicate areas of ornamentation such as ribbons and ball decoration which are built up with plaster on a wire armature.



可能的干预遗迹左膝及槌上的标签。

Remains of modern inventory labels on left knee and on scepter.



可能的干预遗迹左膝及槌上的标签。

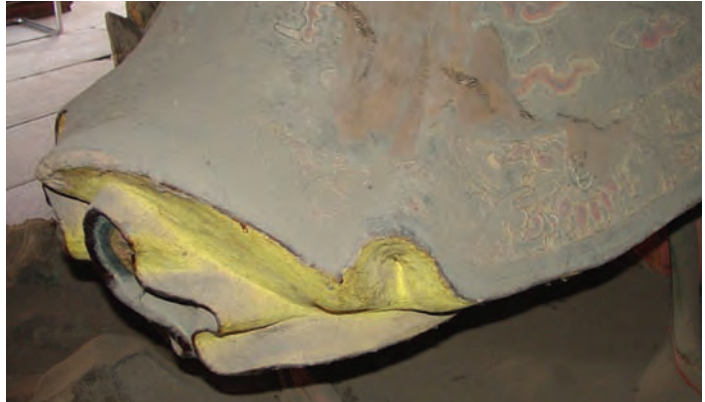
Hole in back of *Heng* which perhaps served as a means to originally anchor and support the statue.



“哼”头部细节，可见严重开裂及油饰地仗层的缺失。  
Detail of head of Temple Guardian *Heng* showing severe cracking and loss of the painted plaster layer.



位于突出装饰及精致装饰部分的小面积缺失，例如飘带以及在金属线骨架上构造的球形装饰。  
Small losses to protruding and delicate areas of ornamentation such as ribbons and ball decoration which are built up on a wire armature.



厚灰尘层覆盖油饰表面，可见较大裂缝。  
Thick layer of dust covers the paint surface and large cracks are visible.



塑像基座上可见小面积缺失。  
Small losses can be seen on the sculpture base.



右腿可见严重裂缝及上部油饰地仗层的缺失，露出其下的棕色纤维层。  
The right leg shows severe cracking and loss of the upper painted plaster layer revealing a brown textile layer below.

### 状况概述 Condition Summary

护法神“哈”将位于山门西端。“哈”将立于台座之上，做出随时准备战斗的姿势。左手高举，挥舞宝剑。其背后有一用途不明的大洞，可能曾经用来锚固和支撑塑像。除了积灰极其严重之外，“哈”将保存状况良好。最严重的问题是他的右手失去了2个手指（食指及小指），且无名指几乎完全脱落，仅通过内部的铁丝骨架连接。

其它较小问题包括裂缝及基座局部上层地仗的缺失。“哈”像上仅有的这些小面积缺失，同样也包括突出及精致装饰部分的小面积缺失，例如飘带以及在铁丝骨架上构造的球形装饰。

塑像肢体部分并未出现与“哼”同样严重的残损。相反，肢体部分只可见细小的网状裂缝，总体上油饰地仗保存状态很好。

The Temple Guardian *Ha* is situated at the west end of Shanmen. *Ha* stands on a base ready for combat, wielding a scepter in the hand of his raised left arm. *Ha* has a large hole in his back, the purpose of which perhaps served as a means to originally anchor and support the statue. Apart from being dusty, *Ha* is in otherwise good condition. The most serious apparent problem is on his right hand where two fingers (the second and the fifth) have been lost and where the fourth finger is almost completely detached, hanging on only by the interior wire armature.

Other minor problems include cracking and some loss of the upper plaster layer on the sculpture base, and losses to protruding and delicate areas of ornamentation such as ribbons and ball decoration which are built up with plaster on a wire armature.

The painted flesh does not exhibit the same serious deterioration as seen on *Heng*. Instead, only a fine network of cracks are visible in flesh areas. In general the painted plaster is in good condition.



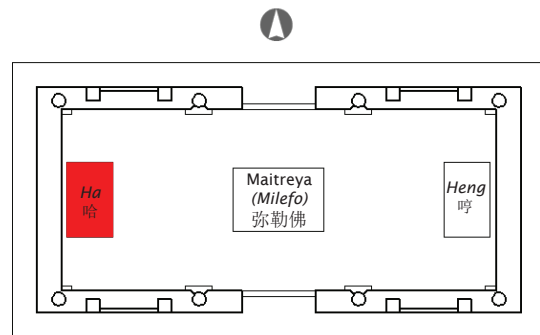
右膝上的标签可能是干预遗迹。

Remains of a modern inventory label on right



塑像基座的部份缺失。

Losses on sculpture base.





山门 - 塑像: 护法神“哈”

Shanmen - Sculpture:  
Temple Guardian (*Ha*)



“哈”头部细节。

Detail of head of Temple Guardian *Ha*.



右手食指和小指缺失。右手无名指断裂并脱离，只由内部铁丝骨架连接。

The second and fifth fingers are lost on the right hand. The fourth finger of right hand is broken and detached, held on by the inner metal armature.



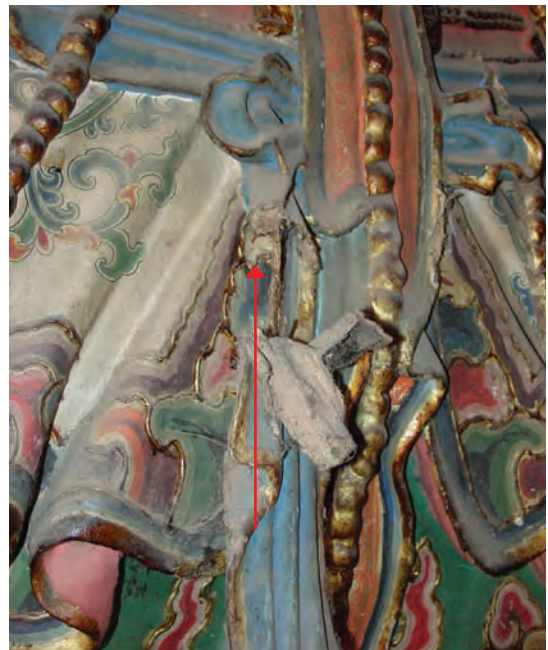
厚灰尘层覆盖油饰表面，且可见小面积缺失。

Thick layer of dust covers the paint surface and small areas of loss are visible.



