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## Codicology and conservation issues of the Asian palm-leaf manuscripts of the Collège de France, Paris

Caroline Riberaigua, Marie Messenger

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Care and conservation of manuscripts 17



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Proceedings  
of the seventeenth international seminar held at  
the University of Copenhagen 11th–13th April 2018

Edited by  
M.J. Driscoll

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## Care and conservation of manuscripts 17

Edited by M.J. Driscoll

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The vignette on the cover is taken from the allegorical representation of Professor Arnas Magnæus/Árni Magnússon's scholarly activities which adorned the oldest series of publications of the Arnamagnæan Commission 1773–1809.

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# Codicology and conservation issues of the Asian palm-leaf manuscripts of the Collège de France, Paris

by Caroline Riberaigua &  
Marie Messenger

Collège de France: Institut d'études  
indiennes

In addition to the most recent indological documentary resources, the library of Indian studies of the Collège de France<sup>1</sup> holds a heritage collection of primary sources, comprising manuscripts, scientific archives as well as inscription rubbings and works of art.

Within this collection, the most interesting corpus from a codicological point of view consists of 81 palm-leaf manuscripts. We will begin with a presentation of this corpus, followed by an examination of the codicological characteristics and variations of the palm-leaf manuscripts, the history of this writing material, its specific conservation issues, the traditional methods of conservation, the preservation programme engaged in at the Collège de France and lastly an illustrative case study of the restoration of the eleventh-century Sanskrit manuscript MS.SL.68, *The perfection of wisdom in eight-thousand lines*.

## The palm-leaf manuscripts of the Collège de France

This corpus comprises 81 items from various palm-leaf manuscript traditions, dating from the eleventh century to the twentieth, and originating in various production centres ranging from Nepal to Indonesia. It represents at least seven languages and twelve alphabets and covers a great variety of literary genres.

The collection can be divided into five groups according to the origin and content of the manuscripts.

The eight oldest manuscripts, dated between the eleventh and fourteenth centuries, are in Sanskrit and written in various scripts affiliated with the north Indian *nāgarī* alphabet. They were collected in Nepal between 1897 and 1922 by Sylvain Lévi (1863–1935), professor of Sanskrit at the Collège de France. This group consists of Buddhist and Hindu treatises, literary and scientific works, including the *codices unici* of several Sanskrit Buddhist texts previously known only through their Tibetan or Chinese translations. Professor Lévi also brought back from Nepal a manuscript which is precious as a work of art: MS.SL.68, The *Aṣṭasāhasrikā Prajñāpāramitā* (*The perfection of wisdom in eight-thousand lines*). The wooden boards which hold together the palm leaves of this thousand year old and almost complete manuscript carry exceptional paintings of the Pāla dynasty (eighth to twelfth century) of northern India. Indeed, another interesting characteristic of this group of manuscripts is that its oldest manuscripts (dated between the eleventh and twelfth centuries), though collected in Nepal, have been copied in the great Buddhist scriptoria of northern India, and were certainly imported into Nepal at the very end of the twelfth century by monks fleeing the raids by the Muslim Ghorids in the region.

The second group comprises ten more recent manuscripts from southern India dated between the nineteenth and twentieth centuries and which were given to the Collège de France by various donors. Their language is Sanskrit, written in the southern Indian Grantha script, or south Indian languages such as Tamil and Kannada. They mainly contain fragments of literary texts or devotional hymns to Hindu gods.

The third group consists of 26 manuscripts of Buddhist texts in Pāli, collected mainly in continental Southeast Asia<sup>2</sup> by Louis Finot, (1865–1934), founder and first director of the École française d'Extrême-Orient. These manuscripts are dated from the seventeenth to the twentieth century and are written in scripts specific to Southeast Asia, such as the *Mūl* script. Pāli is a Middle-Indian idiom transmitted as the sacred language of the Buddhist *Theravāda* Canon. An interesting feature of this group is that most of its manuscripts do not contain ancient canonical scriptures but original works composed in the monasteries of the Lanna Kingdom (northern Thailand) around the sixteenth century.

A fourth group of 33 manuscripts from Southeast Asia, dated between the nineteenth and twentieth centuries, consists of works in various South-east Asian languages (Thai, Burmese, Khmer and Lao). They contain

adaptations of Indian works as well as Buddhist treatises of moral conduct (*cpāp*).

There is, finally, a group of four manuscripts in Javanese. They are datable to the nineteenth and twentieth centuries and came from Indonesia.

## Common codicological features

What are the characteristic codicological features of palm-leaf manuscripts? The text is written lengthwise on both sides of a palm leaf, which has been previously cut to the proper dimension and treated to be written upon or engraved. There are margins which contain the folio number (usually on the verso)<sup>3</sup> and occasionally notes or commentaries. The leaves of the manuscript are bound by textile strings which are made to pass through one or several holes punched in the middle of the (vertical) height of the leaf.

