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On the origin of silk-*ma* combined textiles

Introduction

Silk and *ma* (麻, a Chinese character that is used to name mainly bast and leaf fibres: a group of plant fibres and corresponding plants, such as flax, hemp, ramie, jute, etc., whose fibres are invisible from their source plants at the time of extraction with common sensory properties of being short, coarse, strong with low elongation) are two of the fibres used quite early by humans. Generally, when silk is mentioned in literature or oral communication, it mainly refers to silk filaments of *Bombyx mori*. When *ma* is mentioned in Chinese, it is a common name for a group of plant fibres with similar characteristics, mainly referring to bast and leaf fibres. In historical contexts, silk and *ma* had different properties, functions, and social status. However, they were combined to make textiles as early as 2355±45 BP in China, as attested by the discovery of archaeological fabric fragments woven with both silk and ramie-hemp threads, in the tomb of the Marquis Yi of State Zeng (fig. 1). This date is the average calibrated 14C dating obtained from

wood and charcoal found in the same tomb as the textiles (The Museum of Hubei Province 1989). These early textiles were probably used to make small bags to pack the strings of *Se* (瑟, an ancient Chinese large stringed musical instrument).

Although they did exist, archaeological artefacts and ancient documents of silk-*ma* combined textiles are seldom discovered or recognized. Little attention was paid to them and even less to their origins. When and why did these two materials start to be combined into textiles? Which kind of material played a leading role in their combination? These questions are yet to be discussed by scholars.

This project focuses on silk-*ma* combined textiles throughout East Asian history. It is a PhD program that started in March 2019, under the supervision of Professor Yu Weidong and Yang Xiaoming, hosted by the College of Textiles at Donghua University (CN). The aims of this project are to define and classify the different forms of historical silk-*ma* combined textiles, and to explore their origins.

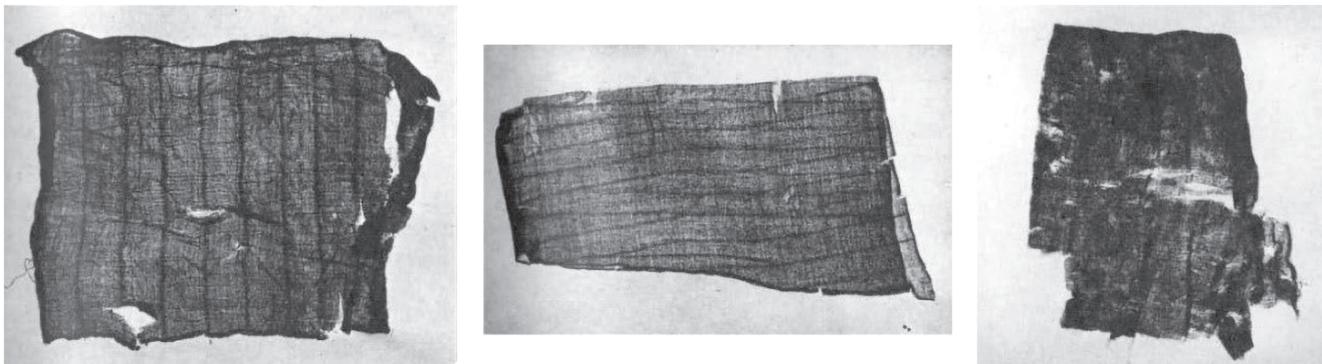
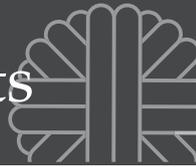


Fig. 1: Silk-*ma* mixed woven fabric fragments unearthed in the Tomb of Marquis Yi of State Zeng (2355±45 BP), Hubei Province, China (Images: Pan Bingyuan and Hao Qinjian, reproduced from The Museum of Hubei Province, 1989)



Related terminologies and definitions

Silk-ma combined textiles

In this project, the term “silk-*ma* combined textile” refers to a textile made of both silk and *ma* fibres, which technically includes textiles with silk and *ma* woven, sewn, or stuck together. Archaeological remains and historical documents of silk-*ma* combined textiles are few, most probably not because of their rare existence in history but because of the lack of precise identification. This was caused by the absence of a well-defined, professional, and recognised terminology, and the resulting ambiguous classification of these textiles (Chen and Peng 1985; The Museum of Hubei Province 1989; Junro 1992; Chen 1993; Yu et al. 1994; Zhou and Li 2002), as well as by the fact that many textile finds were and continue to be unmentioned as important artefacts in archaeological reports.