位于突出及精致装饰部分的小面积缺失，例如飘带以及在铁丝骨架上构造的球形装饰。

Small losses to protruding and delicate areas of ornamentation such as ribbons and ball decoration which are built up in plaster on a wire armature.



护法神哼哈二将的塑像木骨泥胎，以施有粘合剂的布料包裹并罩有很薄的地仗层作为油饰的准备。塑像外表施有油饰。

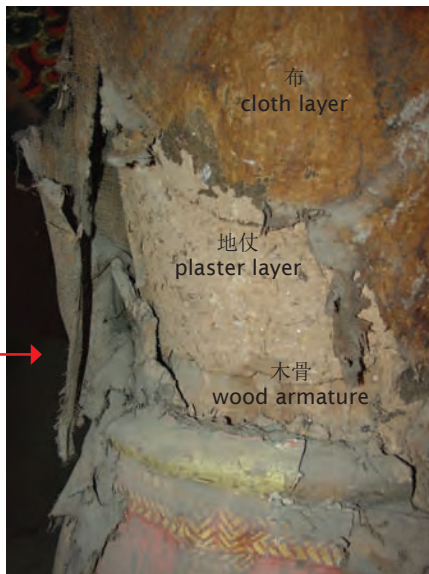
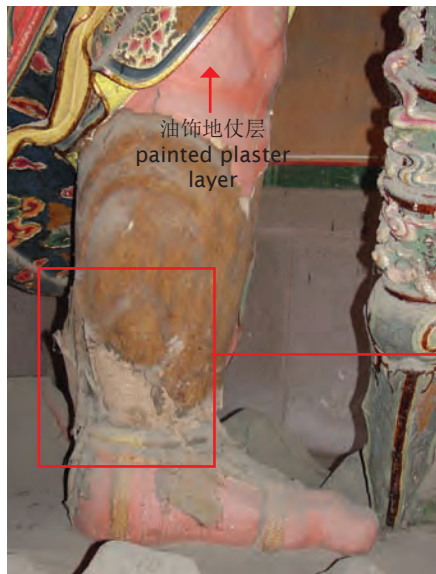
其它部件（如兵器）为木骨，仅带有极薄地仗层作为油饰的准备层。

如服饰上精致装饰物等细节，则在铁丝骨架上施用地仗/纤维塑造成形。

The Temple Guardian statues are shaped in clay over a wood armature, covered with cloth that is applied with an adhesive, and finished with a final thin skim of plaster in preparation for the paint layer. The sculptures are ornately painted.

Other elements such as the weapons are modeled in wood with only a thin skim of plaster in preparation for the paint layer.

Details such as the fine ornamental decoration of the costumes are created using plaster built up on metal wire.



左腿上有较大面积的上层油饰地仗缺失，露出其下的棕色纤维层。此外，左脚踝部有深层缺失直深入到内部木骨架内。

The left leg has lost a large portion of the upper painted plaster revealing a brown textile layer below. In addition, the ankle has a deep loss through to the interior wooden armature.

“哼”左脚踝部深至木骨的缺失部分暴露出了建造技术。

The construction technique is exposed on the left ankle of *Heng* where there is a large loss through to the inner wooden armature.



木制兵器上施有一层极薄的地仗，其上绘彩（细部）。

Detail of weapon modeled in wood with only a thin skim of plaster applied in preparation for the paint layer.

服饰上的飘带使用地仗在铁丝骨架上塑造出来。

Ornamental decoration is created using plaster built up on a wire armature.



# 钟楼 状况评估

## Bell Tower Condition Assessment



### 目录 Contents:

- 描述和干预史 Description and Intervention History

### 室外彩画油饰 Exterior Painted Surfaces

彩画 Polychromed Painted Surfaces (*caihua*)

- 总体状况概述 Overall Condition Summary

### 塑像 Sculpture

- 塑像状况概述 Condition Summary by Sculpture



## 钟楼 - 描述和干预史

## Bell Tower - Description and Intervention History



钟楼下层面宽5间进深3间；上层面宽3间进深1间。1933年及1959年所摄照片展现出了钟楼严重残损的状况。

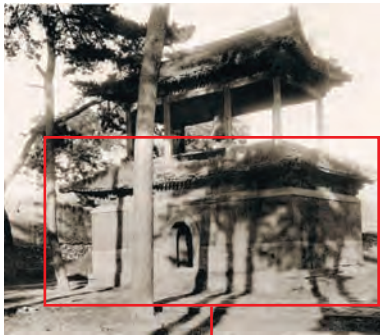
钟楼于1959年进行了维修并于1982至1983年间更换了椽飞、屋顶，并对上层进行了重建。

The lower level of the Bell Tower is five bays wide and three bays deep; the upper level is three bays wide and one bay deep. Photographs from 1933 and 1959 show the Bell Tower in a very deteriorated state.

The Bell Tower was repaired in 1959 and again in 1982-83 with replacement of all rafters, flying rafters, roof, and reconstruction of the upper level.

钟楼西立面。

View of the Bell Tower facing east.



1933关野贞所摄钟楼；彩画尚存的局部细节。

1933 Sekino photograph of the Bell Tower. Detail of areas with surviving painting.



1959年钟楼历史照片；彩画尚存的局部细节。

Historical photograph of the Bell Tower from 1959. Detail of areas with surviving painting.





小片彩画虽然残损严重，但仍可见于下层西南及西北角。

Small patches of painting, though deteriorated, still survive on the southwest and northwest corners of the lower level of the Bell Tower.

钟楼西立面。照片显示西南和西北角残留的彩画。

The west elevation of the Bell Tower with areas of surviving painting indicated.