A complete manuscript is protected by two wooden boards.<sup>4</sup>

## History of palm-leaf writing materials

Palm-leaf manuscripts are the typical medium for the transmission of literature in south Asia, even though other materials have been used in this region. Therefore, when a book is pictured in ancient iconography, it is represented as an oblong palm-leaf manuscript.<sup>5</sup>

Its use was maintained in several parts of India even after the introduction of paper. The historical situation varied depending on the areas: though paper was widespread in north-western India, especially in Gujarat, since the fourteenth century and later on in the Mughal Empire, palm leaves remained in southern and eastern India the main medium for sacred scriptures as well as for epistolary communication until the nineteenth century.<sup>6</sup>

The beginning of the use of palm leaves as writing materials is difficult to trace, however: their ephemerality under tropical climate conditions required constant rewriting of the texts on fresh leaves. Indeed, the lifespan of palm-leaf manuscripts in the subcontinent rarely exceeded five centuries. Eleventh- and twelfth-century manuscripts like those collected by Lévi are therefore quite precious. Their comparatively long-lasting

existence may be explained by their early importation into Nepal, where the climate is more conducive to their preservation.

Certain pieces of evidence attest that the palm-leaf medium was used as far back as the beginning of the first millennium AD. One such piece is the iconographic evidence of palm-leaf manuscripts as attributes of divinities such as the Sarasvatī sculpture from Kaṅkalī Tīla (Mathura), which is preserved in the State Museum of Lucknow<sup>7</sup> and dated (with the help of an inscription) to the year 54 of the Śaka era,<sup>8</sup> i.e. between the second and the third century AD.<sup>9</sup> Yet more convincing is the discovery of fragments of Sanskrit palm-leaf manuscripts by Paul Pelliot in the Taklamakan desert (Xinjiang, China), also datable to the second or third century AD,<sup>10</sup> and fragments of palm-leaf Buddhist Sanskrit manuscripts in the Schøyen collection, dating from the same period and collected in the Bamiyan district of Afghanistan.<sup>11</sup> Again, the specific climate of these areas may explain the durability of these early fragments. Their presence in Central Asia also underlines the early dissemination abroad of Indian literature, particularly Buddhist texts, through palm-leaf manuscripts.

Two main routes of circulation of palm-leaf manuscripts may be distinguished. One is the so-called Asian 'Silk road'. It concerns mainly the transmission of the texts of *Mahāyāna* (Great vehicle) and Tantric Buddhism, written mostly in hybrid Sanskrit, from northern India to eastern Asia through the Himalayas and Central Asia. The manuscripts were kept in the libraries of monasteries, where their texts were studied and translated in the various regional languages (Tibetan, Mongolian, Uyghur, Chinese and so on). With the exception of Nepal, however, local manuscript production soon changed from palm leaf to paper (or in some cases silk), the Chinese material which had been well developed since the Han dynasty (206 BC–220 AD),<sup>12</sup> i.e. at the beginning of the diffusion of Buddhism in this area.

The second route leads from eastern and southern India to Southeast Asia. The situation has been somewhat different in this context. The corpus transmitted was larger, and included texts from various Buddhist and Hindu currents. The texts, in Pāli and Sanskrit, were often studied and copied in their original language in parallel with their translations into the various vernacular languages. More importantly, both Indic and vernacular literature retained the palm leaf as a medium for writing, a tradition still active today in the Buddhist monastic milieu of continental Southeast Asia.

## Regional variations

Various palm-leaf manuscript production centres emerged from Nepal to Indonesia. Although the main use and characteristics of palm leaves are similar from one area to another and in the course of history, variations may be observed. One is the variety of palm trees from which the leaves are collected. Three main species can be identified. The more ancient complete manuscripts which have been preserved use the talipot leaves (*Corypha umbraculifera*).<sup>13</sup> The talipot tree grows in south Asia and Burma. It has been used in north Indian, Nepalese and Sri Lankan manuscript traditions and, at an early period, in south Indian centres before being replaced by the Palmyra palm tree. Talipot leaves are long and wide (up to 9 cm wide and 90 cm long). They are of great quality, which may explain their better preservation,<sup>14</sup> and have a good capacity for ink absorption.

The other prevalent variety is the palm of the Palmyra tree (*Borassus flabellifer*, also called toddy palm, sugar palm or *lontar*), which grows in south India and in most parts of Southeast Asia. It has been used at a later period for south Indian manuscripts and was also the most commonly used for palm-leaf manuscripts in Southeast Asia. The leaves of the Palmyra palm are more fragile and less smooth than those of the talipot, and they have a lower capacity for ink absorption. They are also narrower with a width of only three to four cm and a length of 50 to 60 cm.

A particularity of Cambodia is its predominant use of the *Corypha lecomtei* variety.<sup>15</sup>

Whichever variety of palm leaves is employed, they cannot be used in their raw state and have to be processed. The usual procedure is as follows: the leaves are collected, their ribs are removed; the leaves are gathered in bundles and cut to the proper dimension. They are dried, soaked or boiled in water, dried again, pressed and, finally, polished.

On the basis of this general procedure, many different practices can be observed, even in the use of the same species. The stage of maturity of the leaves collected may differ, sometimes more or less young and green.