Historical sources mentioning silk-*ma* combined textiles are rare in the preserved literature and nearly all of them can therefore be included in this project. They are mainly distributed across the vast region of East Asia, including silk-*ma* mixed woven fabrics on the Chinese mainland, the Korean peninsula and the Japanese archipelago, and silk-*ma* mixed sewn textiles (shoes) in ancient China.

Silk-ma mixed woven fabric

Mixed woven fabric (交织物) (Sarkar et al. 2021) is a fabric woven with yarns of two or more different fibres, and in which each yarn contains only one type of fibre. Silk-*ma* mixed woven fabric refers to the fabric woven with yarns made of silk and *ma*. In ancient Chinese literature, the single word *ma* mostly refers to hemp, and silk-*ma* mixed weaving (丝麻交织) refers to the mixed weaving of silk and hemp threads. To avoid ambiguity in this project, in the absence of any special description, the single character *ma* in silk-*ma* mixed weaving can refer to any type of *ma* fibres. Also, considering the topic and research goals of this project, the silk-*ma* mixed woven fabric mentioned does not strictly follow the definition of mixed woven fabric in the context of modern textile industry. Apart from yarns with a single type of *ma* fibres, blended yarns with different types of *ma* fibres are also included. If there were other fibres involved in the mixed weaving of silk and *ma*, it would also be within the category of silk-*ma* mixed woven fabric investigated in this project. However, no such examples have yet been found.

Silk-ma mixed sewn textiles

Silk-*ma* mixed sewn textiles technically include the cases in which silk or *ma* threads are embroidered

on *ma* or silk fabrics, and the cases in which silk fabrics and *ma* fabrics or braids are sewn together. Archaeological sources only show cases of the latter, mainly referring to ancient Chinese shoes made of silk and *ma* textiles sewn together. Therefore, in this project, the term “silk-*ma* mixed sewn textile” mainly refers to the sewing of silk and *ma* fabrics or braids. Research on the origin of silk-*ma* mixed sewn textiles is based primarily on ancient Chinese footwear artefacts. For the convenience of description and classification, cases with the involvement of silk-*ma* mixed woven fabrics are excluded from this category. Silk-*ma* mixed sewn shoes with silk-*ma* mixed woven fabrics on them are all categorized into silk-*ma* mixed woven textiles.

Research content

In this project, historical silk-*ma* combined textiles were systematically studied and categorised, given terms with definitions and descriptions. From 2019 to 2022, historical sources were found and collected from East Asia, mainly the Chinese mainland, the Korean peninsula and the Japanese archipelago. Based on this data, characteristics of different types of silk-*ma* combined textiles were analysed and summarised, which shed light on regular manufacturing patterns and their region of origin. Information related to historical combined textiles of silk or *ma* with other fibre materials was also collected for comparative analysis.

To find out why these two kinds of fibres were combined into textiles and the earliest date of their appearance, research on the origin and features of using silk and *ma* fibres was conducted. The opportunities for the discovery and use of the two types of fibre, their initial forms, functionalities, and their possible earliest appearance were analysed and demonstrated logically, combined with a rethinking of the original meanings of pictographic ancient Chinese characters silk (丝) and *ma* (麻). Fundamental technologies of making supple artefacts (Tao 2015), such as ropes and mats used for binding, winding, wrapping, or fixing, were also discussed for an understanding of the origin and early pattern of using silk and *ma* fibres. Our hypothesis is that the early process of making and using these artefacts had led to the exposure and use of fibres. The origin of silk-*ma* combined textiles was explored through the combining of insights into the origin of using silk and *ma* fibres, and hypothetical motivations for such an invention were inferred and discussed.

Methodology

This research involves the collection, investigation, classification, and review of silk-*ma* combined textiles.

