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Unit

The Foundations of Printing

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1 The Foundations of Printing

Unit

WARM-UP: Be Proactive

Irene: Hello everyone, from today on, we — iPOD group, start our journey exploring the origin and evolution of the invention of printing. The meaning lies in that the invention of printing has brought civilization, mutual-understanding, peace and prosperity to the whole world. Hence, how printing was born and evolved should also come to light. Do you share my view?

Colette: I do. Here for the first time, let's lay out how we can smoothly carry out our investigation and share our findings with as many people as possible.

Walter: You are right. Careful planning must be made prior to action. My suggestion is that your exploratory learning should be always heuristic, reflective and inspiring in nature.

Jason: How do you understand Socratic dialogue? To simplify it, I need to start with a question: Do you know where the word "education" came from and what it meant originally?

Evan: A lot of English words were borrowed from Latin. I guess education had the same source. Am I right?

Jason: Very insightful! The word "education" means eliciting a response with a question in Latin. Socrates held that teaching should not impart knowledge directly but adopt a sort of reflective dialogue to illuminate wisdom, stimulate brain activity, develop intelligence and finally acquire critical ability to respond thoughtfully.

Walter: I am sure you must see what Jason means. Right? Socratic dialogue is our recommended style of learning. Then you will be self-aware of what is true and learn it deeply. Believe me. You will benefit.

Irene: Oh, I think I see the light. Let me try to start such practice. Everybody, on hearing printing, what does it trigger you to think of?

Colette: For me, first of all, what stimulated the ancient people to invent printing flashes in my mind?

Evan: Yes, I share your view. Besides, what did the ancient people print? And what was their purpose to print?

Irene: Yes. Those are also my puzzles. I think the ancient people hoped to preserve and pass on what they knew to their descendants. And printing could meet the needs of more people because printing could increase the number of their duplications. My questions are how much and for how long could the ancient people preserve their knowledge and wisdom only by word of mouth?

Colette: So our ancestors began storing what they knew by carving, engraving, scribbling and drawing on something, such as rock, stone, bones and so on.

Evan: So then early writing appeared — Chinese characters. Oh, no. It was the pictograph. So they began recording and describing what happened or experiences or knowledge on rocks, tortoise shells, bamboos and whatever they could kind of gain access to.

Irene: Yeah, and they also needed tools to carve or write with, didn't they? Now we are so curious. Why not give Professor Walter's systematic historical speech a warm welcome?

Task 1 Listen to a historical note about Birth of Chinese Printing

Walter: Hello, there! It is a great honor to be invited to pull open the prologue for iPOD. My talk will center closely around what you discussed. Basically, you hope to know the prerequisite of printing. So my topic will be "The Foundations of Printing". I will develop my speech from four aspects because they laid foundation for the invention of printing. These are also what you are interested in and concern the origin of printing. The four aspects cover the social needs, the writing system, carving skills, and materials and tools. Here is a task for you. Do remember to fill in the blanks with the words while you are listening.

As we all know, there are four great inventions (printing, paper, gunpowder and the compass) in ancient China, one of which is printing. The invention of printing, coupled with its evolvement and dissemination across the borders of many other countries, contributed significantly to human civilization and social progress. However, any invention must develop from gradual and constant discoveries and accumulation of techniques, materials and tools over a long period of time. The invention of printing is no exception. The prerequisite is a must. But this prerequisite would not have been met in the absence of widespread fixed and standardized written words and the techniques of character-carving which was the basis of woodblock carving. The invention would not have come into being if there had not been proper material, say, media, such as tortoise shells, rocks, writing brushes, ink and paper. The last but not the least prerequisite is the social need. With the development of society, human beings amassed and built up more and more knowledge and experience. Therefore, the demand for the reproduction and the preservation of these products of civilization in the form of words and drawings became indispensable. Just under such circumstances, the most primitive ways of copying books by hand evolved into early printing to meet the social demand.