西南角，西墙  
Southwest corner, west wall



西南角，南墙  
Southwest corner, south wall



西北角，西墙  
Northwest corner, west wall.



西北角，北墙  
Northwest corner, north wall

## 钟楼 - 塑像：韦陀

## Bell Tower - Sculpture: *Weituo*

韦陀塑像原置于天王殿中。由于这座建筑已不存，韦陀像现位于钟楼内。

韦陀外罩仿铜漆，以镀漆技术建造，与原也位于天王殿内的弥勒佛像类似。

塑像现存状况良好，但有少部分的缺失、轻微摩擦和厚重的尘土。

The sculpture of the deity *Weituo* was originally housed in Tianwang Hall (Heavenly King Hall). This building is no longer extant. The *Weituo* sculpture is currently stored in the Bell Tower.

*Weituo* is finished to resemble bronze and is constructed using a lacquered gilt technique, similar to Maitreya (*Milefo*) which was also originally located in Tianwang Hall.

The sculpture is in good condition with only small areas of loss, minor abrasions, and a thick layer of dust.



韦陀像目前于钟楼内的位置。

Current location of *Weituo* in the Bell Tower.

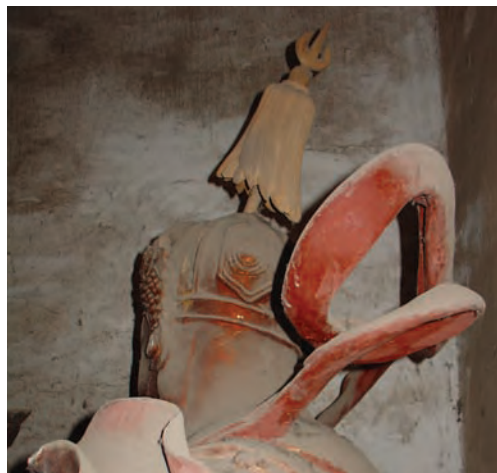


韦陀头像。

Head of *Weituo*.

魏陀脸部细部。注意脸部周围装饰的缺失。

Detail of face of *Weituo*. Note losses of decoration around face.



韦陀头像背部。

Back of *Weituo*'s head.

韦陀像上的标签。

Modern inventory label on *Weituo*.



韦陀像右手的缺损。并注意堆积有厚重的尘土。

Loss on the right hand of *Weituo*. Note also heavy dust deposition.



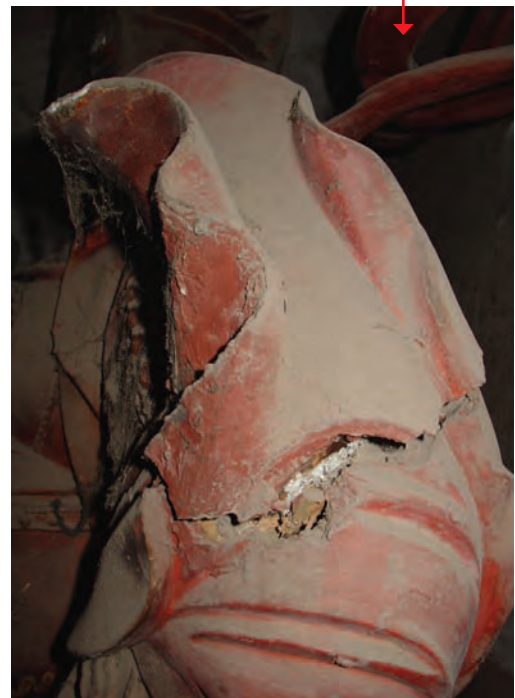
韦陀像前面的盔甲。

Front of *Weituo*'s suit of armor.



韦陀像盔甲的彩色装饰细部。

Colored decorative detail on armor of *Weituo*.



韦陀像左臂的裂缝。

Crack on left arm of *Weituo*.

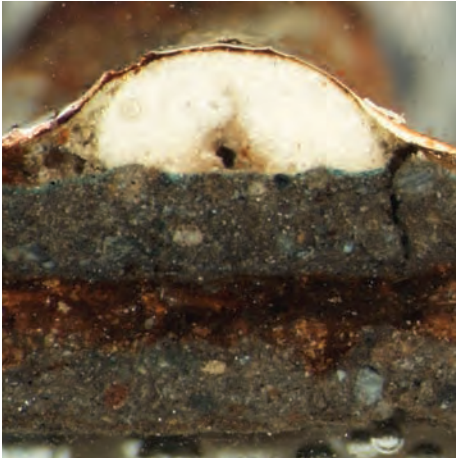


韦陀像背部用于稳固塑像的木杆。

Pole on backside of *Weituo* used to anchor the sculpture in place.







# 分析研究

## Analytical Investigations

### 目录 Contents:

#### 彩画油饰分析研究

Analytical Investigation of Painted Architectural Surfaces

#### 现代维修材料在承德的使用

Chengde Restoration Materials currently in use at the Summer Resort and Outlying Temples



## 介绍 Introduction

这次殊像寺彩画的研究（在2002-2004年之间）一共在会乘殿采集了13个室外与4个室内彩画样品。这些样品或采自掉落的大块残片或采自现场。研究的目的是要确定各种颜料的特性与种类，颜料的胶结剂，地仗层与纤维层的成分，绘画技术与画层结构，与表面的堆积物。这些资料将使我们了解彩画的现况，干预的可行性，也可能影响到承德日后对修护材料的选择。



会乘殿东南角下的彩画檐。

Painting on southeast corner, of lower level of Huicheng Hall.

这份报告是分析研究结果的结论。完整的分析研究结果请参看分析研究报告。

The analytical investigation of the painted architectural surfaces at Shuxiang Temple included thirteen exterior and four interior painting samples from Huicheng Hall, collected between 2002-2004, either as large fallen fragments or as samples collected in situ. The investigation aimed to establish the identity and range of pigments, binding medium of the paint, components of the plaster layers and the fiber layer, and the overall stratigraphy and technique of the paintings and surface accumulations. This information informs the current condition of the paintings, the feasibility of treatment, and may affect the choice of future restoration materials being used at Chengde.

