A Paper Fragment from the Gol Mod Necropolis, Mongolia (a Late First Century BC Archaeological Excavation)

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A Paper Fragment from the Gol Mod Necropolis, Mongolia (a Late First Century BC Archaeological Excavation)

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In China, the existence of paper in antiquity is attested by recent archaeological excavations linked to the Han Dynasties (206 BC–220 AD). Until now, similar discoveries remained very rare in Eastern Asia and the presence of paper at the beginning of our era has only been confirmed in China. The oldest example known to date outside of China, and precisely dated between the end of the 1st century BC and the middle of the 1st century AD, was recently discovered by the French Archaeological Mission in Mongolia at the site of Gol Mod. The Gol Mod necropolis is a rare burial site intended for the elite of the half-nomadic tribe confederation known as Xiongnu (ca. 3rd c. BC–3rd c. AD). In this cemetery, one of the largest monuments, the grave T20, revealed a substantial quantity of artifacts. Amongst these, a chariot, regarded as a symbol of power, contained a paper fragment used as filling material. This article describes the discovery of this fragment, and some of the analyses that were performed in order to prove that it is one of the oldest examples of paper known to date.

1. Introduction

Although paper manufacturing originated in the Far East before our era, discoveries of such ancient paper fragments remain exceptional. As reported by André et al. (2010), recent

archaeological excavations have brought to light evidence of paper production dating from the Western Han Dynasty (206 BC–8 AD). It has been previously thought that paper, like papermaking, spread gradually from China throughout Asia and appeared later in other states including Japan, Vietnam, Mongolia not earlier than 6th to 7th century.

Concerning Mongolia, this late chronology is generally credited to the lack of findings and to the fact that nomads of the steppes have an oral tradition, supposedly without writing. Tangible evidence of the use of paper in Mongolia before the modern period remains very rare, except for paper money, which has been attested during the Mongol Empire. The long paper scroll of Argun, Mongolian Khan of Persia, who replied to the French King Philippe le Bel in 1289, or his next letter, dated from 1305, remain exceptional documents of the medieval period.

The uses of paper in Mongolia can still be questioned for the early medieval period, and until now there was no evidence that paper was used during antiquity. The recent excavation in central Mongolia of a fragment of paper offers a different perspective to these questions. This fragment was found on the site of Gol Mod and seems to be the oldest known example of paper found outside Chinese boundaries.

2. Context of the discovery

2.1 Grave T20, Gol Mod necropolis

The archaeological context of this discovery is the necropolis of Gol Mod, in the province of Arkhangaï. The necropolis is attributed to the confederation of the half-nomadic tribe of Xiongnu and is a rare example of aristocratic burial in this period (3rd c. BC–3rd c. AD). This necropolis was identified by the archaeologist Ts. Dorjsüren in 1954. Since the year 2000, the French Mongolian archaeological Mission has conducted excavations on this site.

This graveyard includes 393 graves. Among these, grave T20 is not only the largest, but it also surpasses the size of most of the graves found at any previously discovered Xiongnu necropolis. The grave adopts the traditional shape of the graves of the elite, and the funerary room of the monument has been excavated down to the bedrock.

The monumental architecture of grave T20 (Fig. 1a) is considered to be a sign of aristocratic distinction of the deceased. The 57 m long superstructure of T20 is formed with a trapezoid enclosure linked to an access ramp, both of which are built out of blocks of schist. The funerary chamber was built 18.3 m below ground level (Fig. 1b), and the complete infrastructure has been excavated carefully down to the natural soil. The excavation process was quite difficult, because of the quick drying nature of the substrate, which was mainly composed of pure sand.

2.2 The chariot as a symbol of power

Grave T20 contained a large amount of furniture, and the funerary inventory gives an even more precise indication of the social status of the deceased. Of these items, the chariots found in grave T20 have already been depicted by André (2003). These precious vehicles embody both the political and ritual power of the great chiefs, as shown by André and Holotova (2009). They can therefore be regarded as one of the main symbols of power among the Xiongnu aristocracy.