(Here you are required to fill in the blanks while listening)

First, printing invention ___1___ the writing system. The earliest recorded events appeared on ___2___ , which should be the prototypes of Chinese characters. More than four thousand single characters founded in ___3___ can be dated back to the thirteenth and fourteenth centuries BCE, which were generally regarded as the earliest and ___4___ Chinese characters.

Figure 1.1.1: The forming process of oracle bone inscription dated back to 13th to 14th centuries BCE (Source from Chinese Museum of Printing).

Figure 1.1.2: The oracle bone inscription of the Chinese zodiac (Source from Chinese Museum of Printing).

These early characters were used to record ___5___. In the Western Zhou Dynasty (1066-771 BCE), ___6___ came into being and characters in this era advanced a great step and became known as ___7___. The first Emperor of Qin (221-206 BCE) endeavored to unify and simplify the great-seal scripts and led to the ___8___ of a new script known as small-seal scripts. Then more types of scripts appeared and formed. The ___9___ , followed by running scripts which made writing more convenient, were quite popular in the Han Dynasty. Towards the end of the Eastern Han Dynasty, the regular script emerged, completing the development of the various scripts of Chinese characters and also ___10___ the typeface for woodblock printing.

Figure 1.1.3: The small-seal scripts of the Qin Dynasty (Source from Chinese Museum of Printing).

Figure 1.1.4: The clerical scripts of the Han Dynasty (Source from Chinese Museum of Printing).

Now let's come to the third prerequisite for the invention of printing — carving skills. The earliest reverse-character carving was used in seals which emerged in the Shang Dynasty (1600-1100 BCE). Carving skills have gone through quite a long process from carving on pottery, rock, bronze and clay mould to stone inscriptions. The most famous stone inscriptions in history are those of *Xiping Stone Classics*. The carving began in the fourth year of the Xiping period of Emperor Hanling of the Eastern Han Dynasty (175 AD). When *the Xiping Stone Classics* were completed, the stone was erected at the main entrance of the Imperial College in the capital, Luoyang, for the public to read, copy and compare with other texts. Carving served as a sort of cultural transmission, indicating that the character-engraving skills were extremely refined.

Figure 1.1.5: The carving on rock of Helan Mountain (Source from Chinese Museum of Printing).

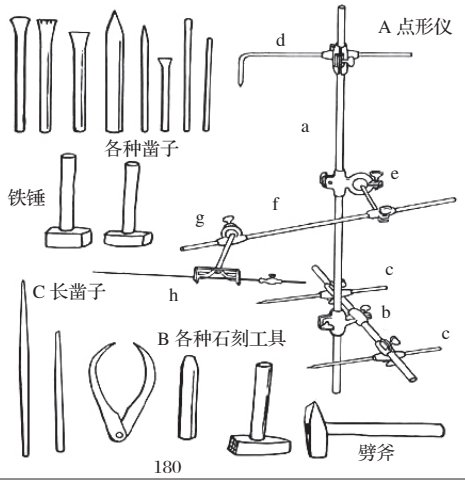

Figure 1.1.6: The carving tools in ancient times

Finally, we should talk about the materials and tools concerning printing. Only with the invention and wide application of materials such as paper and ink, could printing be given birth and produce a large amount of reproduction to meet the strong demand of society. In light of the detailed reading material below, I will leave you with the task of carefully comprehending the following paragraphs and grasping as much information as possible. You will get very helpful and detailed information in this regard.

I think that is all about the historical note for this unit. See you next time.

Task 2 ▶ Discuss the historical note

(Students are required to imitate this dialogue and do role play in groups)

Irene: Hi, everybody. Hearing such a long passage seems like a long journey for me. Don't you think it is a good idea for us to take stock before the further big explorations?

Evan: Oh, I totally agree. We should launch a discussion based on the text above and have a discussion as a group. Competition really helps motivate people to do things, don't you agree?

Colette: So let's raise our own questions to test each other. I think it is also a necessary process of self-reflection.

Irene: Absolutely right. Let's roll up our sleeves.

Evan: The first basic thing that we should do is to make clear the foundation of the invention of printing. Who can list or cite something for me?