This report is a summary of results from the analytical investigation. For complete analytical results refer to the Analytical Investigation Binder.

## 绘画工艺 Painting Technique

每一处彩画的制作工艺都不同。举个例子，在额枋外部的地仗使用了二层纤维，在额枋内部的地仗用了一层纤维。在斗拱，彩画是直接画在薄薄的没有使用任何的纤维的地仗上。

光是通过现场观察和分析地仗样品的剖面，很难了解彩画的制作工艺，这是因为地仗的层理结构不易分清。一般认为室外彩画采用了“二麻七灰”，即两层麻布（或纤维）和七层灰泥的技术；室内彩画采用的是“一麻五灰”的技术。但是从样品剖面来看，室外的样品仅有两层纤维和三层灰泥，而室内的样品仅有一层纤维和两层灰泥。由于地仗是缓慢的、逐层砌抹而成的，因此要分清到底有多少“单一层次”的灰泥层就很困难。

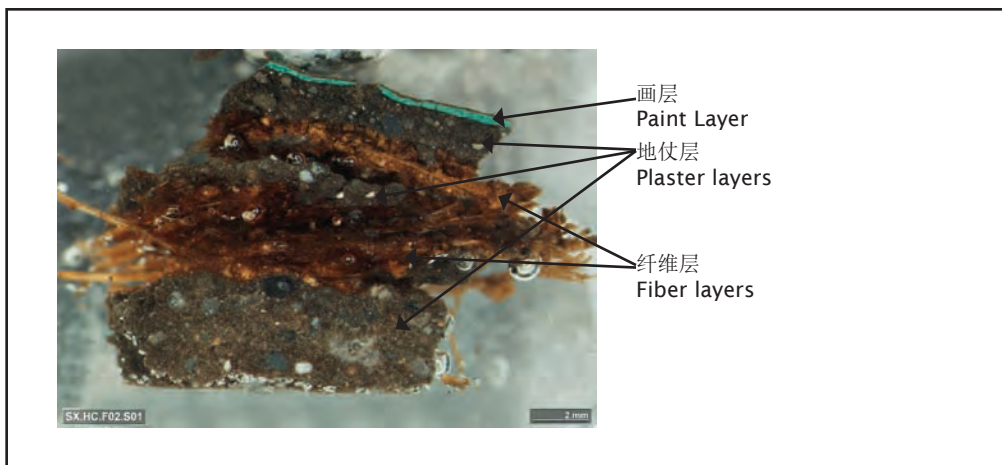
在额枋的外部，木梁都请洗干净并涂上桐油。有些部份木头裂缝已经填入灰泥并且准备好以供绘制彩画。室外彩画的第一层地仗贴在木梁上大约有3-4毫米厚。这一层是一层致密的麻布涂上厚层的淀粉质油灰然后加上较长、疏松的纤维。这层纤维使下一层的灰泥较易粘结。然后是第二层地仗与另一层的麻布。此麻布是为最后一层地仗准备的（大约1.5-2毫米厚）。在这层地仗的表面再装饰绘画、镀金、或沥粉。画层大约在0.25-1毫米厚。从文献及这次分析的结果得知在木头与各层之间使用大量的桐油，因为桐油有很好的粘结力及防水能力。

The painting technique differs depending on the location of the paintings. For example, the paintings on the exterior architraves have two fiber layers while the interior architraves only have one; the brackets have paint applied directly onto a thin skim of plaster without the use of any fiber layers.

The actual painting technique and layer stratigraphy is difficult to interpret from examination of the paintings in situ and through cross-section analysis, as individual layers of plaster are difficult to distinguish. The exterior decoration is thought to be *erma qihui*, a two-fiber and seven-plaster technique and the interior *yima wuhui*, a one-fiber and five-plaster technique. In cross-section one sees two fiber layers and only three plaster layers on the exterior samples and one fiber layer and only two plaster layers on the interior painting samples. The application of the plaster is built up slowly in several layers making the differentiation of individual "layers" difficult.

For the exterior architraves, the wooden beams were cleaned and most likely treated with a primer containing

tung oil. In some areas, cracks in the wood have been filled with plaster to prepare the surface for the first application of plaster. On the exterior, the first section of plaster applied to the wooden beams is approximately 3-4mm in thickness. To this, a layer of compacted hemp fibers, thickly coated in a starch paste adhesive, was applied followed with longer loose fibers which provide a good key for the next plaster layer. The second section of plaster is applied and another hemp fiber layer in preparation for the final plaster layers (approximately 1.5-2mm in thickness). To this surface the paint, gilding or raised decoration is applied. The paint layer ranges from 0.25-1mm in thickness. Literary sources, and analytical results from this investigation, show that tung oil was liberally used in the making of the paintings because of its excellent adhesive and waterproofing properties.



室外样品SX. HC. F02. S01的剖面表现出画层的结构是二层纤维和数层地仗。

Cross-section of exterior sample SX.HC.F02.S01 showing painting stratigraphy with plaster layers and 2 fiber layers.

## 结论

### Summary of Results

#### 颜料 Pigments

会乘殿使用一些简单的颜色，分析结果如下表所示：

A simple color palette was used at Huicheng Hall. The following table summarizes the results of the analytical investigation.