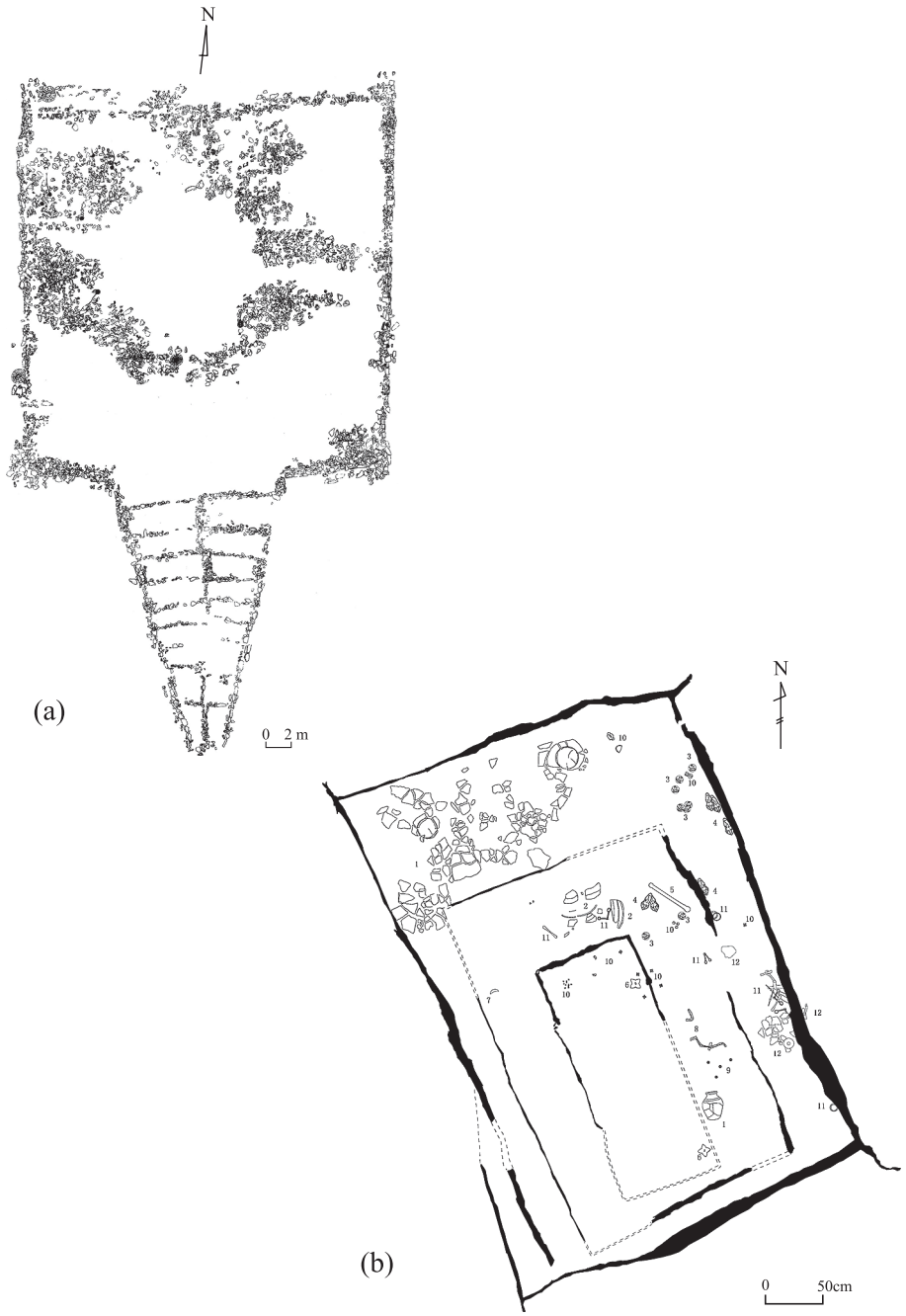

Fig. 1 Drawing of (a) grave T20 and (b) the funerary chamber for grave T20 at Gol Mod, Mongolia (© MAFM)