Irene: That is a piece of cake. First, printing is the result of social development because the amassed knowledge needs to be passed down or spread. Face to face learning and teaching is too limited and the capacity of memory becomes the only dominant factor. Second, in order to overcome forgetting and create more resources for people to refer to, people invented characters — hieroglyphic or pictographics. Thus, the early writing system appeared such as carving, engraving and inscribing etc. Writing can preserve knowledge. But writing also needs materials. So the

third essential foundation was material used as media. People carved in rock, bronze, or on mountains. They also inscribed in stone or in bamboo. Gradually people began to record what they know on silk and paper. So copying became a sort of very professional job. But copying could not meet the need of society and so the invention of printing came into being on the basis of all these factors.

Colette: It is said that writing on stone and rock were shared by people all over the world. What I feel proud of is that we Chinese people invented paper and printing, which really contributed so much to the world. And …

Evan: Wait, wait please. Wasn't it CAI Lun, a eunuch of the Later (Eastern) Han dynasty who invented paper. I think it dated 105 BCE.

Colette: My knowledge, the invention of paper was not by CAI Lun. Who actually first invented paper still remains a mystery.

Irene: The earliest fragment of paper found so far is of what appears to be a map. It was excavated from a former Han tomb and is made from hemp fibers from rags. Fragments of paper have also been found at Dunhuang, the earliest of which dates from 65 BCE. What appears to be part of a letter written on paper made from linen fibers was found in 2006 at the Yumen pass to the northwest of Dunhuang. The paper has been dated to 8 BCE. So we should say it was Chinese Laborers who first invented paper.

Evan: Well, whether you are right or wrong can be confirmed later on. One thing that I want to stress is that we've forgotten the fourth foundation of printing. which is materials and tools, especially tools. Who would like to illustrate some tools for me?

Colette: Figure 1.1.6 clearly shows us the tools. But in my perspective, the four treasures of the Chinese studio should be the indispensably valuable tools for writing and drawing.

Irene: Well I think our discussion about the foundation of printing invention could be suspended for the present. We can find solutions to our questions in the following reading part, do you agree?

Evan & Colette: Sure. Bring it on.

Task 3 ▶ Build up our vocabulary

Match the English words in column A with the Chinese equivalents in column B.

A		B	
1	woodblock	A	石墨
2	great-seal script	B	《熹平石经》
3	small-seal script	C	统治
4	typeface	D	染色，染料，染液
5	*Xiping Stone Classics*	E	有帮助的，起作用的
6	hieroglyphic	F	小篆
7	pictograph	G	人工制品；蜡纸；模板；用模板印出的文字或图
8	hemp	H	案
9	Four Treasures of Chinese Studio	I	甲骨
10	instrumental	K	字体，字面，版面
11	precede	L	大篆
12	Neolithic	M	大麻，大麻纤维
13	unearth	N	碑文
14	artifact	O	木板
15	reign	P	文房四宝
16	conducive	Q	新石器时代的
17	prevalent	R	流行的
18	graphite	S	雕刻
19	dye	T	象形文字，象形文字写成的文章
20	court	U	象形文字，形符
21	engraving	V	先于，位于……之前
22	inscription	W	出土
23	oracle bone	X	有益的
24	stencil	Y	朝廷

Task 4 ▶ Reading activity: Physical Foundations of Printing

The following excerpt is recommended to iPOD. It is about ***The Physical Foundations of Printing: The Invention and Evolution of Paper and Ink.*** *The excerpt is quite helpful for you to explore the origin and development of printing.*

1) The Invention and Evolution of Paper

Printing is a process for the transferring of words or images from a printing plate onto a substrate using ink. Paper and ink are the major raw materials used in printing. The invention of these materials was thus instrumental in the invention of printing.

In ancient Chinese printing, the use of paper was preceded by other materials that appeared a great deal earlier. From the Neolithic age to the Shang, Zhou, Warring States, and Han periods, clay, silk and other textiles, as well as various metals were used widely as printing substrates.