颜色 Color	颜料 Pigment	化学式 Formula	分析方法* Analytical Technique Used for Identification
红 Red	朱砂 Vermilion	HgS	偏光显微镜与X射线荧光光谱 PLM, XRF
蓝 Blue	玻璃蓝 Smalt	SiO <sub>2</sub> , K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , CoO	敷雷叶转换红外光谱 FTIR
	石青 Azurite	Cu <sub>3</sub> (CO <sub>3</sub> ) <sub>2</sub> (OH) <sub>2</sub>	拉曼光谱 Raman
绿 Green	铜绿 Atacamite, Botallackite	Cu <sub>2</sub> Cl(OH) <sub>3</sub>	敷雷叶转换红外光谱 FTIR

白 White	铅白 Lead white	PbCO <sub>3</sub>	偏光显微镜与X射线荧光光谱 PLM, XRF
黑 Black	碳黑 Carbon black	C	偏光显微镜与拉曼光谱 PLM, Raman

\*偏振光学显微镜 (PLM); X 射线荧光光谱 (XRF); 敷雷叶转换红外光谱 (FTIR), 拉曼光谱 (Raman), 气相色谱和质谱联机 (GC-MS), 电子显微探针 (EPMA).

\*PLM (Polarized Light Microscopy), XRF (X-Ray Fluorescence Spectroscopy), FTIR (Fourier Transform Infrared Spectroscopy), Raman Spectroscopy, GC-MS (Gas Chromatography-Mass Spectrometry), EPMA (Electron Probe Microanalysis).

其他颜色如粉红与橙红是铅白与朱砂的混和。除此之外，金叶也被鉴定出来（电子显微探针），沥粉含有碳酸钙（敷雷叶转换红外光谱）。

画层内含有桐油（敷雷叶转换红外光谱，气相色谱和质谱仪），但是需要进一步试验来寻找其它可能的胶结物。

Other colors such as pink and orange were created by mixing lead white and vermilion. In addition to the above pigments, gold leaf (EPMA) was identified and the raised decoration (*lifēn*) was found to contain calcite (FTIR).

Tung oil was identified in the paint layer (FTIR, GC-MS) however further tests will be carried out to look for other possible binding media.

## 地仗 Plaster

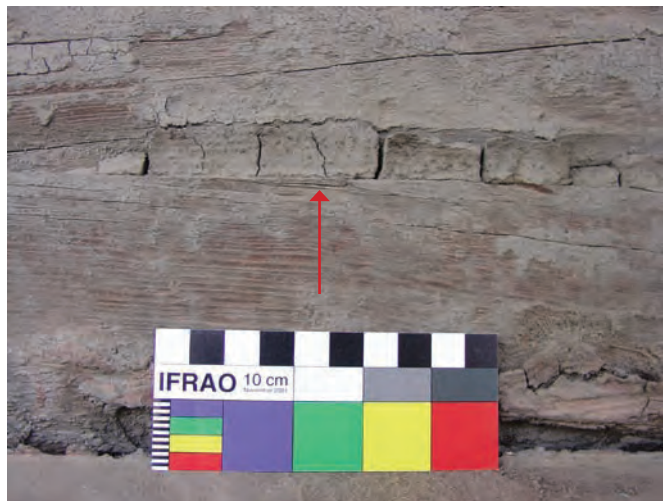
地仗包含粉碎的砖质骨料。根据文献的记载，地仗经常包含有机质的添加物如桐油及猪血。另外不同的地仗混合物被用来制造不同作用的地仗，用来填补木梁不好的地方以供绘制彩画的灰泥地仗的成分就与绘制彩画的细地仗层不同。用分析的方法来研究这些的不同点。

### 地仗：有机成分

#### *Plaster: organic components*

室外彩画的地仗，样品SX.HC.S04.S01是取自东面墙的下部，用手将之分为两块样品：紧接在画层下面的地仗层与可能直接包在木梁上的地仗层。另外，第三块样品SX.HC.S04.S12是木梁的填补剂，取自南面墙东次间的上部。这三块样品都是用高温分解法及气相色谱和质谱仪来分析其中的有机添加物。只发现了桐油（用高温分解法）。

用酚酞/四甲基苯血液试验包（www.Dojes.com）试验是否有猪血的存在。这试验包是依据过氧化物为媒介的氧化作用减低酚酞并用其中的业铁血红素为催化剂。然而，初步的试验显示用这种方法不可能鉴定出泥质的地仗中是否有血的存在。因为地仗中的水溶性材料干扰酚酞与过氧化氢之间的催化作用使已知、确定的样品产生了负面的结果。也用高温分解法及气相色谱和质谱仪分析样品中是否有蛋白的存在，结果是否定的。今后将会有进一步的试验。



木梁的地仗填补位置（样品SX.HC.S04.S12）。

Location of wood beam plaster fill (sample SX.HC.S04.S12).

The plaster is composed of a crushed brick aggregate and, based on literary sources, is thought to contain organic additives such as tung oil, wheat flour and pig's blood. Different mixtures of plaster were used depending on the necessary function of the plaster. For example, a putty-like plaster used to fill imperfections in the wooden beams in preparation for the first application of plaster was different in composition to the fine plaster layer applied in preparation for the final paint layer. Analysis was carried out to investigate these practices.

The plaster from exterior painting, sample SX.HC.S04.S01, from the lower level of the east facade, was manually separated into two plaster samples: the plaster directly below the paint layer and the plaster layer that would have been applied to the wooden beam. In addition, a third plaster sample, SX.HC.S04.S12, from a wood beam fill, was collected from the upper level of the south facade, next east bay. These three samples were tested for organic additives using pyrolysis and GC-MS. Only tung oil was found in all three plaster samples using these techniques (pyrolysis).

The possible presence of pig's blood was also tested using a Phenolphthalein/ Tetramethylbenzidine Presumptive Blood Test Kit ([www.Dojes.com](http://www.Dojes.com)). The kit is based on the peroxide-mediated oxidation of reduced phenolphthalein in which the heme molecule acts as a catalyst. However, initial tests showed that identification of blood in earthen plaster was not possible using this method as water-soluble materials in the plaster were interfering with the catalytic reaction between the phenolphthalein and the hydrogen peroxide reagent producing a negative result in a known positive sample. Samples were also tested for the presence of proteins using pyrolysis and GC-MS and none were detected. Further tests will be carried out.