Apart from this archaeological evidence, the chronicles of the Han Dynasty (206 BC–220 AD) attest that chariots were in vogue among the Xiongnu elites during this period. In China, the chariot was a tool used for military purposes as well as a symbol of social status. It was thus also included in funeral rites. Chariots seem to have had a purely symbolic meaning of power for the Xiongnu people and undoubtedly contributed to reinforce their owner's rule. The grave itself might therefore have been conceived as a monumental carriage drawing the powerful deceased into the beyond.

The chariot n°2 discovered in grave T20 is therefore is considered to be a symbol of civil prestige. The chariot seems to belong to the *yaoche* type described in Chinese texts as discussed by Wang (1997). The shape of the carriage, the construction techniques and its decorative patterns suggest that it dates from a period close to the beginning of the 1st century AD. At that time, it could have been given to a Xiongnu high-ranking official as a diplomatic gift from the Han Empire. These two powers were indeed often in conflict, but artefacts such as these vehicles attest to the fascination of the Xiongnu with Han civilization.

2.3 Discovery of a paper-like fragment

An archaeological piece of paper was discovered in chariot n°2, which was lying on the roof of the funerary chamber of the grave. The chariot was completely dismantled and the original position of each part was noted (Fig. 2). More than 50 elements belonging to this vehicle were found, thus allowing for a clear understanding of the structure. The restoration of its appearance (Fig. 3) shows that the vehicle perfectly corresponds to Chinese models of that period. It can be divided in four parts: body shell, axle and wheels, shaft and yoke, and parasol. The main characteristics of these parts are as follows:

The body was composed mainly of black lacquered wooden side panels. These panels were decorated with a sober lozenge pattern, which is quite different from the rich motifs usually observed on painted lacquerware of the Western Han Dynasty. Two red mud guards were also dismantled from the chariot and deposited horizontally on the east and west sides of the body shell. They were originally mounted horizontally.

The wheels and axle were well preserved. Two 1.3-m diameter wheels were found, one on the east and the other on the west of the body shell. They were almost completely intact and were astonishingly lightweight. The wheels rotated around a fixed axle by means of a system of iron rings fitted one into the other, a traditional system used in China.

A metallic plate on a small lacquered wooden box was mounted above the axle as protection against the jamming of the system. This piece was adorned with a motif of a *taotie*, a mythical beast. The high quality of the casting and the numerous details of the animal's fur were outstanding. Unlike similar pieces found in China dating from the 2nd–1st century BC, no gilding or inlay were found.

The parasol was made of at least 35 ribs driven into a central pole (Fig. 4). Each rib was made of black lacquered wood and terminated with a bronze fitting, simply adorned with a single ring and a line pattern. Some fragments of lacquered wood still remained inside the fittings. A small piece of paper-like material was wound around one of the wooden ribs to hold the bronze fitting.

Simultaneously, a lacquered object inscribed with Chinese characters "Yongshi era"