The leaves can be dried in the sun or in the shade (southern India), or even hung in a kitchen to be exposed to the smoke of ovens.<sup>16</sup>

Recipes for soaking and boiling again often vary. In some instances, the leaves are boiled in clear water only, while in other instances various ingredients may be added to the mix, such as milk and turmeric in south



Fig. 291. Paris, Bibliothèque d'études indiennes du Collège de France (CDF), Rim.94, western Bengal (India), nineteenth century AD: Folio n° 3 (verso) and 4 (recto). Photo: Léonore de Magnée (L. M.).



India,<sup>17</sup> cow dung,<sup>18</sup> different mixtures of herbs in Indonesia,<sup>19</sup> pineapple leaves along with *Beli* fruits (*Aegle marmelos*) and paddy in Sri Lanka.<sup>20</sup>

Practices for the second phase of drying also vary. They sometimes include an intermediary process like a three month period of burying in wet sand<sup>21</sup> or in mud.<sup>22</sup>

The final phase, polishing, sometimes takes place after a period of ten to fifteen days, during which leaves are kept pressed.<sup>23</sup> The tool employed varies – a smooth stone, a conch shell<sup>24</sup> or a round smooth stick of wood<sup>25</sup> – and an oil such as gingelly oil is sometimes added during the process.<sup>26</sup>

The variety and size of the leaf determine the way the manuscript is bound. The holes and strings are never on the edge, as this would damage the leaf. They are always punched in the middle in the width where perforations involve the least possible damage in the leaf. In most instances, a single hole for the string is punched in the middle of the leaf (see Figs. 291 & 292).

In the case of longer manuscripts, however, a single central link could create issues if the leaves lacked the appropriate support, thus rotating around this axis, causing damage. Various solutions were adopted to cope with this problem according to the variety of palm leaf used and to the region concerned. In the north Indian and Nepalese manuscript

Fig. 292. CDF, MS.SL.27, Vidagdhavismāpana, Nepal, ca. fifteenth century AD. Closed manuscript protected by wooden boards. Photo: Caroline Riberaigua.



traditions, for large manuscripts using talipot leaves such as MS.SL.68 (55 cm long × 6.7 cm wide), the stability of the manuscript was ensured by two holes and binds placed in the middle of the width and at a third of the length (see Fig. 293).

The issue is more complex when it comes to large manuscripts using Palmyra palm leaves. Indeed, since these leaves are narrow, a great number of them are required for long texts. Hence the manuscripts are long, narrow and very thick. One may observe two kinds of solutions to stabilise the leaves in the bundle: In south India, two holes are pierced, each at the third of the length, as in north Indian talipot-leaf manuscripts, but a rigid bamboo stick is passed through one of these holes instead of a simple string (see Fig. 294).

In Indonesia, only strings hold the manuscript, but there are three of them: one passing through the centre of the leaves, and one on each end (see Fig. 295).

The variety of the palm used also influences the scribal practice, for each variety has a specific capacity of absorbing ink. In the Nepalese and the north Indian tradition, where talipot leaves are employed, the scribe uses a pen, writing with black ink made primarily of lamp black or charcoal powder, with binders such as gingelly oil<sup>27</sup> and pipal tree resin (*Ficus religiosa*).<sup>28</sup> Red pigments (vermillion and gum<sup>29</sup>) were prepared to underline the separation between chapters, to add corrections or write special passages (see Fig. 291).

Fig. 293. Paris, CDF, MS.SL.68, the Aṣṭasāhasrikā Prajñāpāramitā, northern India, eleventh century AD. F. 109. Photo: Marie Messager (M.M.).



Fig. 294. Paris, CDF, Rim.140, Kiṣṇaṅ tutu, southern India, nineteenth century. Photo: L.M.

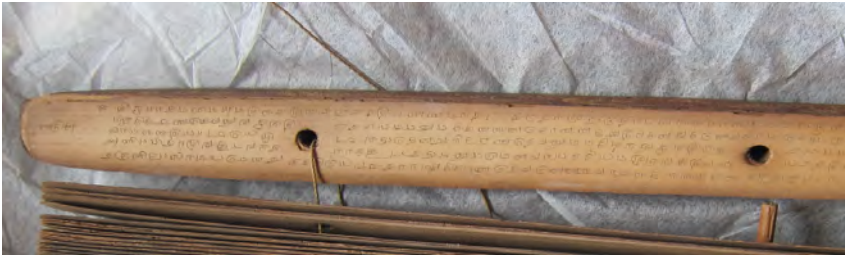


Fig. 295. Paris, CDF, Rim.138, Indonesia, ca. nineteenth or twentieth century. Photo: L.M.



In south India and Southeast Asia, where the Palmyra palm is more widespread, the text is engraved with a sharp stylus made from wood or metal. To be legible, the text must be blackened. The leaf is therefore covered with charcoal powder and then rubbed in such a way that only the engraved text remains darker.<sup>30</sup> Another method consists in applying an ink made from charcoal powder mixed with oil,<sup>31</sup> and then to rub the leaf (see Fig. 296).