#### 地仗：无机成分

##### *Plaster: inorganic components*

对不同地仗层的矿物成分也作了评估。然而由于样品的桐油含量太高而无法分析。在其中的一块样品用氯仿萃取法除去桐油，但是相当高的桐油仍然留在样品中使之无法在水中适当地分散，这是决定颗粒度分布必须有的一个过程。在电子扫描电镜下用目视的方法检查室外样品SX.HC.F02.S01的颗粒度分布上是否不同。结果没有不同。

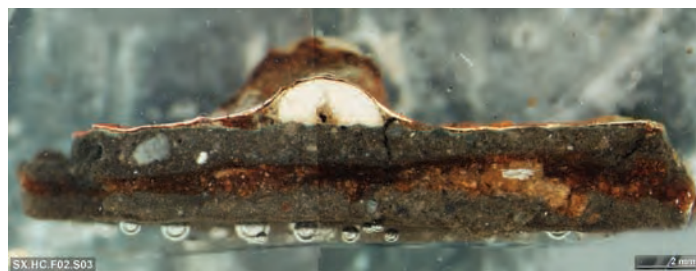
用敷雷叶转换红外光谱（FTIR）鉴定出室内样品SX.HC.F02.S02地仗中有硫酸钡与硅的成分。室内样品SX.HC.F02.S03地仗中硅与石英的成分。也用敷雷叶转换红外光谱（FTIR）来鉴定室外样品，在其中发现石英与石膏的成分。

The mineral components of the different plaster layers were also assessed. However, due to the high tung oil content the samples were unable to be analyzed. A chloroform extraction was performed on one of the samples to remove the tung oil, however, a high enough percentage of tung oil remained in the sample to prevent it from adequately dispersing in water, a necessary step in determining particle size distribution. Instead, exterior sample SX.HC.F02.S01 was looked at under ESEM to visually determine any difference in particle-size distribution between the samples. No difference was seen.

Investigation into the plaster using FTIR identified barium sulfate and silica (FTIR) in interior sample SX.HC.F02.S02 and silica and quartz (FTIR) in SX.HC.F02.S03. In the exterior sample, quartz and calcium sulfate (gypsum) (FTIR) were found.

#### 比较室外与室内的彩画表面

##### **Exterior vs. Interior Painted Surfaces**



室内彩画样品SX.HC.F02.S03的剖面含有一层纤维（一麻）。

Cross-section of interior painting SX.HC.F02.S03 showing 1 layer of fiber.

室外与室内的彩画都使用同一系列的颜色。唯一可见的不同是室内地仗样品是一层纤维（一麻），室外地仗样品是二层纤维（二麻）。由于室内彩画难以接近，建议对室内彩画的工艺作详细的调查。

The exterior and interior paintings are thought to use the same palette range. The only noticeable difference is in the technique of the painting where only one layer of fiber is present on the interior sample while the exterior has two layers of fiber. However,

due to limitations of access to the interior painting it is recommended to examine the painting technique in greater detail.

#### 表面堆积物

#### **Surface Accumulations**

室外的样品显明地比较肮脏，有不同的表面堆积物，包括鸟和动物的排泄物，潮湿的污斑，及不同种类的肮脏堆积物。室内样品状况较好的一般只有厚层的尘土。

室外样品SX.HC.F02.S01壳状的肮脏物用敷雷叶转换红外光谱（FTIR）鉴定结果含有石膏。用电子扫描电镜（ESEM）进一步检查的结果认定这一层含有一般尘土中的各类元素。

The exterior samples are noticeably dirtier with a range of surface conditions which include bird and animal deposits, moisture staining, and different types of dirt deposition. The interior samples, in better condition, are generally just covered in a thick layer of dust.

The crust-like dirt layer on exterior sample SX.HC.F02.S01 was found to contain gypsum (FTIR). Further investigation under ESEM found this layer to contain elements present in a typical dirt layer.





## 简介 Introduction

承德目前正在进行彩画的修护。最近的例子包括重新绘制新维修的普乐寺彩画以及殊像寺宝相阁的绘画。

修护所使用的颜料与胶结物包括现代与传统两种类型的材料。这份报告是有关材料研究，与比较现代材料与承德历史上所使用过的彩画材料的差别。

Restoration of painted architectural surfaces (*caihua*) is being undertaken at Chengde. Recent examples include repainting of the decoration on the newly restored Pule Temple and new painting at Baoxiang Pavilion at Shuxiang Temple.

Both modern and traditional pigments and binding media are being used to carry out these restorations. This report investigates these materials and compares them to historical materials that have been identified in the paintings at Shuxiang Temple.

## 样品 Samples

现代修护颜料的样品有液体状与粉末状两种，是王福山先生在2003年秋天提供的。除此之外，还有取自绘制宝相阁新彩画所滴漏出来的颜料滴。历史上所使用过的颜料样品取自殊像寺会乘殿室内与室外的彩画。这些样品经过分析提供比较。

本报告将这项研究结果的重点摘录如下。

Modern restoration paints were supplied for this investigation, in liquid and powder form, by Mr. Wang Fushan in the Fall of 2003. In addition, samples of paint drips from the restored paintings in Baoxiang Pavilion were collected for analysis. Samples of historical paint from the exterior and interior painted architraves at Huicheng Hall, Shuxiang Temple provided a comparison.

This report outlines the findings of these investigations.