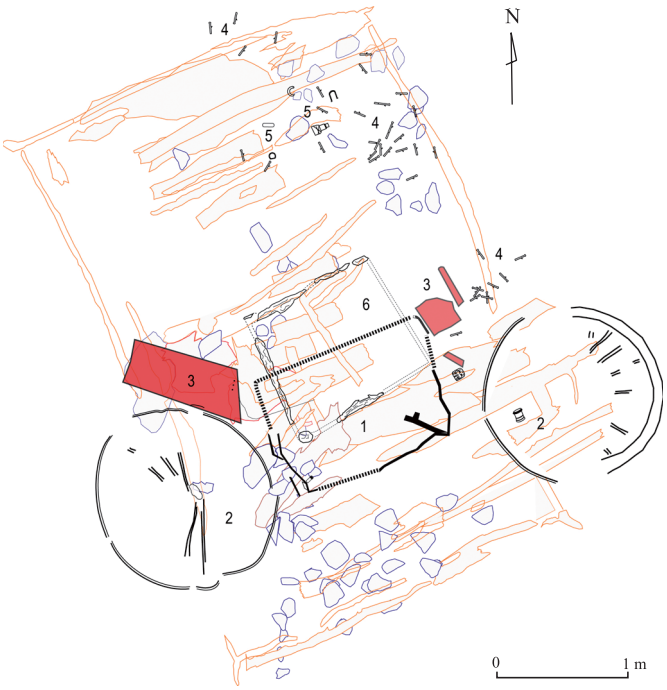

Fig. 2 Artifacts from chariot n°2 found in grave T20 at Gol Mod: (1) chariot body shell, (2) wheels, (3) mud guards, (4) umbrella rib fittings, (5) shaft and yoke, and (6) robbers' shaft (© G. André)

Fig. 3 Reconstruction of chariot n°2 (© G. André)

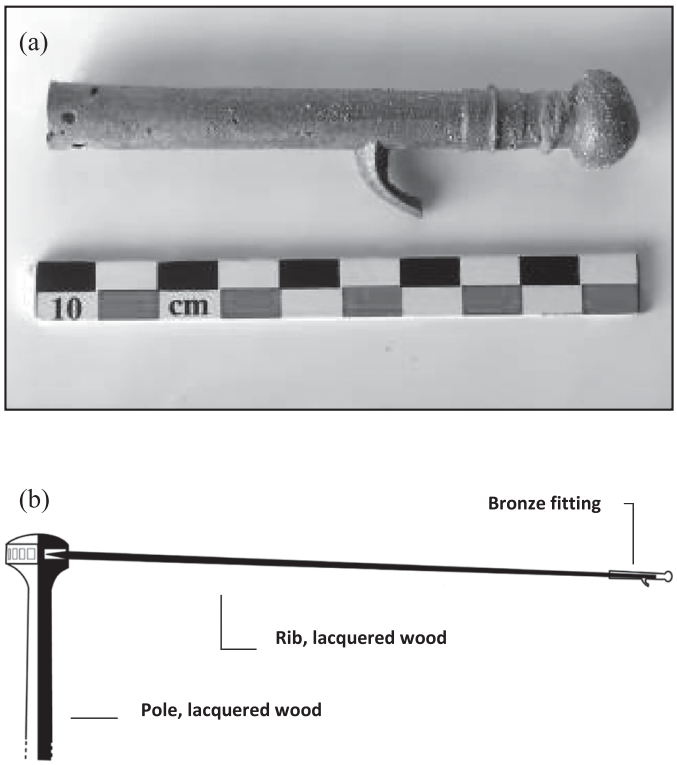

Fig. 4 (a) A bronze rib fitting of the parasol from chariot n°2 (© MAFM) (b) Reconstruction of the system fixing the rib to the parasol of chariot n°2 (© G. André)

(永始)—the period between 16 and 13 BC—was found in the T20 grave. This enabled us to date the paper-like fragment from the same period, that is, around the beginning of our era.

3. Analysis of the paper-like fragment

Examination of the surface of the fragment with a binocular microscope confirmed that the material has all of the visual characteristics of paper (Fig. 5): It consists of a mat of tangled fibers exhibiting no particular order. The fibers are up to several millimeters long and have a diameter ranging from 20 to 50 µm.

To confirm this identification, a fiber was sampled from the surface (Fig. 6). It was pressed between two diamond cells then analyzed in transmission geometry with a Fourier Transform Infrared (FTIR) microscope (Continuum XL and Nicolet 6700, Thermo Electron Co, USA). The infrared signature of the material was that of cellulose, confirming the cellulosic nature of the material.