Fig. 296. *Paris, CDF, Rim.140, Kiṣṇaṅgutu, southern India, nineteenth century. Photo: L.M.*



Some very rare manuscripts, copied for a prestigious patron, have very colourfully illuminated leaves, but, most of the time, the same pigments are used for the illustrations of palm-leaf manuscripts as for their writing: black and red inks. Such is the case for the few illustrated palm leaves of the manuscripts of the Collège de France, as for instance the depiction, in red and black, of the architecture of a *stūpa* on MS.SL.27 (*Vidagdhaṅvismāpāna*) (see Fig. 297).

But some traditions used other pigments. Thus, in the Buddhist monasteries of continental Southeast Asia, especially in Thailand, the edges of the manuscripts are more often than not lacquered and gilded, which, aside from an aesthetic function, protects the edges from damage (see Fig. 298).<sup>32</sup>

The Collège de France holds exceptional painted wooden covers, with images depicting Buddhist deities and Buddha's previous births (manuscript MS.SL.68; see Figs. 299 & 300), or the picture of the lion-headed god Narasiṅha in the Hindu manuscript MS.SL.57 (*Śivadharmā*) (see Fig. 301).

Fig. 297. *Detail of Paris, CDE, MS.SL.27 Vidagdhavismāpana: depiction of a Buddhist monument (stūpa). Photo: L.M.*





Fig. 298. Paris, CDF, MS.PALI.4 Vinayasamoha, Thailand, 1780. Photo: L. M.



Fig. 299. Paris, CDF, MS.SL.68 Aṣṭasāhasrikā Prajñāpāramitā, northern India, eleventh century: scenes of the Jātaka (previous 'births' of the historical Buddha).



Fig. 300. Paris, CDF, MS.SL.68, depiction of the five transcendental Buddhas and of the female personifications of the Perfections of wisdom.



Fig. 301. Paris, CDF, MS.SL.57, Śivadharmā. Painting of the board: Narasiṃha (lion-headed avatāra of the Hindu god Vishnu) with attendants.



## Conservation issues and traditional methods of preservation

Palm leaves are a fragile medium. Even treated, the leaf keeps the vascular system of the plant, which does not have exactly the same plasticity as the other parts and may cause inner tensions. The leaf is therefore very sensitive to hygrometric variations, especially dryness. The lignin present in the leaves is also susceptible to oxidation and hydrolysis, which produces acidic derivatives which can affect the fibre.<sup>33</sup> This fragility is often exacerbated by former deteriorations by insects. Various methods have been developed in temples, monasteries and domestic libraries in Asia to deal with these issues.

The traditional packaging of the manuscripts is, to some extent, designed to protect them from pests and climatic variations. Throughout Asia, manuscripts are wrapped in textile, sometimes anointed with lemon-grass oil to repel insects, and then stored in wooden boxes or chests. The manuscripts are periodically oiled with lemon-grass, camphor or walnut oil to prevent the desiccation of the leaves.<sup>34</sup>

This oiling may sometimes cause further problems. Oils evolve differently in medium and long term depending on their nature. Some of them (like lemon-grass oil, often chosen for its insecticide properties), turn out to be harmful to the manuscript: the oil forms a thick layer on the surface of the leaf which may become hard and increase in weight.<sup>35</sup> The solidification temperature of the oil should also be considered, as some materials used in tropical climates may not be suitable in temperate regions. The improper use of oil may also increase the aggregation of dust on the leaves. The traditional method of oiling the manuscripts should therefore not be considered an innocuous procedure that could be applied as such in western libraries. The chemical properties of each product must be precisely analysed and mastered.

Dehydration of the manuscripts remains a serious problem. A part of the collection of the Collège de France suffered from dryness in the library building. Regulation of the conditions in order to maintain a constant temperature of around 19/20 °C with a relative humidity of 50 % is therefore crucial.

Boxes and chests where the manuscripts are kept in Asia often induce mechanical alterations. Indeed, traditionally, manuscripts of different sizes are stored in the same box and stacked.

As for the textiles in which manuscripts were originally wrapped, the nature and pH of the fibre and of the products added, such as oils and the textile dyes, must be considered. In cases where they must be preserved as a testimony of the original packaging, they should rather be stored separately.

The Collège de France decided to store the manuscripts in new individual custom-made acid-free packaging (this repackaging is still in progress). The packaging of the most damaged documents, those which required restoration, was designed by the conservators.

The promotion and preservation of the palm-leaf manuscripts of the Collège de France was one of the projects of the new team of librarians that arrived in 2012, despite of the difficulties caused by two consecutive relocations of the entire library (in 2016 and 2020), to allow for the renovation of the building housing the libraries.

The collection of palm-leaf manuscripts was not really known to the community of scholars despite its indological value. In most cases, any handling for study or digitisation requires prior restoration. Because the conservation of these palm-leaf manuscripts requires skills at the crossroads of conservation in books, raw organic material and painting (for the boards), the library contacted several interdisciplinary teams of conservators, for the restoration of different manuscripts, in a collaborative work a phase of tests to define the best methodology for this unusual – in a western library context – medium.

