

Aims and Results of the Chinese-German Project for the Preservation of the Terracotta Army

"How the Ancients Portrayed Death" is the title of a famous work of literature written by the German poet Gotthold Ephraim Lessing in 1769. In this essay, Lessing gives a detailed description of the "Ancients" (the Greeks and Romans) depicting death not as a macabre skeleton but instead personifying it as a winged genius. The horrible and drastic depiction of the skeleton as a "dead man" is a post-Antique conception, influenced by Christianity and especially prevalent in the Middle Ages. At this congress, I hope to learn more about how the ancient Chinese conceptualised death.

Despite its massiveness and huge dimensions, the terracotta army was "only" a burial furnishing which until now has often been misunderstood. For many years now, Professor Yuan has done research on the discovery as well as on the function of the terracotta army of the First Emperor. Furthermore, he has also published the existing descriptions concerning the content as well as the arrangement of the actual burial chamber or tumulus grave. How death was conceptualised is still not known. We merely know about the burial rites, rituals and fashions. Since we are dealing with "colour" in our joint project, it would of course be very interesting to learn more about the colour of "death" in China.

In burial sites found in Germany from the same period no known life-size sculptures have been discovered. Similarities may be found in the grave goods such as weapons, vessels, textiles and bronze objects required for daily use.

The antique sculptures in Germany are almost exclusively an inheritance from the Roman Empire. Nevertheless, a joint project between the Terracotta Museum and the Bavarian State Conservation Office concerning the conservation of the polychrome terracotta soldiers has been realised. The state restoration workshops of Bavaria have intensively studied the conservation of sculpture polychromy of the last 100 years. Conservation work has been done on countless wooden and stone sculptures dating from 1000 AD and later in the state restoration workshops.

In comparison with medieval sculptures, the restoration of polychrome surfaces of antique sculptures is a topic that has only been dealt with superficially. For the majority of sculptures from Greek and Roman civilisations as well as Near East civilisations, research on polychromy has until now remained an unfulfilled desire. This is due to the fact that polychrome surfaces from these civilisations have rarely survived, were lost during excavation, or were removed shortly thereafter to show the "pure form" of the sculpture. Even though the polychromy of the terracotta army is in a very fragmented state, the impressive artistic quality has been preserved on countless fragments. For the first time in the history of archaeology, one of the main goals of an excavation is to also preserve the polychromy, which has been partially possible due to the exemplary excavation. Archaeologists in China have taken the opportunity and responsibility and

have avoided the errors that were committed during excavations of Mediterranean civilisations in Europe. The practice of erecting huge protective structures over excavation sites, so that all archaeological treasures can be left where they were found in their own excavation museums is firmly established in China (e.g. with Neolithic objects in Bambo). The opportunities and possibilities of this type of preservation of the stratigraphy of the excavation and presentation of the findings can be observed in the very difficult situation in Pompeii, where great efforts will have to be made to save the original situation there before it deteriorates further.

Countless conversations during preparation for this congress confirmed that, at present, research concerning the polychromy of antique sculptures does not receive a great deal of academic attention. Summaries on this complex topic concerning iconography, knowledge of materials, restoration and scientific aspects do not exist. Even today "colour" used for the design of antique sculptures is still a "blank" on the map of archaeology. This lack of attention might almost give the false impression that we are grateful to earlier generations of archaeologists and restorers who, in their work, attempted to eliminate the problem of preserving the polychromy on sculptures by removing every last bit of paint with great effort. Upon discussing the future of the terracotta army, one encounters astonishment when one explains that these thousands of life-size sculptures originally bore a colourful polychromy.

In the following presentations at this congress, the composition of pigments and binding material of the terracotta army as well as possible ways of preserving the polychromy will be discussed. In retrospect, our joint research is not only a success story but also a story of mistakes and failures. If one considers that the chemical composition of a fresh Chinese Chi-lacquer is complex, then one can imagine how difficult it would be to analyse a 2000 year old sample that has been preserved, "stored", under very poor conditions. Today only a few research institutes in the world are capable of analysing such aged material.