Given the importance of the sample, and to learn more about the composition of the material, we felt that it was justified to collect additional fibers to identify them by conven-

Fig. 5 Paper fragment from chariot n°2: the bronze rib with the paper-like fragment (top), detail of the surface of the paper-like fragment (bottom) (© CRCC)

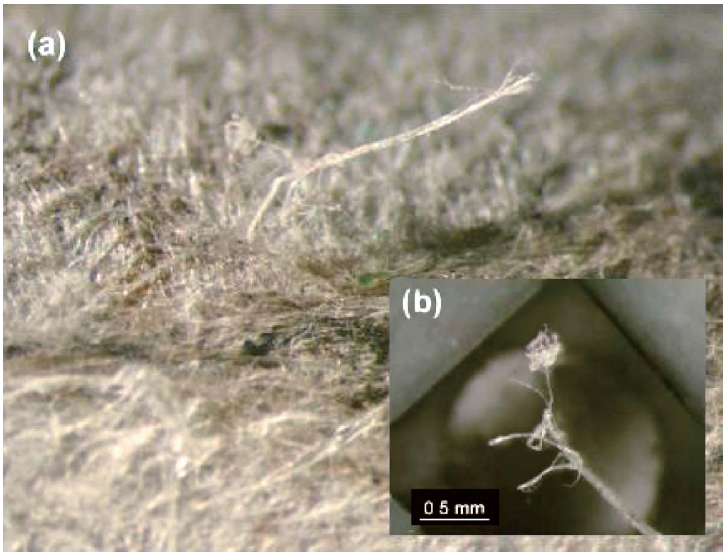

Fig. 6 Sampling of a fiber for FTIR analysis: view of the fiber (a) before and (b) after sampling (© CRCC)

tional microscopy. The fibers were mainly hemp (Fig. 7) but a few resembled flax.

Some fibers were also observed by scanning electron microscopy (SEM) coupled with an X-ray fluorescence detection system (JSM 5410 LV, JEOL and Link Pentafet, OXFORD, UK). Small particles were noticeable on the fiber surface (Fig. 8). Some were composed exclusively of calcium and were thus attributable to calcium carbonate. Others were composed of silicon and aluminum and therefore belong to the family of aluminosilicates.

These observations led us to conclude that this material can be likened to paper. The sample is mostly composed of hemp and contains calcium carbonate, these two points being quite similar to modern western papers.

The condition of this paper fragment is exceptionally good, which is particularly remarkable considering its age and the fact it was in close contact with a bronze object. This good condition is probably related to two factors. First, the use of calcium carbonate as a filler may have helped delay paper degradation, and second and more likely, the object was kept away from the two main vectors of natural degradation for two millennia, water and oxygen.

The presence of aluminosilicates in the paper remains difficult to interpret. This component could be inherent to the papermaking process, or it could simply be represent external pollution from the surrounding sand.

A more distinct feature was observed by the optical and scanning electron microscopy. The distribution of the fibers seems to show two different aspects. The great majority of them are entangled in no particular order, but some of them, such as those represented on Figure 8, seem to be parallel to each other in a bundle. This observation suggests that the fibers were