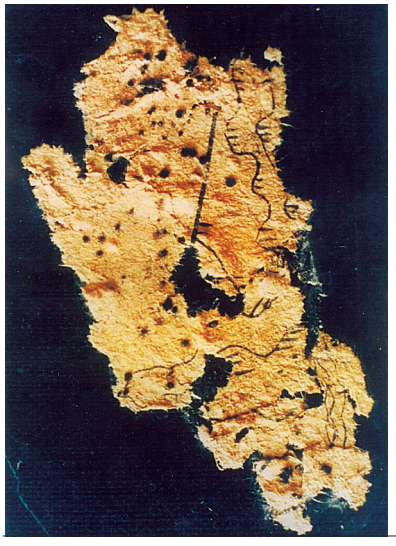

Figure 1.4.1: A paper map from the Western Han Dynasty. Unearthed at Fangmatan, Tianshui, this artifact dates back to between 176 BCE and 141 BCE.

Figure 1.4.2: A sheet of paper with writing from the late Western Han period, unearthed from the Xuanquan remains, Dunhuang, in 1990.

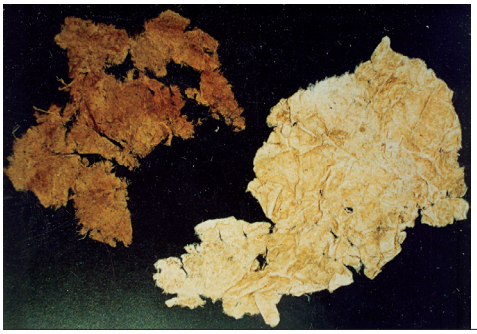

Figure 1.4.3: Paper from the Western Han Dynasty. The piece on the left is Jinguan paper unearthed at Juyan in 1973; the piece on the right is Maquanwan paper, unearthed at Dunhuang in 1979.

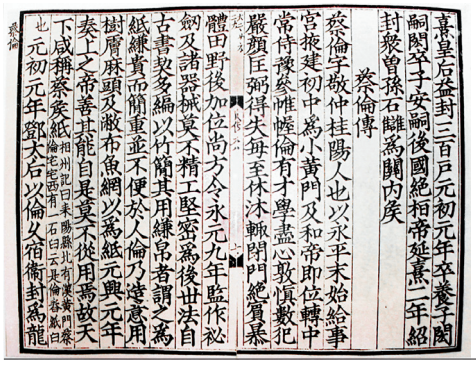

Figure 1.4.4: An ancient woodblock-print of the Book of *the Later Han*. The section in the figure contains an account of CAI Lun's papermaking technique.

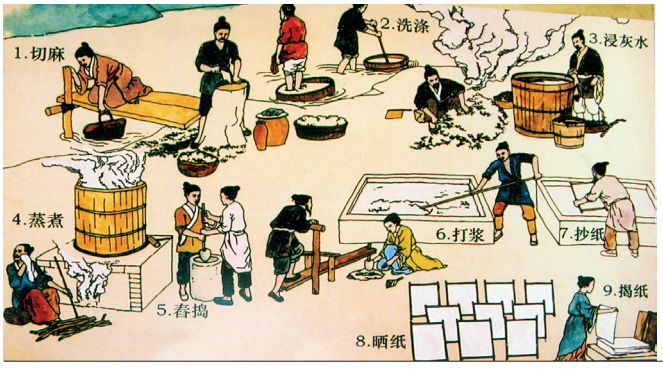

Figure 1.4.5: A picture showing how paper was made in the Han Dynasty.

The earliest paper has been dated to 8 BCE. The use of paper sheets began to appear in records towards the end of the Western Han Dynasty. Early paper was made of various materials. All kinds of raw materials were used, depending on their availability in a particular region. Hemp was the most important in the early centuries. It was joined by paper mulberry (chu), mulberry bark, and rattan in Tianhe centuries before the Tang Dynasty. According to the *Book of Han*, paper was used in the imperial harem for the wrapping of medicinal pellets in the first year of the Yuanyan era of the Western Han Dynasty. At the time, the paper was referred to as "He Ti".

