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A COLOURFUL WORLD FOR THE EMPEROR'S SOUL: THE POLYCHROMY OF THE TERRACOTTA SCULPTURES AT QIN SHIHUANG'S BURIAL COMPLEX

Catharina Blänsdorf and Xia Yin

ABSTRACT

The terracotta army from the burial complex of the first Chinese Emperor Qin Shihuang (died 210 BC) is well known as a collection of grey sculptures which appear from the distance to be a uniform troop. All the sculptures, chariots and weapons were originally painted, but the few colours which survived the centuries were lost during excavation. One of the aims of the Chinese-German co-operative project is the difficult task of conserving this polychromy. Parallel to conservation efforts, analyses of the pigments and their application techniques, and reconstructions of the colour combinations and the elaborately painted patterns, have been undertaken. They have helped provide an understanding of the polychromy as it was originally intended. The polychrome schemes are of extraordinary quality and importance. They provide insight not only into ancient painting techniques, but also into the style of clothes and uniforms in the ancient state of Qin. Reconstructions of the polychromy on two replicas are an attempt to visualize the original appearance of the figures.

ZUSAMMENFASSUNG

Die Terrakottaarmee aus der Grabanlage des Ersten Chinesischen Kaisers (gest. 210 v. Chr.) ist gut bekannt als Formation grauer Figuren, die aus der Ferne als einheitliche Truppe erscheinen. Ursprünglich waren jedoch alle Skulpturen und auch die Wagen und Waffen bemalt. Die Farbfassungen haben leicht reduziert die Jahrhunderte überstanden, gehen aber bei der Ausgrabung unwiderruflich verloren. Einer der Schwerpunkte des Chinesisch-Deutschen Forschungsprojektes ist die schwierige Aufgabe, diese Farbfassungen zu erhalten. Parallel dazu werden Untersuchungen zu Pigmenten und Maltechnik, zur Rekonstruktion der Farbschemata und der aufwändig gestalteten Muster wurden durchgeführt, die hier vorgestellt werden. Die Farbfassungen sind von außerordentlicher Qualität und großer Bedeutung. Sie erlauben einen Einblick nicht nur in die antike Maltechnik, sondern auch in den Stil der Kleidungen und Uniformen des antiken Staates Qin. Rekonstruktionen der Fassungen auf zwei Gipskopien sollen versuchen, sich dem ursprünglichen Aussehen der Figuren zu nähern.

INTRODUCTION

The terracotta army is one of the most important archaeological discoveries of the twentieth century and one of the most famous cultural monuments and greatest tourist attractions in China. The terracotta army is part of the burial gifts of the first Chinese Emperor Qin Shihuang. Twelve years after unifying the country, Qin Shihuang was buried close to his capital city in 210 BC. It has always been known that his grave is under a 70 m high earth pyramid near Lintong, 30 kilometres east of Xi'an, the capital of Shaanxi Province, but the extent of the complex and the quality and quantity of the treasures concealed underground were unknown. In 1974, peasants discovered the terracotta army by accident. This resulted in an excavation campaign which has lasted for more than 30 years: 188 pits surrounding the grave mound are known. They contain objects representing all aspects of the emperor's life: chariots, civil servants, acrobats, an underground river with bronze birds, stables, a zoo etc. Four of these pits are occupied by the terracotta army.

This gigantic burial complex eclipsed all previous royal graves and set standards for the following emperors. From this time onwards, a terracotta army was among the burial objects in every imperial grave. Qin Shihuang's terracotta army however was not only the first of its kind but also the only one with figures that are larger than life-size.

But Qin Shihuang overextended himself with his huge building projects. Moreover what was planned as an eternal resting place did not remain undisturbed for long. According to the annals written in the Han Dynasty around 90 BC [1–3], the burial complex was never completed and was destroyed by a

rebel army in 206 BC. Archaeological research seems to confirm this, as several of the pits are empty and all show damage from a severe fire.