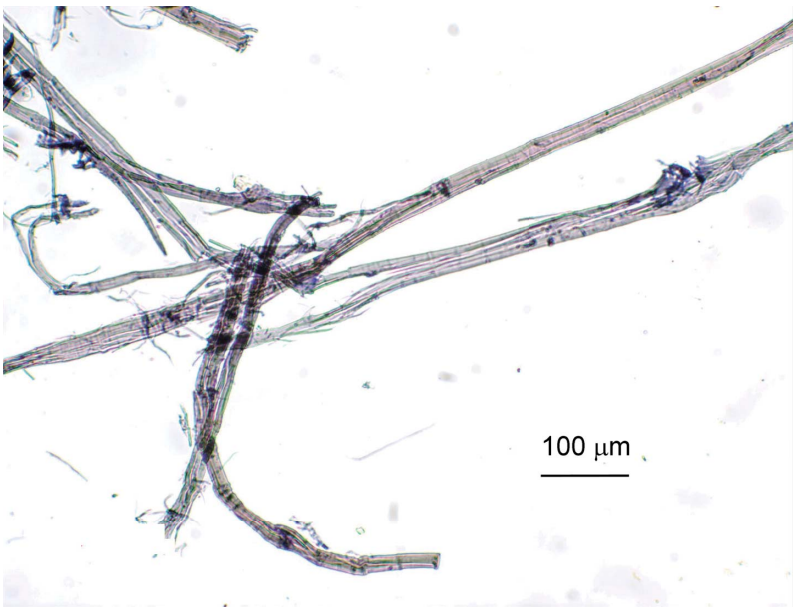

Fig. 7 Example of hemp fibers sampled on the paper fragment (© CRCC). No fibrillation was observed on the fibers

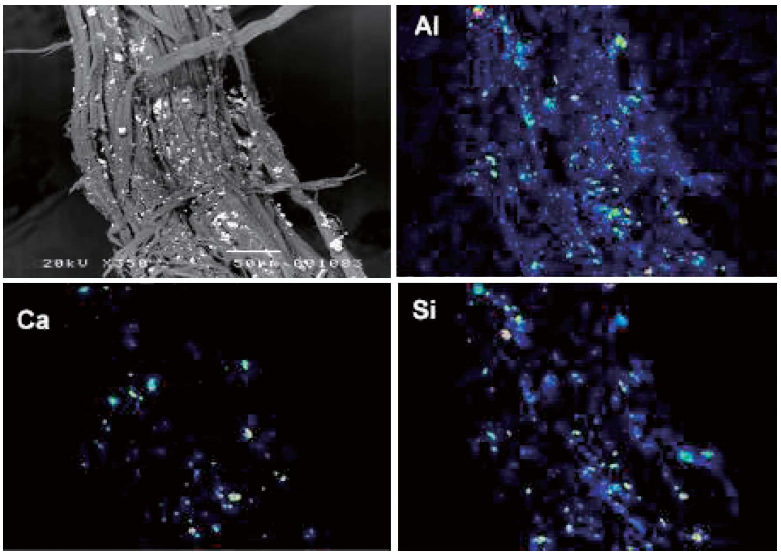

Fig. 8 SEM/EDS measurements on paper fibers. The electron backscattered picture (top left) was taken on a sample of fibers that remained parallel to each other in a broad beam. Elemental mapping was performed to detect the presence of calcium (bottom left), aluminum (top right) and silicon (bottom right)

not all separated during the preparation of the pulp.

The paper fragment is firmly inserted into the bronze fitting and it is not possible to extract it without causing damage. This point seriously restricts the number of micro-destructive or non-destructive methods that can be implemented to examine it. In particular all morphological examination regarding to the presence and regularity of laid lines, remain unachievable with conventional techniques.

4. Conclusions

The discovery of a fragment of paper at the Gol Mod necropolis in a context dated from the late first century BC to the beginning of the first century AD highlights the fact that this material was, at least to a certain extent, experienced by the nomadic people of the steppes. There is no evidence of its place and date of manufacture. We may suppose, however, that this paper was of Chinese origin. Similar to the case of the chariots, its presence may be a result of the Xiongnu people's curiosity about Han civilization. It remains difficult to know to what extent and for what purpose paper was used at this time. The presence of this fragment of paper at this place may appear anecdotal, but it raises questions about the use of paper during this period. Holding a parasol rib is obviously a diverted use of this material, but the original function of paper in the Xiongnu civilization remains unanswered.

The discovery of this fragment of paper proves that this material existed in Mongolia since antiquity. The question arises that if they had access to paper, did the Xiongnu civiliza-

tion have their own writing system? Archaeological research in this area has not yet been able to answer this question.

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