The methodology was mainly developed on the preliminary study and restoration work of one of the jewels of the collection, MS.SL.68. This manuscript involved the greatest number of preservation issues. It was assigned to the workshop of Marie Messenger<sup>36</sup> in 2013, in partnership with Emilie Masse,<sup>37</sup> with particular specifications requested by the librarians for the packaging. Since the painted boards could be requested for exhibitions, the packaging had to allow for the handling and exhibition of these boards without touching the very fragile palm leaves.

### A case study: the conservation of MS.SL.68

The eleventh-century manuscript MS.SL.68 *Aṣṭasāhasrikā Prajñāpāramitā* comprises 208 palm leaves written on both recto and verso and gathered between two wooden boards painted on their inner sides. The whole



item is about 55.5 cm long × 6.7 cm wide and 7 cm thick. Two types of palm leaves can be distinguished according to their thickness, colour and shape. The text was written using carbon-based ink between rulings dividing the palm leaf width in three parts. The two perforations were originally surrounded by ornamental scrollwork. Original foliation was laid out on the verso.

The wooden boards present wonderful paintings covering the whole surface of their inner face. These two sets of nine human figures, sometimes with animals, were painted on a white ground with tempera type paint. The binder has not been identified, and there was no evidence of any surface protection, such as varnish.

The palm leaves and the two wooden boards were originally bound by two textile threads passing through the two holes, as remainders of fibres showed.

The palm leaves presented various types of damage, such as a strong soiling, dust, concretions, mud blots, glued residues that had induced chemical alterations such as coloured halos and also a general browning. They also suffered from several mechanical alterations: fraying on the gatherings and on the margins, weakened and irregular folds, breaks, tears and losses, superficial on the right side but in some cases extending the whole width of the leaves. Gluing and sticking have led to transfers of material from one leaf to the opposite. These can be classified into three degrees of severity: transfer of ink only; transfer of ink and of the superficial layer; transfer of the whole palm leaf width. In addition, excretion deposits reveal insect activity, which caused losses, as did rodent activity.

The carbon-based ink showed good cohesion with the support. The ink is slightly powdery when rubbed due to the limited penetration into the support. Smudges can be observed, as well as wears and abrasions.

The wooden boards were in quite good condition, considering their age. Both sides presented dust, concretions and aggregates concentrated in the margins of the painted side and around the two holes. The paint was not powdery and showed merely mechanical alterations such as losses that sometimes left the wood visible, sometimes just the white ground and lifting around the losses.

The causes of the alterations were, as usual, multiple. Firstly, the halos, concretions and the fact that the majority of the mechanical and chemical degradations on both palm leaves and paint were located on the same side are due to a long period of exposition to humidity, suggesting con-

tact with liquid water. That explained the adhesion between the leaves by reactivation of the coating and the poor condition of the media at this place showing more lacks or lifts.

The hydrolysis of the cellulose added to the biological agents activities and to the material nature induced the lack of mechanical resistance and the high concentration of alterations.

Poor conservation conditions in the origin, such as improper protection, high or very low hygrometry rates and high temperature were also the cause of some of the damages.

Human interference, including all the traditional maintenance treatments carried out throughout the years such as oiling or cleaning the palm leaves, is also at play. The substances left on the leaves have made them fragile and have increased the chemical degradations. Human activity is also at the origin of accidental mechanical alterations such as breaks, folds and fraying of edges during handling or storage.

The manuscript MS.SL.68 was in very poor condition. It suffered from its long history, the quality and nature of the material constituents and of its initial preservation conditions. Handling was almost impossible without endangering the palm leaves' integrity. The condition of the two wooden boards was worrying. The risk of paint layer losses was high and tended to increase over time if not fixed. In addition, the manuscript had lost part of its documentary value due to the fact that a large part of the text was no longer legible. In the light of this, treatment choices were decided in close collaboration with the librarians in charge of the collection. They were guided by keeping the most important values (historical, documentary, use), trying to understand the traditional approaches around this kind of corpus (coating treatments for example) without removing any clues that could be useful for further research.

So we decided to set up three axes or focal points: curative treatment of the palm leaves in order to restore readability and access to the text, stabilisation treatment of the wooden boards by cleaning them and of the paint layer by consolidating it and, at the end, a preventive conservation action in the form of customised packaging.

As the conservators in charge of the restoration were not familiar with *nāgarī* script and numbers (the foliation had in any case partly disappeared), and to facilitate processing by the team in charge of digitisation, the palm leaves were numbered with a graphic pencil in the order they were found. The work of rearrangement will be carried out after the treatment.

In order to identify the best treatment method, tests were undertaken. A bathophenetrolin test did not reveal the presence of free iron(II) ions in the ink. A solubility test revealed that the ink was soluble in water and in a mix of water and ethanol, but not soluble in ethanol or acetone. This observation supported the hypothesis of a vegetal binder, probably gum arabic. This test was the occasion to observe the planar distortion of the palm leaves during treatment. The bigger deformation occurred with water whereas no deformation was observed with acetone. The paint layer cleaning test determined that the best cleaning agent was saliva. No paint layer solubilisation was observed.