The initial concept of creating an underground world with thousands of larger than life-sized terracotta figures is not well understood, though burial figures have been found in tombs of the sixth century BC. Ideas on the intent behind the army have mostly focused on the clay as an important material: terracotta makes mass production possible, but also allows detailed modelling and portrait-like faces. The terracotta army shows this fascinating combination of mass and individuality. This impression is intensified by its present appearance: rows of greyish brown figures seem to rise out of the ground between earthen walls of the same colour. Individual faces and types can be perceived but the monochromatic coloration dominates, emphasizing the impression of unity and uniformity. The grey seems appropriate for an underground 'Army of the Netherworld'.

But the terracotta figures were originally completely painted. This has always been known, since extensive remnants of polychromy were found. This was not surprising because realistically painted grave figures of servants and guards, equipped with clothes and weapons, exist from the fourth century BC [4, 5]. When excavations in Lintong began, it was also known that later terracotta armies from the Han Dynasty (206 BC–AD 220) were colourfully painted, as for example the 2400 figures from the burial complex of the first Han Emperor (died in 195 BC) in Yangjiawan, excavated in 1965. But the polychromy of Qin Shihuang's terracotta figures flakes off directly after the surfaces of the figures are exposed to the damp loess soil. Only tiny remnants of pigment remain on the terracotta. So it is difficult to imagine a coloured army instead of a grey one.

THE CHINESE-GERMAN RESEARCH PROJECT

Project structure

The Chinese-German Research Project for Preservation of the Cultural Property of Shaanxi Province was founded in 1988. It is supported financially by the German Federal Ministry for Research and Education (BMBF) and the Chinese State Administration of Cultural Heritage (*Zhongjia wenwu ju*). Two German and three Chinese institutions are involved: the Bavarian State Department for Historical Monuments (BSDHM, Bayerisches Landesamt für Denkmalpflege) in Munich; the Roman-Germanic Central Museum (Römisch-Germanisches Zentralmuseum) in Mainz; the Museum of the Terracotta Warriors and Horses (MTW) in Lintong; the Archaeological Institute of Shaanxi Province in Xi'an; and the Technical Center for the Conservation and Restoration of the Cultural Heritage of Shaanxi Province in Xi'an.

The aim of the project is to find solutions for unusually difficult conservation problems, accompanied by research on objects which all are of great cultural importance and high artistic quality. Natural sciences and academic research are combined with conservation in the project: restorers, chemists, geologists, art historians and sinologists work together. Furthermore, contacts and co-operation with other institutions such as universities, research institutions and chemical companies give wider possibilities for scientific exchange. The BSDHM and the MTW have focused together on problems in the preservation of the terracotta army and newer findings from Qin Shihuang's burial complex:

conservation of earthen structures, assembling the broken terracotta figures, climate control and microbiological problems and, since 1999, conservation of the newly-discovered stone armour sets made of limestone plates.

Conservation of the polychromy of the terracotta sculptures

This has been an important objective of the project from the start. For a long time no possibility of conserving the polychromy was seen in Lintong: the paint layers on the sculptures were lost during excavation. Some could be rescued in the soil, as the pigment layer adhered to the soil on top of the sculptures — as a kind of ‘negative imprint’. Because colour photography was limited, colours were mainly recorded briefly in lists, and individual patterns were documented in drawings.

The critical and most problematic step for the preservation of the polychromy is the conservation of the brown ground layer. It was obviously the material which on drying developed cracks, deformed and peeled off the terracotta, resulting in the complete loss of ground and pigment. One of the first results of the research project was the identification of the material of the ground layer: Though severely degraded, it could be identified as east Asian lacquer (*qi* in Chinese, *urushi* in Japanese). The conservation of the water-saturated lacquer is a problem which required the development of a new conservation technique, as all standard conservation methods had failed. Principally, a non-evaporating material must be introduced to replace the water and a consolidant is needed to re-establish the adhesion between lacquer and terracotta. The extremely fine porosity greatly limits the possibilities and excludes the adhesives which are commonly used in conservation. Two procedures suitable in principle have been developed: polyethylene glycol (PEG) 200 and a water-soluble dispersion of consolidant, or methylacrylate or methacrylate monomers (HEMA) polymerized by electron beam irradiation, published elsewhere [6–11]. Each involves disadvantages and difficulties; thus improvements in these procedures and long-term tests are still in progress. The focus of the present text is on the results of current research on painting techniques.