## 分析研究与结果 Analytical Investigation and Results

颜料与胶结介质的分析是使用X射线荧光光谱，敷雷叶转换红外光谱，偏光显微镜，与拉曼光谱。然而所提供给我们的现代样品特别是液体漆，可能是有专利权材料而且成分非常的复杂。我们无法完全辨认所有的颜料与胶结物。下列的表格是这次研究结果的摘要。

XRF, FTIR, PLM and Raman were used to identify the pigments and binding media. However, given that some of these modern materials—the liquid paints in particular—are possibly proprietary materials and are quite complex in composition we were unable to fully identify all of the pigments and binders present. The following tables summarize the results of this investigation:

### 粉末状颜料样品结果摘要 Summary of Powder Paint Samples Results

样品标签 Sample Label	颜色 Color	颜料（偏光显微镜） Pigment (PLM)	颜料（拉曼光谱） Pigment (Raman)
铁红粉 ( <i>Tie Hong Fen</i> ) Iron Red Powder	红 Red	铁红 Red iron oxide	-----
樟丹粉 ( <i>Zhang Dan Fen</i> ) Red Lead Powder	红 Red	铅丹 Red lead	-----

红朱 ( <i>Hong Zhu</i> ) <b>Cinnabar</b>	红 Red	无法辨认 Unable to identify (dissolved in Meltmount mounting medium)	无法辨认, 可能是有机物 Unidentified; probably organic
佛青 ( <i>Fo Qing</i> ) <b>Buddha Blue</b>	蓝 Blue	合成群青 Synthetic ultramarine	群青 Ultramarine
巴绿粉 ( <i>Ba Lu Fen</i> ) <b>Bright Green Powder</b>	绿 Green	-----	酞菁绿染料 Phthalocyanine green
铁黑粉 ( <i>Tie Hei Fen</i> ) <b>Iron Black Powder</b>	黑 Black	铁黑也叫马尔斯黑, 人工矿物颜料 Iron black (also known as Mars Black, an artificial mineral pigment made from iron metal)	-----

## 现代漆样品摘要 Summary of Modern Paint Samples

颜色 (标签) <b>Color (as labeled)</b>	颜料 (X 射线荧光光谱, 敷雷叶转换红外光谱, 拉曼光谱) <b>Pigment (XRF, FTIR, Raman)</b>	胶结剂 (敷雷叶转换红外光谱) <b>Binder (FTIR)</b>	添加剂 (填充剂) <b>Additives (fillers/extenders)</b>
白调合漆 <b>White Mixed Paint</b>	钛白, 锌白 (X 射线荧光光谱) Titanium white, zinc white (XRF)	醇酸树脂 Alkyd resin	碳酸钙 Calcium carbonate
铁红调合漆 <b>Iron Red Mixed Paint</b>	铁红 (X 射线荧光光谱) Red iron oxide (XRF)	短油醇酸树脂 Short-oil alkyd	重晶石, 碳酸钙, 锌白 Barytes, calcium carbonate, zinc white
铁红瓷漆 <b>Iron Red Enamel Paint</b>	铁红 (X 射线荧光光谱) Red iron oxide (XRF)	醇酸树脂 Alkyd resin	碳酸钙, 锌白 Calcium carbonate, zinc white
大红调合漆 <b>Bright Red Mixed Paint</b>	无法辨认, 可能是合成的有机红色 (敷雷叶转换红外光谱, 拉曼光谱) Unidentified; probably a synthetic organic red (FTIR, Raman)	短油醇酸树脂 Short-oil alkyd	重晶石, 碳酸钙, 锌白 Barytes, calcium carbonate, zinc white
中蓝瓷漆 <b>Mid-blue Enamel Paint</b>	酞菁蓝染料 (拉曼光谱) Phthalocyanine blue (Raman)	醇酸树脂 Alkyd resin	碳酸钙 Calcium carbonate
绿调合漆 <b>Green Mixed Paint</b>	酞菁绿染料与无法辨认的黄色 (拉曼光谱) Phthalocyanine blue with unidentified yellow (Raman)	短油醇酸树脂 Short-oil alkyd	重晶石, 碳酸钙, 锌白 Barytes, calcium carbonate, zinc white
绿瓷漆 <b>Green Enamel Paint</b>	铅铬绿 (普鲁士蓝与铬黄铬酸铅的混合) Chrome green (mixture of Prussian blue and chrome yellow) (XRF, FTIR, Raman)	醇酸树脂 Alkyd resin	重晶石, 碳酸钙, 锌白 Barytes, Calcium carbonate, zinc white

黄调合漆 <b>Yellow Mixed Paint</b>	铬黄铬酸铅(X 射线荧光光谱, 敷雷叶转换红外光谱) Chrome yellow (lead chromate) (XRF, FTIR)	短油醇酸树脂 Short-oil alkyd	重晶石, 碳酸钙 Barytes, calcium carbonate
黄瓷漆 <b>Yellow Enamel Paint</b>	铬黄铬酸铅(X 射线荧光光谱, 敷雷叶转换红外光谱) Chrome yellow (lead chromate) (XRF, FTIR)	醇酸树脂 Alkyd resin	碳酸钙 Calcium carbonate
中灰调合漆 <b>Mid-gray Mixed Paint</b>	碳黑(X 射线荧光光谱) Carbon black (XRF)	短油醇酸树脂 Short-oil alkyd	重晶石, 碳酸钙, 锌白 Barytes, calcium carbonate, zinc white
中灰瓷漆 <b>Mid-gray Enamel Paint</b>	碳黑(X 射线荧光光谱) Carbon black (XRF)	醇酸树脂 Alkyd resin	碳酸钙, 钛白, 锌白 Calcium carbonate, titanium white, zinc white
黑调合漆 <b>Black Mixed Paint</b>	碳黑, 棕土(氧化铁与氧化锰的混合)(X 射线荧光光谱) Carbon black, umber (mixed Fe/Mn oxides) (XRF)	醇酸树脂 Alkyd resin	碳酸钙, 锌白 Calcium carbonate, zinc white
黑瓷漆 <b>Black Enamel Paint</b>	碳黑, 棕土(氧化铁与氧化锰的混合)(X 射线荧光光谱) Carbon black, umber (mixed Fe/Mn oxides) (XRF)	醇酸树脂 Alkyd resin	重晶石, 碳酸钙, 锌白 Barytes, calcium carbonate, zinc white