Palm-leaf treatments were influenced by paper treatment moderated by the specific 3D structure of the material and the test results. Dry cleaning was carried out by scratching excretions with a scalpel and brushing. The removal of the dust was undertaken using barely damped hydrophilic cotton, after which the leaves were air dried. The folds were flattened by humidification and drying under light weights, so as not to destroy the 3D structure. When needed, they were reinforced by a piece of chamois Japanese paper (100 % kozo, 3.7 g/m<sup>2</sup>, Gaby Kleindorfer<sup>38</sup>) pre-coated with Klucel G (CTS<sup>39</sup>) reactivated with water.

The palm leaves that were stuck together were separated using a dry treatment to avoid the softening and the falling down of the 3D structure of the material. Sometimes, facings were realised to prevent losses or mixings and let the palm-leaves pieces to be replaced at the right place. This part of the treatment was particularly important because it enables the text to be legible again.

Depending on the situation, the palm leaves' mechanical delaminations were stabilised with wheat starch glue (Zin Shofu, Conservation By Design<sup>40</sup>) alone or associated with local reinforcements by lining the zone with Klucel G (CTS) pre-coated chamois Japanese paper (100 % kozo, 3.7 g/m<sup>2</sup>, Gaby Kleindorfer) reactivated with water. This paper was chosen for its translucency and its coloured aspect, which remains very discrete.

Planar distortion and lacunae were not treated because they were deemed acceptable for readability and digitisation. Furthermore, the conservation project was focused on stabilisation and not on aesthetic approach.

Conservation of the painted wooden boards was undertaken by Emilie Masse, a French independent conservator specialised in sculpture. The

Fig. 302. Treatment of the transferred zones, before and after. Photo: M.M.



Before treatment



After treatment

Fig. 303. Treatment of the delaminations, before and after. Photo: M.M.



Fig. 304. *Treatment of the painted wooden boards, details before and after.*



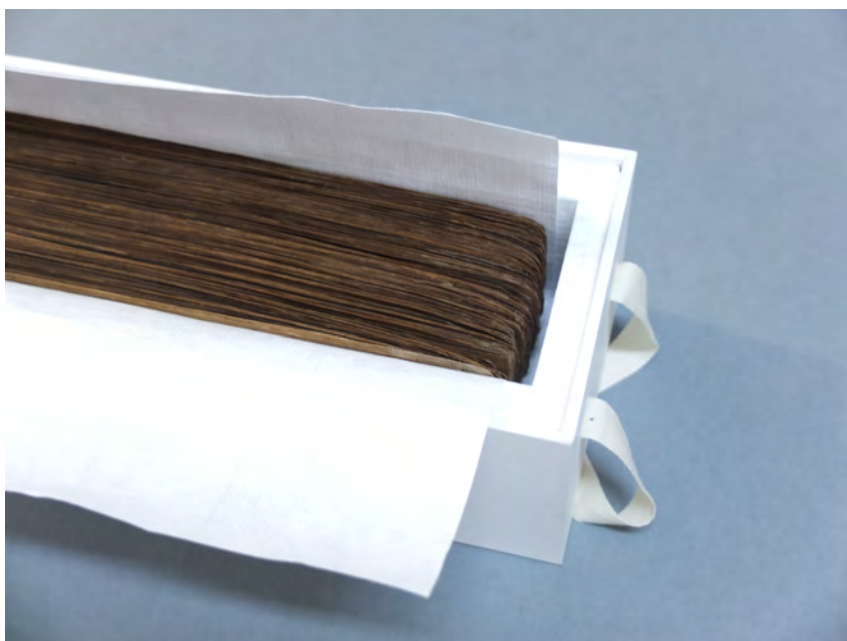
two wooden boards were cleaned by scratching concretions, brushing and suction through a tulle fabric. Then both sides were cleaned with saliva applied with hydrophilic cotton, rinsed with a 1 : 1 mix of water and ethanol. The flakes and lifts were stabilised with sturgeon glue (Kremer<sup>41</sup>) prepared at 1 % in water.

The manuscript was originally wrapped in tissues and packed in a red textile covered case.

Because of the high vulnerability of the paint layer to rubbing, we decided not to join the 208 palm leaves and the wooden boards. A ribbed cardboard box (Klug Conservation<sup>42</sup>) was designed to contain three cradles. The first one contains the palm leaves wrapped in Tyvek (Conservation by Design), the two others cradles contain the two separated wooden boards. Everything was wedged with Plastazote foam (Conservation by Design) protected by Tyvek. The paint layer was protected with tissue paper (Conservation by Design).

This packaging was a good compromise between a low volume, a nice display of the two wooden boards without handling them and of the palm leaves which were digitalised. It also provides good protection from the environment and abrasions.

Fig. 305. *Packaging, details of the palm-leaf cradle. Photo: M.M.*



## Conclusion

Though modest in size, the collection of palm-leaf manuscripts of the Collège de France is representative of the various codicological and technical traditions. Unfortunately, many items also demonstrated an array of conservation issues.