The polychromy on newly-excavated sculptures has been conserved using these procedures since 1999. Treated figures (about 20 by now) exhibit much more polychromy than was imaginable before. For the first time the terracotta figures appear as polychrome rather than monochrome sculptures. Guided by preserved polychrome remnants and archaeological reports, efforts to understand and reconstruct the original appearance of individual figures and small units have been intensified since 2003.

PAINTING TECHNIQUE AND PAINTING MATERIALS

The terracotta figures were modelled by hand and fired at approximately 950°C. The reduction firing caused the terracotta to turn light grey. Basically the figures were fired in one piece, a remarkable achievement for the time. The quality of the terracotta hardly varies at all; the clay appears to have been prepared at a centralized station. The potters mastered production of the 1.80 m high figures not only with technical perfection and expertise, but also with great sculptural skill. The figures are realistically and expressively modelled down to the details. More than 80 artists can be identified from the numerous signatures; some of them were craftsmen from the vicinity who scratched their names in the clay, others were employees of the imperial court who used official seals.

Qi lacquer ground

The figures were painted after they were fired. They were first completely coated with a ground of *qi* lacquer, onto which the pigment layer was then applied. The *qi* lacquer was applied in

two thin layers, the first of which is brown and visibly porous, perhaps indicating a poorer quality of lacquer. Together both lacquer layers have a thickness of 30–100 µm. The lacquer did not penetrate into the terracotta surface: it seems that the terracotta had first been coated with a sealant. Presumably the use of a sealant made it possible to achieve a smooth surface with applications of two thin layers of lacquer, without polishing. This barrier represents one of the conservation problems today, because it is responsible for the lacquer detaching from the terracotta surface like a film.

Qi lacquer layers are extremely stable, being sensitive only to ultraviolet light and changes of humidity. This was already well known in antiquity and may have been one reason *qi* lacquer was used on so many burial objects in Qin Shihuang's tomb: not only the terracotta sculptures but also the chariots and the shafts and textile sheaths of weapons were coated with lacquer. It might not be merely a historical myth that the complete extinction of lacquer trees in this region dates back to extraordinary consumption during Qin Shihuang's time. Moreover, lacquer was very valuable. Only the emperor could afford to have everything he wanted covered with lacquer, an expression of his power and his endless wealth.

Dust-free rooms and a humid climate are necessary for hardening lacquer. A relative humidity of 65–90% and a temperature of 16–22°C are ideal. These conditions generally exist in Lintong in May and September; the winters are too cold and dry and the summers too hot. Probably there were no climate-controlled lacquer drying rooms at the time, especially of the necessary size. Therefore, the production might have been seasonal, with the terracotta figures being fired in the winter, lacquered in spring and autumn, and painted during the winter months.

Pigments

Numerous polychrome layers have been investigated over a 15 year period, but the fragments they came from were chosen for conservation trials, not for technological questions. Systematic studies were only started in 2000, using polarised light microscopy (PLM), X-ray diffraction (XRD) and X-ray fluorescence (XRF). For particular questions scanning electron microscopy (SEM-EDX/WDX) and Raman spectroscopy were also employed.

Only inorganic pigments were used for the polychromy. The range broadly accords with the palette known in antiquity: white lead, kaolin, yellow and red ochre, cinnabar, malachite, azurite, and bone black. The extensive use of bone white (i.e. bone ash), the most frequent white pigment in white and pink layers, is interesting: it might be explained by the use of animal bones left over from catering for thousands of workers and artisans. A violet barium copper silicate was used, nowadays known as ‘Han purple’ or ‘Chinese purple’. This man-made pigment was well known in Chinese antiquity, but fell out of use after the Han Dynasty. It was identified for the first time again in 1983 [12, 13].