By the reign of the Guangwu Emperor LIU Xiu, the restorer of the Han and founder of the Eastern Han Dynasty, the royal book collection was divided into silk books, bamboo slips, and paper books. Over recent decades, the Western Han Dynasty paper sheets unearthed from Fangmatan in Tianshui, Maquanwan in Dunhuang, and Xuanquan in Dunhuang (figures 1.4.1, 1.4.2 and 1.4.3) have proven that the application of paper sheets began in the early years of the Western Han Dynasty, or in other words, the second century BCE. Early paper sheets were expensive to make and few in number, which made their widespread application impossible. Paper only really became a major writing medium with the invention of the much higher quality "Duke CAI Paper". In the first year of the Yuanxing era (105 BCE) of the reign of the Emperor He of Han, CAI Lun made a high quality hemp paper using bark of trees, remnants of hemp, rags of cloth, and fishing nets (figures 1.4.4 and 1.4.5). CAI Lun's refinement of the papermaking process introduced more raw materials and allowed for the creation of paper sheets that were higher in quality. This invention was thus of major significance in the development and evolution of papermaking. Moreover, CAI Lun's paper won the praise of the emperor, which was also conducive to the spread of paper sheets at that time. Although paper was in use throughout the entire Eastern Han Dynasty, it tended only to be used in small quantities, and bamboo slips remained the prevalent medium for the production of books at the time. By the later years of the Eastern Han period, the quality of paper was already high, and the number of varieties had increased as well. However, owing to the traditional preference of bamboo over paper, people were still generally unwilling to use paper. In the last years of the Eastern Han Dynasty, ZUO Bo (who also went by the name Ziyi), a native of Shandong, became renowned for the exquisite paper he made, which was praised as being "beautiful" and "marvelous". By the Western Jin period, paper was already being applied widely. According to the *Book of Jin-Life of Zuo Si*, after ZUO Si completed his *Three Capitals Rhapsodies*, which took him 10 years to write, the demand for the book among the nobility was so high that it caused paper prices in Luoyang to rise. The Jin Dynasty scholar FU Xian once wrote a book entitled "*Ode to Paper*" in which he lavished praise on paper. At that time, paper had become an indispensable tool that no intellectual could do without. By the Southern and Northern Dynasties period, paper had replaced bamboo and silk as the major writing medium, signaling that the age of the paper book had begun. In the Sui and Tang Dynasties, more mature papermaking techniques, higher paper quality, and larger output created sound conditions for the invention of printing.

2) The Invention and Evolution of Ink

China has a very long history of using ink. Colored pottery dating back to

the late Neolithic period more than 5,000 years ago was decorated with various patterns using pigment. These pigments were most likely made from natural plant extracts or minerals, and black pigments were most probably made from graphite. Tools for the grinding and mixing of pigment (figures 1.4.6 and 1.4.7) have been unearthed from Neolithic ruins, such as those associated with Yangshao Culture and Majiayao Culture. Natural dyes made from plants were used widely in the Shang and Zhou periods. The book *Rites of Zhou-Terrestrial Offices* contains mention of a grass that was used to make dye. Varieties of dye plant that were being used at the time included madder and purple gromwell. The first records of "ink" are found in *Zhuangzi*, which dates back to the Warring States period. *Zhuangzi* contains the following passage: King Yuan of Song wanted to have his portrait painted. His many painters arrived at the court and knelt before him. After hearing the king's command, the painters stood up beside the king. They then wet the brush and mixed the ink. In the passage, the term "mixed the ink" refers to the act of grinding a stick of ink in water. The oldest ink to be found so far is a block of ink unearthed in 1975 from a tomb dating from the Warring States period to the Qin Dynasty in Yunmeng County, Hubei Province. An inkstone and a piece of stone used for grinding ink were excavated from the same tomb. The inkstone and rock both have signs of wear as well as traces of ink, and therefore fit the description of mixing the ink that is given in *Zhuangzi*. This serves as evidence that artificial ink and inkstone to grind ink were in use well before the Qin Dynasty. A number of ink balls and an inkstone were once excavated from a Western Han Dynasty tomb in Guangzhou belonging to the Nanyue King. There is a piece of stone located on the inkstone that was used for the grinding of the ink. Analysis shows that the ink was made from pine soot (figure 1.4.8). In 1965, fragments of five pieces of ink dating back to the Eastern Han period were unearthed in a Han tomb located in Shan County, Henan Province. Records show that there were large numbers of ink workshops during the Eastern Han Dynasty (figures 1.4.9 and 1.4.10). There were also government-run organizations and personnel for the administration of paper, brushes, and ink. The provision of ink to officials was done on the basis of rank. The first documented master ink maker was WEI Dan, who lived during the Three Kingdoms period. There was a saying that only a tiny bit of ZHONG Jiang's (another name for WEI Dan) ink was needed to make a deep shade of black. WEI Dan's ink formula remained the formula of choice for a considerable period of time that followed. The book *Qi Min Yao Shu* (Main techniques for the welfare of the people), which was written by JIA Sixie in the Northern Wei period, contained a section entitled "Methods for Making Ink". This demonstrates that mature and highly advanced ink making techniques were already available by the Southern and Northern Dynasties period.