### 宝相阁样品摘要 Summary of Baoxiang Pavilion Samples

样品 <b>Sample</b>	颜色 <b>Color</b>	颜料(敷雷叶转换红外光谱, 拉曼光谱) <b>Pigment (FTIR, Raman)</b>	胶结物 <b>Binder</b>	添加剂(填充剂) <b>Additives (fillers/extenders)</b>
SX.BX.F03.S09	红 Red	无法辨认, 可能是合成的有机红色 Unidentified; probably a synthetic organic red	醇酸树脂 Alkyd resin	硫酸钡, 滑石, 碳酸钙 Barium sulfate, talc, calcium carbonate
SX.BX.F03.S09a	红 Red	无法辨认, 可能有合成的有机红色 Unidentified; probably a synthetic organic red	醇酸树脂 Alkyd resin	测不到 None detected
SX.BX.F03.S18	蓝 Blue	群青 Ultramarine	很少量 Very little present	测不到 None detected
SX.BX.F03.S19	绿 Green	酞菁绿染料(合成的有机颜料) Phthalocyanine green (synthetic organic pigment)	可能是合成的胶结物(C=O possibly indicates a synthetic binder)	硫酸钡, 石英 Barium sulfate, quartz

SX.BX.F03.S20	黄 Yellow	测不到(敷雷叶转换红外光谱) Not active in the mid-infrared (FTIR only)	醇酸树脂 Alkyd resin	硫酸钡, 碳酸钙 Barium sulfate, calcium carbonate
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## 结论 Conclusions

所有确认出来的胶结介质（宝相阁的样品与液体修护漆）都含有醇酸树脂或短油醇酸树脂。

现代的粉末颜料都辨认出来了。除了一罐红色颜料（标签可能有误，写的是红朱）根据拉曼光谱的分析应该是有机红颜料。从宝相阁取来的红漆及大红调合漆也无法辨认，但是根据拉曼光谱与敷雷叶转换红外光谱测定可能是有机红颜料。这些红色样品的颜料无法辨认但是可以认为是合成的有机颜料，这是制造现代醇酸树脂和短油醇酸树脂颜料的典型材料，亟不可能用天然的有机红来制造这些类型的漆。除此之外，辨认液态漆样品中的颜料以及从宝相阁取出来漆样品的颜料是困难的，因为它们都有混合物与其他添加剂（如重晶石，碳酸钙等）。然而，基于这些结果我们有信心的推断这些修护颜料与我们以前为会承殿所辨认的历史样品的颜料不同。

All binding media identified (in Baoxiang Pavilion samples and the liquid restoration paints) were found to contain either an alkyd or short-oil alkyd binder.

The modern powder pigments, were all identifiable except for the red (as received incorrectly labeled on the sample container as cinnabar) which is thought to be an organic red (Raman). The red paint sample from Baoxiang Pavilion and the bright red restoration paint were also unidentifiable, but again indicate an organic red (Raman, FTIR). These red samples, the pigments of which are as yet unidentified, are thought to be a synthetic organic red, as is typical for modern alkyd and short-oil alkyd paints. It is highly unlikely that a natural organic red would be used in paints of this variety. In addition, the identification of pigments in the liquid restoration paint samples and the Baoxiang Pavilion samples was difficult due to the presence of extenders and other additives (such as barytes, calcium carbonate, etc.). However, based on these results, shown in the table below, we can confidently infer that the restoration pigments are different from the historical paint samples from Huicheng Hall that were previously identified.

## 历史颜料样品与现代样品的比较 Comparison of Historical vs. Modern Paint Samples

颜色 Color	历史上的颜料（化学式，分析方法） Historical Pigments (chemical formula) (analytical method used for identification)	历史上的胶结物 Historical Binding Media	现代的修护颜料 Modern Restoration Pigments	现代的修护胶结物 Modern Restoration Binding Media
红 Red	朱砂 Vermilion (HgS) (PLM, XRF)	-----	无法辨认，可能是有机红，铅丹，铁红 Unidentified; probably a synthetic organic red Red lead, red iron oxide	醇酸树脂和/或短油醇酸树脂 Alkyd resin and/or short-oil alkyd

<p>蓝 <b>Blue</b></p>	<p>大青 (敷雷叶转换红外光谱) Smalt (<math>\text{SiO}_2, \text{K}_2\text{O}, \text{Al}_2\text{O}_3, \text{CoO}</math>) (FTIR) 石膏 (拉曼光谱) Azurite (<math>\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2</math>) (Raman)</p>	-----	<p>Phthalocyanine blue (synthetic organic pigment) 酞菁蓝染料 (合成的有机颜料)</p>	<p>醇酸树脂和/或短油醇酸树脂 Alkyd resin and/or short-oil alkyd</p>
<p>绿 <b>Green</b></p>	<p>铜绿 (敷雷叶转换红外光谱) Atacamite, botallackite (<math>\text{Cu}_2\text{Cl}(\text{OH})_3</math>) (FTIR)</p>	<p>桐油 (敷雷叶转换红外光谱) Tung oil (FTIR)</p>	<p>酞菁绿染料 (合成的有机颜料) Phthalocyanine green (synthetic organic pigment) 铅铬绿 (铬黄铬酸铅与普鲁士蓝的混合) Chrome green (mixture of chrome yellow <math>\text{PbCrO}_4</math> and Prussian blue <math>\text{Fe}[\text{Fe}^{3+}\text{Fe}^{2+}(\text{CN})_6]_3</math>)</p>	<p>醇酸树脂和/或短油醇酸树脂 Alkyd resin and/or short-oil alkyd</p>
<p>白 <b>White</b></p>	<p>铅白 (偏振光光学显微镜, 射线荧光光谱) Lead white (<math>\text{PbCO}_3</math>) (PLM, XRF)</p>	-----	<p>钛白, 锌白, 碳酸钙 Titanium white, zinc white, calcium carbonate</p>	<p>醇酸树脂和/或短油醇酸树脂 Alkyd resin and/or short-oil alkyd</p>
<p>黑 <b>Black</b></p>	<p>碳黑 (偏振光光学显微镜, 拉曼光谱) Carbon black (C) (PLM, Raman)</p>	-----	<p>碳黑, 铁黑 Carbon black, iron black</p>	<p>醇酸树脂和/或短油醇酸树脂 Alkyd resin and/or short-oil alkyd</p>