Completely missing, except for golden ochre, is the colour yellow. There is only one bright yellow layer, hidden under a light pink one. During the investigations of the project, the colorant of this layer was identified as vanadinite. This intensive ‘sunflower’ yellow lead-vanadium compound which naturally occurs in lead ores has not previously been known as a pigment. The same pigment has also been discovered in a Han Dynasty tomb mural in Xi'an. Further research on the wider use of this mineral as a pigment has been carried out, with SEM-EDX [14], and Raman and micro-XRF [15].

One emphasis has been on surveying and interpreting pigment mixtures and colour nuances, such as the different compositions and colours used for pink and whitish tones. All flesh colours

were made using mixtures of white and red only. Bone white was generally employed as the white, sometimes mixed with lead white. The red pigment was always cinnabar, usually extremely finely ground (average particle size about 1–3 μm). Pink parts of the garments were also mixed with bone white, or lead white and cinnabar, but often the cinnabar is rather coarse. It is still not clear which of the many detectable variations in the mixtures are attributable to the work of numerous painters over more than a decade, and which indicate artistic intent.

Binding media and application techniques

It has not yet been possible to identify the binding medium for the pigment, which has largely deteriorated during the 2200 years when the sculptures were covered with moist earth. Aqueous materials such as animal glue, a plant gum, starch or egg are likely, whereas oily and resinous binding media do not appear to have been used in China for sculptural polychromy. The loss of the binding medium causes many layers to appear completely opaque. Many of the faces now seem unnaturally pale. The frequently-found layer structure with a darker pink layer under a lighter one, must have been part of an artistic concept despite the considerable thickness of the layers, but it is not visible today because the layers are completely non-transparent. The ‘fading’, especially of the faces, often mentioned by Chinese archaeologists, is simply caused by lightening during the drying process. The appearance of the still-damp pigment layers on freshly excavated figures, with slight transparency and bright colours, is very attractive — and probably closer to the original concept than the dried-out layers.

The application techniques might provide an indication of binding media. The pigment layers were generally applied in a single layer of considerable thickness (0.01–0.8 mm). Still-visible brush marks indicate experienced and rational application. Brushes more than 10 cm in width were used for the clothes, finer ones for more detailed and smaller areas. The fine patterns on the armour of high ranking officers have extremely precise lines less than 1 mm in width, which appear slightly raised in raking light.

Trials with different kinds of binding media showed that it is impossible to create layers and surface structures like this using gums, pure egg or egg yolk, or mixtures with additions of oily components. Glue and mixtures of glue and egg or casein gave satisfying results, though even they are difficult to apply in thick layers.

Surface textures and pastiglia

Visible brushstrokes were perhaps an unavoidable part of the painting technique, but they were also used as part of the technique. They follow the natural lines of facial features and they even seem to indicate thread structure on the garments. This is particularly evident on the acrobats’ skirts where the brushstroke runs horizontally on the skirts themselves, but vertically on the broad white border. In the latter the brushstroke is combined with fine, raised ornaments. These ornaments of dimensions only 1.2 × 2.5 cm have lines of c.1 mm width with sharp edges, Fig. 1. The straight brushstroke without a discernible beginning or end clearly represents the texture of the fabric.

Similar imitations of materials with raised paint are also found on the bronze chariots and the bronze birds. Tiny dots in staggered rows appear on the white surface of the first charioteer’s shield and on the disc hanging from his belt, the latter suggesting a jade *bi* disc with its typical raised dots, Fig. 2. The feathers on the white bronze birds are depicted in such a manner that there was initially speculation as to whether real feathers had been pressed into the paint. In fact the texture was achieved with brushes, with the quill of the feather then modelled. All the paint



Fig. 1 Detail of the border of the skirt of acrobat No. 6 (originally white, but blackened by fire); modelled lozenge pattern (single elements about 1.2 × 2.5 cm).



Fig. 2 Detail of the charioteer of bronze chariot No. 1, (diameter of disc c.5 cm).

layers of this type that were studied are white, thick, and contain bone white, sometimes also lead white.

Raised decorations as part of white ground layers are known in Europe under the term *pastiglia*. In Chinese, the technique is widespread on Buddhist sculptures, often used in combination with gilding, and called *lifen*. On the Qin figures the same technique is used, but using the paint layer itself. Reconstructions showed that an effect like this can be convincingly imitated using bone white in animal glue.