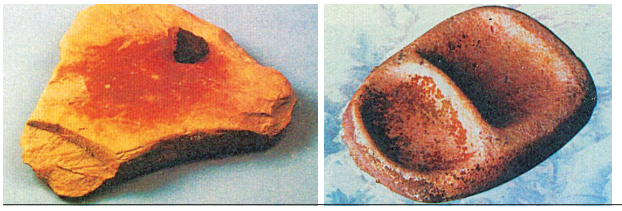

Figure 1.4.6: A stone grinding plate from the Neolithic age.

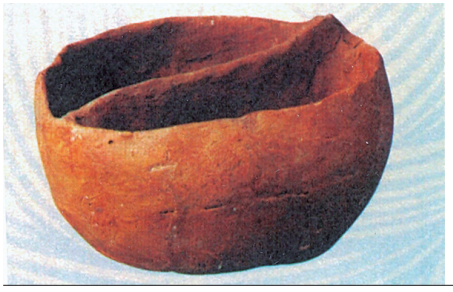

Figure 1.4.7: A two-section pottery container for mixing pigment. Characteristic of Majiayao culture.

Figure 1.4.8: A Western Han Dynasty inkstone, grinding stone, and ink balls unearthed from the tomb of the Nanyue King in Guangzhou.

Figure 1.4.9: Pine-soot ink dating back to the Eastern Han Dynasts, unearthed in Guyuan, Ningxia, in 1974.

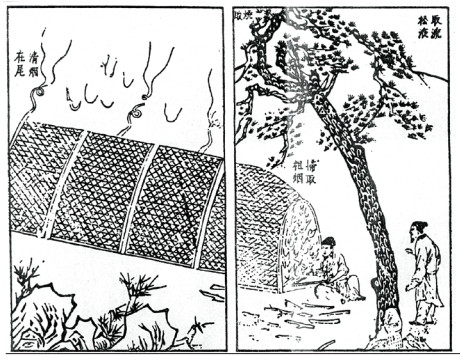

Figure 1.4.10: A picture depicting the production of ink from pine soot, selected from Tiangong Kaiwu.

Task 5 Reading comprehension

(Students are required to imitate this dialogue and to answer all the questions raised in it)

Irene:	Let me test you two first. What were the printing materials before paper?
Collete:	I don't want to answer it now. I suggest that each of us raise as many questions as we can. Then we can initiate an online forum so that other students can join us and share each other's wisdom.
Evan:	Oh, there's a brilliant idea, Collete. It's my turn to pose some questions: First, please explain what "He Ti" refers to in ancient times. Then, can you list book categories in the Han Dynasty?
Collete:	Now my question is: Now that the invention of paper can be traced back to before the Han Dynasty, why was paper not widely used then?
Irene:	Who do you think is the real first inventor of paper? Was it Duke CAI Lun? Let's share your knowledge and wisdom!
Evan:	How many people can be mentioned as contributors to the refinement of paper?
Irene:	So up to now we know that paper was invented, widely spread and used in the Song Dynasty. We still need to figure out the other foundation of printing.
Collete:	Sure. Let's make clear how ink was invented and evolved, agreed?
Evan:	I couldn't agree with you more. I also have interest in the invention of pigment. Who'd like to give an explanation of that based on the reading excerpt?
Collete:	I am waiting for the forum online. But I'd like to add other questions here too: What are the four treasures of the Chinese studio? How did the ink stone evolve?
Irene:	Hey, guys, too many questions will get on other people's nerves. So how about leaving it there for this forum?
Collete:	OK. Let's start the online discussion.