For those readers who are not chemists it might be helpful to know that, at the beginning of this century, an artificially produced product called "bakelite" showed certain chemical similarities to "Chi-lacquer". In the 19th century, "Chi-lacquer" could be found in every professional chemical laboratory. It was completely resistant to most chemicals and an extremely durable surface on laboratory tables. Under good conditions, dry atmosphere and no damp ground contact, lacquer particles composed of this material will last thousands of years. Numerous findings in China dating from the Neolithic period and later, prove the amazing ageing qualities of this material. Even more durable is natural resin amber which was originally an organic material whose contents are important, allowing us to reconstruct the ancient DNA structures of organisms trapped in the amber. This

represents an ideal data bank. The resilience that these natural resins have shown over thousands of years is amazing.

The use of Chi-lacquer in China is a very old tradition. Cultivating the lacquer tree plantations as well as obtaining the resin has been a tradition since primitive times. Accounts record that the Second Chinese Emperor wanted his City Wall to be painted with lacquer. But, even considering Chinese standards, this idea, which had a streak of megalomania was not carried out. Similar to silk production lacquer production and craftsmanship is one of the oldest Chinese techniques. It has fascinated Europeans since Antiquity. One only has to recall the enthusiasm for Chinese culture in the 17th and 18th centuries in Europe. The European lacquer technique of the "New Age" is the result of an unsuccessful attempt to imitate the Chinese prototype.

The work we have done together over the years in Lintong and Munich has often focused on very small corroded lacquer particles. The despair we experienced with this very obstinate material often threatened our enthusiasm for the project. Most relevant and even some questionable techniques were tested in order to conserve the lacquer-ground of the terracotta-soldiers. In most cases these attempts failed or had minimal success. The analysis and determination of the pigments of the polychromy was relatively easy in comparison to the treatment of the lacquer-ground, which led to a number of negative results. The identification of the so-called "Han-Purple", previously an almost unknown pigment, was one of the small highlights of our analysis. Progress over the years was only made by disqualification. May I say a few words to my European colleagues concerning the pigments used, especially cinnabar, a main component of the flesh colours of the terracotta sculptures.

As is well-known, cinnabar is won as a mineral in large deposits which are also found in China. It has served since Antiquity as a pigment, especially for the colour red in lacquerware. At the same time, cinnabar is also an important material in Chinese alchemy and is probably the oldest man-made "chemical" product. Even though the First Emperor was not the first one to show a special interest in this material, he encouraged studies on and production of this "magic elixir". He also strove to obtain more knowledge on the reproducible and reversible reactions of elements such as sulphur and mercury, which generated a great variety of black, red or "silver" coloured effects. Cinnabar, a product of protochemistry, has been known in ancient China since primitive times. Compared to European products the Chinese product is far superior in quality because of the use of very old preparation techniques with natural cinnabar. Even today, it is still extremely difficult to determine which cinnabar (natural or man-made) was the original product. Mercury, a component of this "elixir", was found in extremely high quantities in the burial chamber of the grave site. As a result of this finding, traditions and rites from the so called "Seas and Oceans" of the Antique World, which describe the mortuary world of the Emperor in the tumulus, become credible. If the tumulus of the grave should ever be opened, it is very difficult to imagine how one would be able to preserve the volatile substance, mercury.

Considering the sound knowledge of the participating conservators regarding painting techniques, this project would still have been inconceivable without the crucial and decisive information from the participating scientists. I do not know of any other exemplary restoration, where the cooperation between chemists, mineralogists and physicists together with conservators and archaeologists has been so extensive. In addition, I

know of no other project where all of the different disciplines involved were so interdependent. For most experts, the cooperation of those dealing with the material Chi-lacquer was a new experience that had to be learned. This included not only the restoration studios and institutes in Germany but also the cooperation on an international level.