MS.SL.68 was one of the most damaged manuscripts, and its conservation enabled the establishment of a protocol for various conservation issues. Since this first restoration work in 2013, ten other palm-leaf manuscripts, from a variety of production centres, periods and utilising different palm-leaf varieties, have been treated. Most of them are being digitised and will be published soon on the digital library of the Collège de France, Salamandre: [salamandre.college-de-france.fr](http://salamandre.college-de-france.fr).

The renovation programme of the libraries of the Institute of Civilisations of the Collège de France, which should be completed at the end of 2021, includes the installation of special storage facilities for heritage col-



Fig. 306. *Packaging, one of the wooden board cradle. Photo: M.M.*



lections featuring a controlled environment (temperature: 18/19°C, relative humidity: 50% [ $\pm$  5%]).

These ideal preservation conditions and the diversity in types of palm-leaf manuscripts restored and preserved at the library will enable the observation, in the mid- and long term, of the evolution of palm-leaf material, as well as more precise assessment of the restoration methods.



## Notes

1. The library of Indian studies is a department of the Far East division of the Institute of Civilisations of the Collège de France.
2. Only one manuscript of this group, in Sinhalese script, was produced in Sri Lanka (MS.PALI.12); the others came from Thailand, Laos or Cambodia.
3. This foliation uses numbers, but also, in some cases, letters, syllables or even words with a numerical value. See: P. Visalakshy, 'Numerical denotation in manuscripts and inscriptions', *Some aspects of manuscriptology*, ed. P. Visalakshy (Trivandrum, 2008), pp. 40–52, at p. 40.
4. The Collège de France holds a Nepalese manuscript with parchment covers instead of wooden boards (Paris, Collège de France, Bibliothèque d'études indiennes, MS.SL.46, *Bṛhatkathāślokaśaṅgraha*), but it is an exception. In the south Asian cultural context, parchment and leather are most of the time considered as impure and not proper to the protection of sacred books.
5. T. A. Gopinatha Rao, *Elements of Hindu iconography* I–II (Madras, 1914–1916), II, part I, p. 13.
6. Gérard Colas, 'La feuille de palmier, support d'écrit dans l'Inde ancienne', *Papiers et protopapiers: les supports de l'écrit ou de la peinture*, ed. Claude Laroque (Paris, 2017), pp. 119–35; D. C. Sircar, *Indian epigraphy* (Delhi, 1965), pp. 61, 68; Jérôme Petit, *Gestion des fonds de manuscrits indiens dans les bibliothèques françaises* (Lyon, 2008), p. 16.
7. Vincent A. Smith, *The Jain stupa and other antiquities of Mathurā* (Allahabad, 1901), pl. XCIX; Catherine Ludvik, *Sarasvatī: Riverine goddess of knowledge* (Leiden, 2007), pp. 231–35, fig. 3; N. P. Joshi & A. L. Srivastava, *Śilpa-sahasradala: Directory of unique, rare and uncommon brahmanical sculptures* I–III (Varanasi, 2012–2016), III, p. 232.
8. G. Bühler, 'New Jaina inscriptions from Mathura', *Epigraphia indica* 1 (1892), Inscription n° XXI, pp. 391–92.
9. Ludvik, *Sarasvatī*, pp. 232–33; Louis Renou & Jean Filliozat, *L'Inde classique: Manuel des études indiennes* I–II (Paris, 1947–1953), I, pp. 161–63.
10. Paris, Bibliothèque nationale de France, Pelliot sanscrit fragments sur ôles (Discovery number 882, site: Douldour-âqour). See Richard Salomon, 'Kharoṣṭhī manuscript fragments in the Pelliot collection, Bibliothèque nationale de France', *Bulletin d'études indiennes* 16 (1998), pp. 123–60.
11. Oslo, Schøyen collection, MS 2373/1; MS 2179/44; MS 2376/1; MS 2375/08. Part of these manuscripts is published online: the Schøyen collection, Oslo, 'Buddhism collection', [www.schoyencollection.com/22-buddhism-collection](http://www.schoyencollection.com/22-buddhism-collection) [access 06.09.18]. See also: Jens Braarvig & Fredrik Liland, *Traces of Gandhāran Buddhism: An exhibition of ancient Buddhist manuscripts in the Schøyen collection* (Oslo, 2010), pp. 2–7, 18–21, 32–33, 46–49; Jens Braarvig, *Buddhist manuscripts in the Schøyen collection* I–IV (Oslo, 2000–2016), I, pp. 1–62; 243–73; II, pp. 1–10; 37–44; 239–54; III, pp. 161–76.
12. Jean-Pierre Drège, 'Le livre manuscrit et les débuts de la xylographie', *Le livre et l'imprimerie en Extrême-Orient et en Asie du Sud*, ed. Jean-Pierre Drège & Mitchiko Ishigami-Iagolnitzer (Bordeaux, 1986) pp. 19–38.
13. David Diringer, *The book before printing: Ancient, medieval and oriental* (New York, 1982), p. 358.