Evidence of combined textiles with other materials is also investigated for comparison, and the earliest form of using silk and *ma* fibres is demonstrated on the basis of archaeological facts and logical analysis. In this project, archaeological material is collected through literature reviews, visiting exhibitions or collections, and interviews with traditional textile craftspeople, collectors, researchers, or experts. Several databases are used for recording, searching, and studying historical documents, including 愛如生中國基本古籍庫 (Erudition Database of Basic Chinese Ancient Books, dh.ersjk.com), Chinese Text Project (中国哲学书电子化计划, ctext.org), 한국사데이터베이스 (Korean History Database, db.history.go.kr), 한국고전종합 (Comprehensive Database of Korean Ancient Books, db.itkc.or.kr), and 国書データベース (Union Catalogue Database of Japanese Texts, kotenseki.nijl.ac.jp), etc.

Based on investigation and study of historical sources, logical methods including induction, analytical synthesis, and comparison are used to summarize types and characteristics of silk-*ma* combined textiles, to infer and demonstrate the appearance of silk and *ma* fibres, and to raise hypotheses as to the earliest date and reason for their invention.

Findings and further studies

On the origin of using fibre materials

Based on all works mentioned above, the hypothesis

was raised that the properties of fibre materials were discovered thanks to the frequent use of stripped or sliced materials taken from plants. They were originally used for their properties for making simple woven artefacts with both fineness and strength, and used for utilitarian functions, such as ropes, strings, mats, and fabrics used for tying, stringing, blocking, wrapping, or hunting. This activity led to the discovery that certain plants contain fibres hidden inside their stems or leaves, that is, *ma* fibres. Following this hypothesis, *ma* was the first to be used among the four main types of natural fibres, cotton the second, wool a little later and silk last. This time sequence is generally consistent with the dating of archaeological textile remains discovered so far.

On the origin of using *ma* fibres

Ma fibres come from the inner parts of plants. As the first kind of fibre materials to be used, they were exposed gradually during the processing of plants and artificially spliced or extracted for human demand for finer soft materials. Domestication of *ma* crops came hand-in-hand with human demand for *ma* fibres and occurred after *ma* fibres first started to be used. According to early plant fibre evidence from across the world, the earliest plant fibre products were mostly cordages or strings (Lynch 1980; Zhejiang Provincial Institute of Cultural Relics and Archaeology 2003; Hardy et al. 2020). The oldest specimens indicate that the plant species were maybe more primitive, with a