Last, but not least, the experience and knowledge gained from this joint venture shows that "archaeology", as a field in conservation, should be perceived in a new light. Furthermore, the status of natural science in conservation should be re-evaluated. It should be taken even more seriously than to date, because we can only adequately treat and protect monuments with the aid of natural science methods. With the conservation work on the terracotta army the sciences successfully interacted as equal partners. I know of only few projects which have taken place in the restoration studios of the Bavarian State Conservation Office that have been based on such intensive cooperation. Our work with Japanese colleagues on the research project on Baroque and Rococo lacquer techniques should be mentioned here in addition to certain aspects of the conservation of bronze objects.

Cinnabar and lacquers are materials that the conservator is relatively familiar with even though in Europe the raw materials come from different sources. The common link for this congress lies in Arabian traditions, where the origin of modern western chemistry has its roots. Indeed, it is most likely that the origin of Arabian traditions can be traced back to the first contact Arabian scholars had with Chinese traditions. Such cross-references concerning the exchange of knowledge and culture make Chinese Antiquity, as a topic, particularly interesting. It even gives a non-sinologist a notion of the complex structure of ideas in ancient China. The notion of "colour", pigments, dyestuffs and their production process as conduits for the exchange of knowledge in Antiquity is not new. Recent research emphasising and expanding upon this topic will be presented at a later time by Mr. Berke. Similar conclusions can be drawn in even greater dimensions concerning dyestuffs which were necessary to colour textiles. The parallelism of these developments and the application of these dyestuffs is quite amazing. They suggest that the ancient trading routes transported far more than just pure goods and merchandise.

"Colour" and "polychromy", used as keys for a deeper understanding and interpretation of antique civilisations, have not been important topics. This congress offers the chance to better understand "colour" and its symbolic function.

Ovid describes amber as "Tears of the Gods" in his collection of myths called "Metamorphosis". In one of the myths, the daughter of the Sun-God mourns the loss of her brother Phaidon by shedding "amber tears". To process raw amber for lacquer, it first has to be melted in heated oil in order to apply it. This was discovered around 1000 AD in the western world. The use of Chi-lacquer as a protective coating on metal to hamper corrosion has been a tradition in China for the last 4000 years. Shortly after the birth of Christ, monumental statues were made consisting of countless layers of lacquer on a support containing hemp. The clay core used in manufacturing was removed after the lacquer had dried and hardened. Considering all that we know about this topic, the use of lacquer as a ground for clay sculptures with a polychromy is very unusual and probably unique to the terracotta army. The lacquer, as material, first became an uncommon and unusual conservation problem due to a combination of a pigmented layer (polychromy) bound by an aqueous binding medium. This binding medium, used together

with the pigments has not yet been successfully identified. There is a good chance that the material has totally disintegrated.

In the first few years of our research project, we thought that this unusual combination of materials was an error in the painting technique. Spending years on this problem and realising that

we have very incomplete knowledge of ancient Chinese technology has taught us that we need to be much more careful when forming our conclusions. We need to look for mistakes in our lack of understanding instead of looking for errors in the ancient painting techniques.

(translated by Mark Richter)

艾默林

中德保护兵马俑项目的经验和成果

“古人如何表现死”，系德国作家戈特霍尔德·埃弗拉伊姆·莱辛于1769年发表的一篇著名文章的标题。莱辛在文中详细地描述了，“古人”，即古希腊和古罗马人并不是把死表现为令人毛骨悚然的骷髅，而是把它塑造成带翅膀的守护神。拿一具赤裸裸的骨架作为死的化身，乃是与古代晚期和中世纪受基督教影响的观念一脉相承的。至于中国的“古人”如何反映死，西方对此所知甚微。

兵马俑的规模虽然庞大，但它们“只”是陪葬品，呈现赫赫“礼仪”，这一点，西方人常常没有真正地意识到。中国皇帝陵墓中如何以及是否塑造和表现了死，人们还不清楚。我们所知的只是墓葬形式和葬礼。

