

Chinese lacquer: Much more than Chinese lacquer

中國漆器：遠遠不只是中國漆

Michael R. Schilling¹, Herant Khanjian¹, Julie Chang 張倚竹¹,
Arlen Heginbotham², Nanke Schellmann³

¹Getty Conservation Institute, Los Angeles, CA, USA, ²J. Paul Getty Museum, Los Angeles, CA, USA, ³Academy of Fine Arts, Vienna, Austria

¹美國加州洛杉磯蓋蒂保護研究所

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A significant portion of Asian lacquer collections in today's western museums was originally made in China specifically for export to European markets. The J. Paul Getty Museum's collection includes pieces of French furniture dating to the mid-eighteenth century that incorporate panels of Chinese export lacquer as part of their surface decoration, an early eighteenth-century inkstand thought to be of Ryukyuan origin (76.DI.12), an eighteenth-century *secrétaire* (65.DA.3), and an eighteenth-century black lacquered cupboard (78.DA.119).

In a systematic technical study of these lacquered objects, analysis of the organic constituents in individual lacquer layers was carried out using pyrolysis – gas chromatography – mass spectrometry with tetramethylammonium hydroxide derivatization (THM–Py–GC–MS) [1–3]. Additionally, the presence of protein, oil, and starch within the layer structure of lacquer cross sections was visualized with both visible and blue light illumination after treatment with selected stains used in histochemical protocols [4]. As the research progressed, objects from other museum collections were studied for comparative purposes in order to gain a broader understanding of temporal and geographic trends in Chinese lacquer formulation.

It had been assumed that all Chinese *qi* lacquerware was made from urushiol, which is the exudate of *Toxicodendron verniciflua* trees that grow throughout specific regions of China, Japan and Korea. However, this study revealed that Chinese export lacquered objects were formulated with laccol, which is the exudate from *Toxicodendron succedaneum*.

現今西方博物館收藏的亞洲漆器，有大部份是中國專為外銷歐洲市場而生產的。蓋蒂博物館的藏品有一些十八世紀中葉的法國傢具使用了中國出口的漆飾板為表面裝飾的一部份，包括一件相信來自琉球的十八世紀早期的墨水瓶架 (76.DI.12)、一張十八世紀書桌 (65.DA.3) 和一個十八世紀的黑漆櫥櫃 (78.DA.119)。

我們對這些漆器進行了有系統的技術研究，以四甲基氫氧化銨衍生熱裂解氣相色譜質譜 (THM–Py–GC–MS) 分析各漆層的有機成分 [1–3]。此外，在可見光和藍光下，利用組織化學染色法觀察漆層的橫切面，發現含有蛋白質、油和澱粉質 [4]。在研究期間，我們也檢測了其他博物館的藏品以作比較，期望進一步了解中國漆料在不同時期和地區的成分。

中國漆器一般相信是用漆酚製造，即是在中國、日本和韓國特定地區生長的漆樹 (*Toxicodendron verniciflua*) 所分泌出的樹液。然而，這次的研究顯示中國出口的漆器含葛漆酚，是野漆樹

(*Toxicodendron succedaneum*) 所分泌出的樹液。由於較早前在一批十八和十九世紀的廣東漆器中也發現含有葛漆酚 [5]，我們推斷中國出口的漆器極可能普遍使用葛漆酚。儘管越南和台灣漆器都與野漆樹有密切關係 [6]，許多中國出口漆器都是在中國南方生產，接近盛產這種野漆樹的地區。近期的分類學研究發現在廣西省也有野漆樹 [7]，顯示所謂越南漆器的範疇可能延伸至比以往所知更遠的華南地區。

有系統地調查有關漆成分的中文文獻後，我們清楚知道中國工匠悠久以來都在漆料中加入多種有機

Correspondence to: Michael Schilling, Getty Conservation Institute, Los Angeles, CA 90049, USA. Email: mschilling@getty.edu

聯繫人：Michael Schilling, Getty Conservation Institute, Los Angeles, CA 90049, USA 電郵：mschilling@getty.edu

Considering that laccol was also identified in a group of eighteenth- and nineteenth-century Cantonese objects [5], laccol usage may have been quite common in Chinese export lacquerware. Although *T. succedaneum* is closely associated with Vietnamese and Taiwanese lacquers [6], much Chinese export lacquer was produced in the south of China, near regions where this tree is widespread. Recent taxonomic research suggests that the range of so-called Vietnamese lacquer may extend further into southern China than was previously known, with laccol trees identified in Guangxi Province [7].

Systematic review of the Chinese literature on the topic of lacquer formulations makes it clear that a wide range of organic materials that can be added to *qi* lacquer has long been available to Chinese artists [8]. In this study, significant amounts of cold-pressed and heat-bodied tung oil, linseed oil, and perilla oil (with the latter two often identified in glossy finish layers) were identified in the export lacquers. Cedar oil and minor amounts of camphor were also detected, which was unusual considering that extensive review of the Chinese literature on lacquer formulations failed to uncover specific mention of cedar oil and camphor. However, some tree resins may share the same Chinese characters, making it difficult to find specific references to a single resin.