POLYCHROME SCHEMES

The polychromy exhibits brilliant tones with lively contrasts. The (probably always) relatively matt colours contrasted with the glossy lacquer layers. The lacquer not only served as the ground for the pigments, but was also used as a glossy dark brown colour to depict hair as well as shoes, armour plates and caps made of lacquered leather. The areas to be lacquered but not painted were particularly carefully modelled and smoothed. Colours were used in bright contrasts next to each other, but mainly each area of the garment was uniform in colour. Therefore, some collars and sleeve cuffs which vary in colour over a single area, often from blue or green to ochre, seemed inexplicable. They were first interpreted as discolourations, but the investigation of structure and



Fig. 3 Kneeling archer 002812 from pit No. 2.

pigments showed this is part of the original concept, reminiscent of batik.

The polychromy was not only colourful and individualistic but also was intended to appear as realistic as possible. The details and the imitations of various materials contribute to this effect. The base slabs which were necessary to provide support for the standing figures were the only unlacquered components, thus making them practically invisible on the grey brick floor of the pit. The sculptures seemed to be standing on their own feet rather than on plinths, a trick intended to increase the realism of the figures. Furthermore, originally the warriors were equipped with weapons from the real Qin Army. The wooden and textile parts such as the shafts of the weapons, the covers of the blades and the chariots were also lacquered and painted.

The polychromy of one formation

Starting in 1999 it was possible to conserve completely the polychromy on nine figures that were excavated in corridor 18 of pit 2 (which had not been so badly damaged by fire). The sculptures are part of a unit of kneeling archers who were arranged in a double row of 2 × 20 figures. Their polychromy can be almost completely reconstructed: it turned out that all nine archers were painted differently. Fig. 3 shows one archer after conservation, and Fig. 4 shows reconstructed colours sketched for all nine archers. There is no dominant colour within this small troop, and combinations do not repeat themselves. Archaeologists had already described this phenomenon in 1988. Military ranks are above all recognisable by the caps. A few written documents from the Qin Dynasty and the polychromy of Han Dynasty terracotta armies suggest that there were no uniforms at the time: soldiers had to provide their own clothing. The polychrome reconstruction of nine of the archers suggests how colourful such an army must have looked.

One of the kneeling archers is modelled like all the others but his face is green. The 'green face' is a riddle to the archaeologists. Close examination as part of the polychromy investigation showed that there is no colour change (as assumed at the beginning). Furthermore, not only are his hands and feet flesh-coloured, but also his neck, the back of his ears and even the parting in his hair. Though we cannot solve the mystery, at least we know now that he is not a green-skinned warrior, but a warrior in green make-up — why, however, no one can say.

Armour with patterns for high-ranking officers

Some figures were not only painted, but had decorations on the armour with very fine patterns. From the style of their caps, they can be identified as generals and officers in special positions. The numbers make it clear that these figures are truly special. Of approximately 1500 figures excavated so far, only 16 of them have these particular decorations. There are hardly any pigment remnants on these figures. Only the archaeologists' line drawings, a few colour photographs and a few fragments of pigment layers in the soil (Fig. 5) have survived. None of the patterns can be interpreted, and neither the repeat nor the colours for all ornaments were known. In this situation, reconstructing the polychromy of these figures is like a jigsaw puzzle where slowly single parts come together, allowing us to reconstruct more and more of the original polychromy.

Meanwhile, four different types of patterns could be identified, and the pattern repeats have been completely recorded. The generals have armour which is edged with geometrically patterned trimming. On a reddish brown to violet background black lines form a grid of rhombi which are filled with small coloured designs. Except for the colours and sequence of the small designs, this pattern was rather well-documented and thus easy to reconstruct. On the chest, there is another type of pattern,



Fig. 4 Reconstruction of the nine kneeling archers from pit no. 2, excavation area 21, corridor 18.