14. Om Prakash Agrawal, 'Conservation in South and South-East Asia', *Museum* 27.4 (1975), pp. 155–212, at p. 167.
15. For further details on the palm tree species used in South and Southeast Asia, see Colas, 'La feuille de palmier', pp. 121–25. In Indonesia, other varieties of poorer quality may sometimes be used in areas where the *Borassus flabellifer* is not available; for further details see Dick van der Meij, *Indonesian manuscripts from the Islands of Java, Madura, Bali and Lombok* (Leiden, 2017), pp. 241–42.
16. N. Harinarayana, 'Techniques of conservation of palm-leaf manuscripts: Ancient and modern', *Palm-leaf and other manuscripts in Indian languages* (Madras, 1996), pp. 261–74.
17. P. Visalakshy, *The fundamentals of manuscriptology* (Thiruvananthapuram, 2003), p. 11.
18. Colas, 'La feuille de palmier', p. 125.
19. H. I. R. Hinzler, 'Balinese palm-leaf manuscripts', *Bijdragen tot de Taal-, Land- en Volkenkunde* 149.3 (1993), pp. 438–73.
20. Champa N. K. Alahakoon, 'The division of labour in the production of Sri Lankan palm leaf manuscripts', *Journal of the Royal Asiatic Society of Sri Lanka* 57.2 (2012), pp. 215–28.
21. P. Perumal, 'The Sanskrit manuscripts in Tamilnadu', *Aspects of manuscript culture in south India*, ed. Saraju Rath (Leiden, 2012), pp. 157–72; for a description of the processing in Tamil Nadu as observed by the author see pp. 159–60.
22. Colas, 'La feuille de palmier', p. 125.
23. Hinzler, 'Balinese palm-leaf manuscripts', p. 448.
24. Sircar, *Indian epigraphy*, p. 61.
25. Nanda Wickramasinghe, 'Conservation of palm leaf manuscripts in Sri Lanka', *Conservation issues in Asia: Sharing good practices*, ed. O. P. Agrawal, Nilabh Sinha & Smita Singh (New Delhi, 2016), pp. 79–82.
26. Harinarayana, 'Techniques of conservation', p. 264.
27. Harinarayana, 'Techniques of conservation', p. 264.
28. Sircar, *Indian epigraphy*, p. 80.
29. Sircar, *Indian epigraphy*, p. 81.
30. C. Panduranga Bhatta, 'Palm-leaf and other manuscripts in Sanskrit (available in the four southern states)', *Palm-leaf and other manuscripts in Indian languages* (Madras, 1996), pp. 211–32.
31. The type of oil varies according to regions. Gingelly oil, mustard oil can be used, for example; see Agrawal, 'Conservation in South and South-East Asia', p. 168.
32. Agrawal, 'Conservation in South and South-East Asia', p. 169.
33. K. G. Sreelekha, 'Preservation of palm-leaf manuscripts', *Some aspects of manuscriptology*, ed. P. Visalakshy (Trivandrum, 2008), pp. 53–64.
34. Agrawal, 'Conservation in South and South-East Asia', p. 171.
35. D. G. Suryawanshi, M. V. Nair & P. M. Sinha, 'Improving the flexibility of palm leaf', *Restaurator* 13.1 (1992), pp. 37–46.
36. Marie Messenger EURL; 12 rue Godefroy de Cavaignac, 75011 Paris and 6 bis Rue Royale, 74 000 Annecy, France; tel. +33 622866098; marie.messenger@gmail.com
37. Emilie Masse, 18 rue de la Croix, 84000 Avignon, France, tel. +33 622204790; masseemilie@hotmail.fr
38. GMW, Gabi Kleindorfer, Aster Straße 9, DE 84186 Vilsheim, Germany, tel. +49-870-61094, www.gmw-gabikleindorfer.de (Chamois Japanese paper Paper Nao, 100 % Kozo, 3.7 g/m<sup>2</sup>).
39. CTS France S. A. R. L., 26, Passage Thiéré, 75011 Paris, France, tel. +33-143-556044, cts.france@ctseurope.com, www.ctseurope.com (Klucel G; ethanol).

40. Conservation by Design, Time-care Works, 5 Singer Way, Woburn Road Industrial Estate, Kempston, Bedford, MK42 7AW, United Kingdom, tel. +44-123-4846300, [www.cxdinternational.com](http://www.cxdinternational.com) (iron gall ink test paper; wheat starch, Zin Shofu; Tyvek; Plastazote).
41. Kremer Pigmente GmbH & Co, Hauptstraße 41–47, DE 88317 Aichstetten, Germany, tel. +49-756-591120, [krimmer-pigmente@t-online.de](mailto:krimmer-pigmente@t-online.de), [www.kremer-pigmente.de](http://www.kremer-pigmente.de) (Sturgeon glue).
42. Klug-Conservation, Zollstraße 2, DE 87509 Immenstadt im Allgäu, Germany, tel. +49 8323 965330, [www.klug-conservation.fr](http://www.klug-conservation.fr) (ribbed cardboard box).