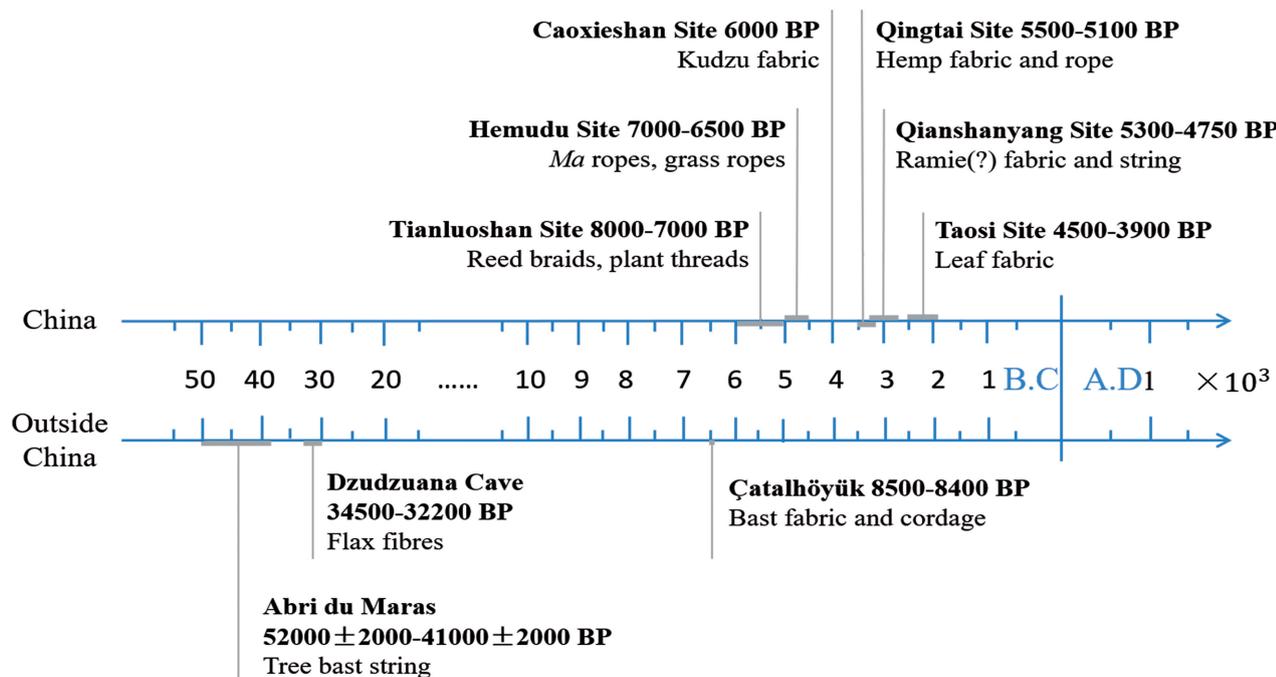


Fig. 2: Chronology of early *ma* fibre evidence in the world (Image: Zhang Xiyao)

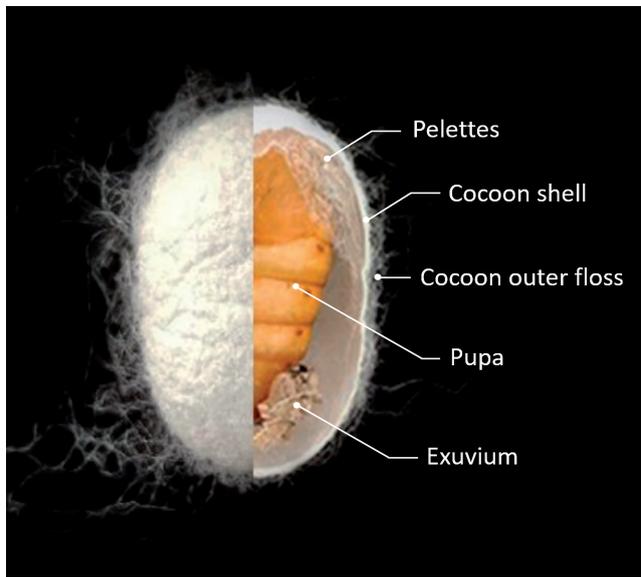
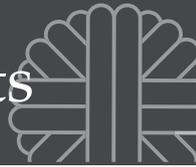


Fig. 3: An intact mulberry cocoon with a half anatomic image (Image: Zhang Xiyao)

lower degumming rate and thicker fibre bundles. *Ma* fibres are a large group of plant fibres of varied species, such as flax, hemp, ramie, jute, sisal, nettle, pina, etc. Different places can be identified as points of origin for their domestication, depending on local condition, sub-species, etc. Different species of *ma* fibres started to be used in different parts of the world at different

times (fig. 2), but their processing methods to free and separate the fibres or fibre bundles were much the same. Studying this aspect of *ma* fibre production is rendered difficult by the impossibility of studying the earliest archaeological specimens stored in museums and the overshadowing research and knowledge on flax and other western bast fibres in Asia. Taking the opportunity of a one-year research visit at the Centre for Textile Research, University of Copenhagen (DK), studies on the early use of flax and experiments will be conducted to improve my understanding of the process and allow comparisons.

On the origin of using silk fibres

Silk is extracted according to three different techniques: floss making, silk spinning, and silk reeling, among which spinning and reeling are processes dealing with the fibres while floss making is a technique dealing with the cocoon shells (fig. 3). Considering the difficulties in obtaining this type of material, the complexity of the production process and the growing demand for silk across the world, it seems probable that silk fibres were first processed with the spinning technique. With sufficient spinning knowledge, it was easier to find and obtain short silk fibres from the cocoon's outer floss than filaments from the inner cocoon shell. However, it could only be an attempt to use a new type of fibres. We can imagine that there was no need for fine silk fibres without pre-existing knowledge on