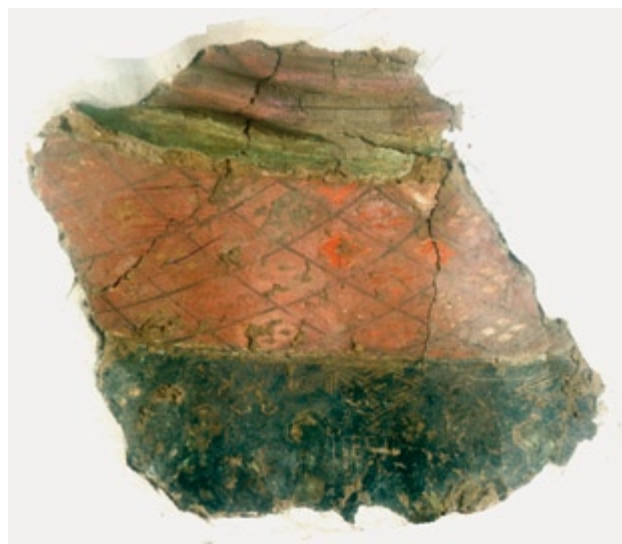


Fig. 5 B-0101, the only fragment of the armour of general T9:1 from pit No. 2, mounted in plaster (longest dimensions 13 × 15 cm).

but only a few fragments were documented. They were described showing key- or cucumber-shaped forms which could not be interpreted immediately. By incorporating all the fragments and remnants from the figures, it was possible to reconstruct the pattern in 2005: it obviously shows stylized pairs of birds (probably peacocks) with suns between them arranged in rows, which are separated from one another by angular geometric patterns. These patterns obviously depict woven fabrics. They even imitate the angular forms and especially the six-sided 'dots' which would be caused by weaving. Even the distortion of the fabric caused by stretching across the body, is painted: the rhomb-shaped grids on the trimming are distorted and also the bird pattern is slightly bent close to the edges.

The angular forms are not a design style. This becomes clear by examining sculptures with other dresses: the skirts of the acrobats have finely curved, not angular, ornaments which seem to depict embroidered patterns, whereas the white on white *pastiglia* lozenges on the skirts borders of their skirts most likely represent damask or silk gauze with woven-in ornaments. The artists evidently intended to imitate different types of weaving techniques for fabric.

Such an exact depiction of fabric raises questions of prototypes and the significance of the patterns. No fabric from this period has survived in the vicinity of Xi'an, but several have been preserved in graves in east and south China and in Xinjiang. Woven fabric from Hunan (Zuojiatang near Changsha) and from Hubei (Mashanling near Jiangling), both dating from the fourth century BC in what was then the southern state of Chu, show stylized animals with angular dots and edges set off by colours. A piece of fabric from Mawangdui near Changsha from 168 BC displays woven peacocks and suns. Silk gauze from the same burial complex has almost the same ornaments as on the borders of the acrobats' skirts. An exact interpretation of the patterns and an investigation of connections to Central Asia (where peacocks, for example, originate) via Xinjiang and to southern China (the state of Chu) have only just begun and will demand more time.

RECONSTRUCTION OF THE POLYCHROMY

Visual impression of the polychromy today

Even the figures that have been conserved are only a pale reflection of the terracotta army's original appearance, because the polychromy has aged and been diminished. Extensive gaps, discolouration to yellow from the yellow soil, as well as lost surface textures and thin top layers impair the effect. The missing

binding medium makes the pigment layers seem too light and opaque. Consolidation measures also have the unavoidable effect of changing saturation and depth of colour. This could be a step back towards the original appearance, but as it is still impossible to say how much saturation and gloss the pigmented layers had, it can also be a falsification of the visual impression. As the colours of the lacquer and the terracotta surface are also slightly changed by both consolidation methods, the conserved fragments actually might be quite far away from the original impression.

The dust deposits in Lintong are another unresolved problem because it is not possible to remove them from the mechanically sensitive pigment layers. Moreover the figures' 'accessories' are gone: only the bronze components of the wooden accessories are preserved; the weapons and quivers are missing. In view of the progressive drying out of the pits it is unlikely we will encounter better preserved polychromy.