One unusual finding was the detection of significant levels of carbohydrates which correspond to laccol-containing layers. Although catechol-rich saps exuded by lacquer-producing trees contain small amounts of naturally occurring glycoproteins and carbohydrates [9], these components have never been reported in Py-GC-MS studies of underivatized *urushi* and laccol lacquers [10]. In THM-Py-GC-MS of *urushi*, methylated carbohydrate monomers and dimers are barely detectable even with the aid of selected ion chromatograms such as SIC 88. In contrast, every laccol-containing sample showed two prominent series of GC peaks easily located with SIC 129, and their mass spectra corresponded most closely to various methylated derivatives of uronic acids. In peak area reports for the eighteenth-century Ryukyuan inkstand, the laccol carbohydrates comprised more than 10% of the total detectable species. These pyrolysis compounds are highly unlikely to have originated from a lacquer additive, as they were also detected in fresh sap from a *T. succedaneum* tree tapped by the authors.

As a consequence, there may be significant conservation implications on the aging behavior of laccol-containing objects. For instance, scanning electron microscope imaging of dried *urushi* films reveals tiny pockets of carbohydrate-rich material that become holes after photo-oxidation reactions, eventually leading to microcrack formation between the holes

物料 [8]。這次研究發現在外銷漆器中含有不少冷壓和熱稠化的桐油、亞麻油、紫蘇油（後兩者多數出現在光漆表層中）；當中亦發現柏木油和少量樟腦，這些成分並不尋常，而我們在翻查中文文獻期間亦沒有發現相關記載。然而，有些樹脂可能使用相同的中文名稱，因此難以尋找單一樹脂的具體參考資料。

另一項不尋常的發現是在含葛漆酚層中找到大量碳水化合物。雖然漆樹分泌的樹液含豐富的兒茶酚，亦含有少量天然的糖蛋白和碳水化合物 [9]，但以熱解氣相色譜－質譜為未經衍生化的漆酚和葛漆酚漆料進行分析，卻未有發現這些成分 [10]。即使在 THM-Py-GC-MS 分析漆酚的研究中利用了選擇性離子色譜如 SIC88，也難以偵測出甲基化碳水化合物的單體和二聚物。反之，使用 SIC129 便很容易辨認出在每個含葛漆酚樣本出現的兩個明顯的氣相色譜波峰列，而它們的質譜與各種糖醛酸的甲基化衍生物最為相符。在十八世紀琉球墨水瓶架的氣相色譜研究中，葛漆酚碳水化合物佔可偵測的總峰面積超過 10%。這些熱裂解複合物不大可能來自漆料的添加劑，因為我們在野漆樹抽取的新鮮樹液中也檢測到它們。

因此，對於含有葛漆酚的器物，這些碳水化合物可能會令其老化情況對修護工作造成極大影響。例如，在掃描電子顯微鏡的觀察下，漆酚乾膜中含高碳水化合物的小囊經光氧化反應後變成小洞，最後在小洞之間形成微細裂縫 [11]。由於葛漆酚的碳水化合物含量高於漆酚，我們可以預期葛漆酚表面的氧化損害和開裂會更為嚴重。

雖然大部份中國的內銷漆器都一如預期含有漆酚，但是在英國國立維多利亞與艾爾伯特博物館卻收藏一個罕見例子——一件有五爪金龍圖案、附嘉靖皇帝章款的十六世紀中葉彩繪漆碟（FE.87-1974），基底層混有柏木油和樟腦的葛漆酚，而在上面數層紅漆則發現葛漆酚與混有樟腦的漆酚。這或可在明朝文獻中得到答案，文獻記錄當時有大量來自現今越南北部的葛漆酚進貢到中國朝廷 [12]，意味着中國工匠即使在中國北方也可以選用葛漆酚，推翻了我們對漆的使用和供應的傳統觀念。

以上研究得出的結論顯示，中國漆器的成分遠比所知的為複雜和多變。這對於進一步制定修護方法有着重要的意義，亦為中國漆器的斷代、特性分辨和真偽鑑定等研究提供了新的機遇。更深入和全面的研究無疑會增進我們對這些獨一無二的文物的理解。

[11]. Considering that the carbohydrate content of laccol exceeds the levels in *urushi*, one might expect that oxidative and cracking damage to laccol surfaces would be even more pronounced.

While most Chinese lacquers made for the domestic market were found to contain urushiol as expected, one unusual example was a mid-sixteenth century filled-in polychrome lacquer dish from the Victoria and Albert Museum that depicts a five-clawed dragon design, bearing the mark of Emperor Jiajing (FE.87-1974). The ground contained cedar oil and camphor mixed with laccol, whereas a mix of laccol and urushiol with camphor was identified in the upper red layers. This may be explained by parallel archival research into contemporary Ming dynasty records which state that large quantities of laccol from a region that is within present-day northern Vietnam were offered to the Chinese Imperial court as tributary gifts [12]. This implies that laccol was available to Chinese craftsmen working even in the north of China, confounding the conventional wisdom regarding lacquer use and availability.

In conclusion, this study demonstrates that Chinese lacquer ware is compositionally much more complex and varied than previously understood. This may have significant implications for the further development of conservation treatment methods and may also offer new possibilities for dating, attributing and authenticating Chinese lacquer. Further studies will doubtless expand our understanding of these unique and distinctive objects.

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