修复古代雕塑的表面彩绘，是一个有待深入的领域。对大多数古希腊、古罗马包括近东的古代雕塑的彩绘，均匮乏研究，主要原因在于保存下来的彩绘表面极其罕见，这些彩绘常常是有意去掉的，以求显现雕塑的“真胎”和“纯形”。无数的兵马俑残片上残留着原始彩绘，艺术质量突出。能保护和妥善保存秦始皇兵马俑的彩绘，把它作为发掘的纲领性目标来实现，这在考古史上尚数首次。中国考古界因此获得了机遇也是任务，避免重犯欧洲地中海沿岸国家在发掘古代高度文明时所经历的过失和疏忽，从而为抢救出土文物作出榜样。

即使今日，“色彩”依旧是古代雕塑的一个“空白点”，对于颜料和粘合剂的组成成份，我们的认识十分有限。兵马俑身上涂有化学结构相当复杂的漆，由于地下埋置条件不利，2000年后去查明这种材料谈何容易。在中国，漆的使用具有悠久的传统，种植漆树和割取树脂远古便有流传。据记载，秦二世曾欲漆其城。类似丝绸的织造和加工，生漆的获取和加工亦属中国最古老的工艺之一，自古希腊和古罗马以来，一直使欧洲人心醉，这里我们只需回想一下16至18世纪欧洲掀起的中国热。

如果说分析和确定兵马俑彩绘的颜料不太复杂的话，一种迄今(几乎)未知的颜料，即所谓的汉紫也成功地得到了证实，那么处理漆底色层却充满艰辛。

朱砂是陶俑肉色的主要成份，众所周知，这种矿物在中国的不少矿床都有开采，自古以来一直作为颜料使用。同

时，朱砂亦是中國煉丹方士所鍾情的材料，而且可能是人類製造的最早的化學產品。讓人研究“攝生”仙丹的，秦始皇並不是第一個，但他對此卻格外傾心。作為原始化學的產品，朱砂在古代中國便已流行，經過數百年對自然材料的處理，獲得的質量是歐洲無法想象的，即使今日，只有克服許多困難，才能確定無論是自然的還是人工的原產品。

在兵马俑的保护上，化学家、矿物学家、物理学家同修复师以及考古学家进行了出色的合作，这对考古发掘来说很不寻常。进行这种合作，按最佳准则解决考古修复的问题，既是挑战，也是喜悦。对所有参与者来说，保护兵马俑及其彩绘，无论过去还是现在，甚至在未来的几十年里，都是一种挑战。

令人兴奋的是，正象贝尔克教授在报告中所证实的那样，在近东、埃及和中国文化中，颜料生产方面的情况存在某些令人感兴趣的类似。利用色彩尤其是彩绘作为加深理解古代高度文明的钥匙，为了作新观察对它们进行阐释，乃是一个尚未深化的课题。也许在获得这些经验后，未来能在这些方面予以更多的关注。

公元初年之际，奥维德在他的古老神话集《变形记》中将琥珀视之为“神的眼泪”，即太阳神的女儿们为悲恸她们的兄弟法厄同所抛洒的眼泪。将琥珀作为漆原料来加工，在烧热的油中使它融化，从而能够使用，是西方公元1000年左右的发明。将漆材料涂在金属上防锈，在中国已有4500年的悠久历史。至少从东汉初年始，中国已用麻布与漆层层相叠，制成高大的夹纻漆像。制作时需要泥模，俟漆层干后脱模。据我们迄今所知，用漆作为彩绘陶俑打底的材料，实属异常。漆这种材料只是在与涂绘的带水粘合剂的颜料结合时，才成为保护的难题。迄今未能找到彩绘颜料的粘合剂，也许该材料已彻底分解了。

在我们研究的头几年，我们趋向把这种异常的材料结合看作涂绘工艺上的失误。经过多年对这个问题的探索，很遗憾，我们对中国古代工艺依旧认识不全，但是我们今天判断更谨慎了，这一失误，与其说是在古代的绘画工艺中，倒不如说是应在我们残缺的认识中去寻找。