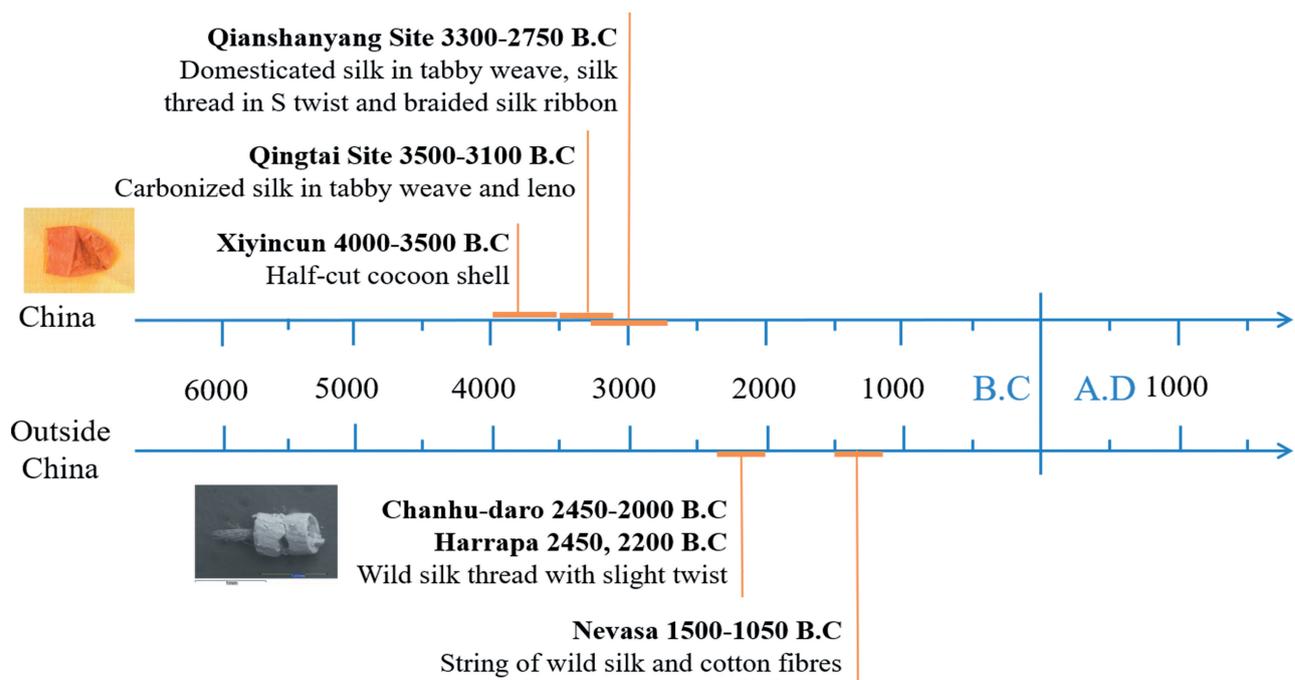


Fig. 4: Chronology of early silk evidence in the world (Image: Zhang Xiyao)

how to process them into useful products. Therefore, the appearance of silk spinning must have come after that of twisting threads with short fibres and earlier than silk reeling, which necessitates a more complex installation. Silk reeling was invented to answer the growing demands of the weaving industry, which developed to create products with decorative rather than practical functions. In turn, silkworm domestication was promoted by the growing large demand from reeling silk workshops. Therefore, silk reeling appeared after the birth of weaving technology and before the activity of rearing silkworms. Studies on the sequencing of both domesticated and wild silkworm genomes have shown that the domestication of silkworm occurred before 7000 BP (Guo 2011; Yang 2014), from which it could be inferred that silk reeling was developed no later than 7000 BP (see summary diagram in fig. 4).

The earliest reason for inventing silk-ma combined textiles
Bringing together the evidence of preserved historical silk-*ma* combined textiles and the origin of using respectively silk and *ma* fibres, it is possible to propose several hypotheses. The first is that silk-*ma* mixed sewn textiles may have been invented for decorative purposes in which silk fabric was added to *ma* products. The second is that silk-*ma* mixed woven textiles may have been invented for several purposes, following the technological developments of both silk and *ma* fibre production, such as the technical refinement of *ma* threads that became fine parallels to silk threads.

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