Depicting the results of the investigations

Descriptions, line drawings and data on the colours record information but do not convey a visual impression, especially in regard to colour nuances, surface textures and patterns. Photographs only reflect the diminished state of the figures today (Fig. 6), so that details and colours often can hardly be imagined. Therefore attempts were made to visualize existing findings using colour sketches, gradually moving from small coloured fragments (Fig. 7) back to the original polychromy and the overall design. It was not possible to reconstruct the entire polychromy on any one of the figures with patterns. But the prevailing analogies of the basic colour schemes and the arrangement of patterns within one type of figures allow a relatively assured completion of the design, Fig. 8. Colour sketches have the disadvantage that the modelling of three-dimensional figures, and surface characteristics such as brushstrokes and gloss, are difficult to represent.

These problems can partly be solved by computer animation combining 3-D scans, photographs and the application of



Fig. 6 The back of the general T9.



Fig. 7 Reconstructed colour sketch of B-0101.

virtually designed surfaces which can be used to reduce discolouration and fill in missing parts. Even several figures can be combined and shown in a reconstruction of the original surroundings inside the pit. Computer animation of the polychromy has been part of the ongoing work of the project since 2003.

Reconstruction on replicas

Another method consists in colour reconstruction on replicas of the sculptures. The same materials and techniques as used in antiquity can be used, and the figures can be experienced in space like the originals. The possibilities and limitations of the materials themselves, such as the influence of binding media on



Fig. 8 Reconstructed colour sketch of the back of general T9:1 from pit No. 2.

colour depth, surface texture and gloss, provide the constraints in this approach. Moreover, the issue arises of how to deal with gaps for which there is no information; other than on a drawing, they cannot simply be left blank.

Despite these limitations and problems, an attempt to make polychrome reconstructions has been started on two replicas in January 2006. The replicas are made of gypsum, remodelled by hand and coated with raw *qi* lacquer, which results in a shiny, black-brown surface. The pigments were chosen in accordance with the paint analyses and have been acquired from Beijing. 'Chinese violet', which is no longer available today, was made expressly for this purpose.¹ Various binding media such as animal glues, egg white, egg yolk, gums, starch and casein were tested in order to achieve an effect similar to the originals. Parallel to this, attempts were again made to identify the binding medium, and for the first time, there might be a result: preliminary analyses seem to indicate the presence of egg [16]. Therefore, a mixture of egg with skin glue has been used as the binding medium for now. Even if this reconstruction remains speculative in some respects, it might give an initial impression of the original appearance of a terracotta warrior.

SUMMARY

Research results give an idea of the complicated polychromy of the terracotta figures. The extensively used valuable pigments and *qi* lacquer were both expensive materials that only an emperor could afford. Through its paint scheme the terracotta army became a highly realistic and colourful replica of a Qin Dynasty army. Painted and modelled patterns imitate contemporary fabrics in a realistic manner and further enrich the detailed brushwork.

If the paint layers and organic materials had survived, one would see a structurally organized but finely detailed, colourful crowd instead of a grey army. Rows of figures would be broken up by protruding weapons, quivers and chariots, whose wooden components were also glossily lacquered and painted. It is not possible to imagine this effect today. Conservation and reconstructions based on research on all available material can only give an idea what the polychromy might have looked like on single, isolated figures. Nevertheless, it might be a first step to understand the original appearance of the terracotta figures found as burial objects around Qin Shihuang's grave.

However, it can be assumed that the terracotta army was never to be seen in antiquity as it is today. The height of 3.20 m of the dividing walls would hardly have allowed anyone to see the figures. Moreover the corridors were certainly never open, since the pits were not roofed over by halls. Rather one must imagine that the figures disappeared piece by piece, according to an established plan, into the darkness of a corridor which was covered with wooden beams and locked against thieves at its entrances. Thus not even the successor of Qin Shihuang would ever have seen Qin Shihuang's terracotta army in its complete splendour.

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¹Prof H. Berke, University of Zurich, is conducting intensive research on Chinese blue and violet. He has provided 1 kg of violet to the project for painting the replicas.