Task 6 Translation practice

(Students are required to translate the following Chinese paragraph into English individually, in pairs or in groups)

Evan: Oh, I really appreciated that reading excerpt. Without paper, what would our modern society be like? Maybe human beings would live in a very primitive era, and all the generations could not pass down to the younger generations effectively. Your Chinese ancestors were really outstanding in ancient times.

Irene: Frankly speaking, I totally agree with you. I also appreciate your comment on our ancestors. We are all proud of our glorious ancient civilization.

Collate: Oh, I couldn't agree more. But we'd better get on with the job. Don't forget Professor Walter's instruction.

Irene : You mean his assignment?

Collate: Sure. He asks us to amass and build up our knowledge little by little so that we can really have a thorough grasp.

Evan: I think so too. I just saw a Chinese passage and I really would like to get its English equivalent. Maybe you ladies could help me!

Irene: OK. Let's do the translation together so that we can prepare how to discuss Chinese printing in English. Everybody knows that English and Chinese belong to two quite different language families. So word for word translation will not work. So we need to consider how we can best translate Chinese concepts into English clearly, accurately and beautifully. So finally let's get started.

有了文字之后，最重要的就是要有一个很好的载体。古代埃及人利用尼罗河的纸草来记述历史；在古代的欧洲，人们还长时间地利用动物的皮，比如羊皮，来书写文字；而在中国，在造纸术发明以前，甲骨、竹简和绢帛是古人用来供书写、记载的材料。但是甲骨、竹简都比较笨重，秦始皇一天光阅读奏章，就要整整一车；绢帛虽然轻便，但是成本非常昂贵，也不适于书写。到了汉代，由于西汉的经济、文化的迅速发展，甲骨和竹简已经不能满足发展的需

求了，从而促使了书写工具的改进——纸被发明出来了。早期的纸张价格贵、数量少，难以推广使用，其真正用于书写是在蔡伦造出质地优良的“蔡侯纸”之后。东汉时期宦官蔡伦利用树皮、废麻、破布、旧鱼网等原料，造出了优质的麻纸。这一工艺改进扩大了造纸原料，提高了纸张质量。自从造纸术发明之后，纸张便以新的姿态进入社会的文化生活之中，并逐步在中国大地传播开来，以后又传播到世界各地。纸的发明是中国在人类文化的传播和发展上，所作出的一项十分宝贵的贡献，是中国史上的一项重大的成就。

Task 7 Attend Professor Jason's public lecture on Early Techniques of Duplication

Lecture 1

Early Techniques for the Duplication of Images

Professor Jason

Hello, my name is Jason Shaw. Today it is my privilege and my pleasure to introduce you to the interesting and complex history of Chinese printing. The Beijing Institute of Graphic Communication, in conjunction with various noted scholars and historians, has developed this series of lectures in order to inform and educate you concerning this topic. The study of printing will not only open up a historical window into the past, but will also help you to better understand the development of Chinese civilization and culture leading up to today, and just maybe, give you a glimpse into the possibilities of what the future may bring.

Modern printing in China has come a long way. However, in order to gain a full understanding of how this industry developed to the point it is at today and look forward to tomorrow, it is first necessary to gain a historical perspective of the various techniques and advances that brought us to where we are. So here we go.

The art of printing would not have been possible without the development of two major techniques, those being carving and transferring. Carving is exactly what you think it is, producing an aesthetically pleasing object or design by cutting into or shaping a hard material.

On the other hand, transferring is the ability to convey a drawing or