

Hydraulic Economy and Logographic Writing in Ancient China: Factor of Topography

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Abstract

Chinese civilisation is characterised by two distinctive features – a strong centralised administration and the system of logographic writing. This paper investigates nature's powerful impacts on human development, in terms of organisation and communication in ancient China. It argues that ancient China's topography played a crucial role in the formation of ancient Chinese civilisation and its hydraulic economy pushed the state stronger than society, hence a strong centralised government emerged.

Keywords: topography; hydraulic economy; Ancient Chinese civilisation; central government; Chinese writing development

1. Introduction

China has four thousand years of civilisation and was one of the earliest sites inhabited by organised groups of human beings. The ancient Chinese civilisation took root in the lower Yellow River valley of northern China, namely in Dadiwan, Yangshao, Majiayao and Longshan because of a kind of special yellow clay called *loess* found in this area: a type of soil found in only a few other places in the globe. From Neolithic times (New Stone Age –12,000 years ago) to the present, people of this region have made pit dwellings or cave homes (*yaodong* in Chinese) in the fine, yellow, windborne loess soil that covers about 100,000 square miles of China's north to a depth of about 150 feet (Fang, 2012). Loess has a quality of vertical cleavage, ideal for this purpose. These cave homes on the side of loess cliffs are cool in summer, and warm in winter. Loess soil is also made air-borne by the strong seasonal winds which blow between the high plateaus of Central Asia and the Pacific Ocean. This process, which has gone for hundreds of thousands of years, has built up loose soil that covers successive layers of grass, thus retaining their minerals. The result has a sponge-like quality and is easy to work with. It is also quite fertile where water is available. It was in this loess territory that the proto-Chinese people made a decisive step from being primitive nomad – drifting through life by their hunting and food-gathering needs – to a sedentary life of organised agriculture, involving crop cultivation, the domestication of animals for food and work, pottery, silk production, textiles, and villages. In this manner, the landscape in China has been transformed over thousand years by human habitation. While the surface layer of loess made the lower Yellow River valley fertile for agriculture, the ingenuity that enabled the Chinese people to feed its population exacted a significant ecological toll – yet this itself had a significant impact on early Chinese development. The early inhabitants' attempts to control the devastating floods of the Yellow River contributed directly to the establishment of a centralised authority, and the development of China's unique writing system, as well as specialised division of labour, the formation of a state and the dynastic principle of hereditary rule.

2. Floods

The way that Chinese civilisation adapted to the physical environment has influenced its development in many aspects. Recent archaeological discoveries reveal that wild plants such as millets and rice were domesticated before 7000 BC (Makeham, 2008). Over six thousand years ago, the origins of this ancient civilisation emerged along the Yellow River valley, firstly spreading across the north of China, to roughly the area of the today's Mandarin-speaking region, including contemporary Henan, Hebei, Shaanxi, Shanxi, and Shandong Provinces. After this, Chinese society spread southward and eastward, to the coastline towards and beyond the Yangtze River area, to the areas that are now contemporarily known as Jiangsu, Zhejiang, Anhui, Hubei, Sichuan, Hunan, Jiangxi, Fujian, Guangdong, Guangxi, and Guizhou Provinces. In the heart of this ancient civilisation, the Yellow River valley – affectionately referred to by contemporary Chinese as the cradle of the Chinese civilisation – the early settlers undertook deforestation for living and farming. The consequent erosion throughout the centuries changed the face of the country, and erosion is still a major problem today. The river is extremely prone to flooding. It has flooded 1,593 times in the last 4,000 years, while its main course has changed twelve times, with at least five large-scale changes from 602 BC to present. These course changes are due to the large amount of loess carried by the river and continuously deposited along the bottom of the river's canal. The Yellow River is by far the muddiest river in the world, with its average silt concentration being thirty four times higher than that of the Nile (Pan, 1985, p.9). This sedimentation causes natural dams to slowly accrue. These sediments later deposit in the lower regions of the river, elevating the riverbed in some places from fifteen to thirty feet higher than the surrounding terrain. It is in this way that it has become the famous “river above ground” (Fang, 2012, p.13). Eventually, the enormous amount of water has to find a new way to the sea, causing a flood and thus forming a new valley. As this phenomenon was unpredictable, flooding often caused difficulty to the nearby farmers.

3. The Legend of Yu

Yu the Great is one of the legendary Three Sage-Kings and Five Virtuous Emperors of the ancient Chinese civilisation, enjoying an equal reputation with Yao and Shun. Legend has it that some five thousand years there was a terrible flood in the Yellow River which washed away whole villages with their houses and inundated large areas of cropland. Many people lost their lives in the flood and those who were fortunate enough to survive were forced to abandon their homes and go and live on hillsides. Because tending crops, weaving, and fashioning pots required different sorts of technical and social skills to those for hunting and gathering food, it is most likely that skilled elders began to vie with hunters and warriors for leadership, which became more and more based on wisdom rather than physical strength. At that time, the leader of the federation of the tribes was the ancient sage king named Yao, who at once summoned together the chieftains of all the tribes to discuss how to get the flood under control. At the meeting, a man named Gun was elected by unanimous vote to take charge of the plans. Under Gun's leadership, the people spent nine long years building dams and dikes to stop the flow of the rivers. All the efforts, however, ended only in more disastrous floods. It happened more than once that no sooner was a dam or dike built than it was destroyed by flood which carried sands and mud downstream until the mouth of the Yellow River was choked up and the afflicted areas became larger and larger while the number of victims increased (Sima Qian, n.d.). By this time Yao himself was getting very old and so he yielded his place to one named Shun who attached great importance to flood control, personally visiting work sites for inspection. When he found that Gun had failed in his mission, he first had him incarcerated on Feather Hill and then killed. Oddly, even three years after Gun was killed, his dead body showed no signs of putrefaction, and when someone cut it open, out jumped a boy called Yu. Everyone believed that Yu was the son of a god, and an ingenious, capable and peerless hero (Birrell, 1993).

When he grew up, he was determined to have the flood under control and remove the menace to the people. He left his newly-wedded wife behind and set off for the work site. Yu first made a study of the causes that had led to his father's failure. Then he made a careful survey of the afflicted areas and asked for advice from experienced workers. Knowing that water tends to flow from higher to lower regions, he abandoned Gun's method of building dams and dikes to stop the flow of waters. Instead he led his men in digging ditches and canals to divert the waters. He also directed them in dredging the river channels so as to provide outlets for the floods into the sea. To better handle the people and eliminate the possibility of losing large numbers of people at once, he divided the people into nine sections and dispatched them into different areas. In order to cut a canal into the mountain, Yu turned himself into a bear, braving most of the force to accomplish this task.

Eventually, he succeeded in cutting a canal through Mount Longmen and thus made it possible for the water to flow by way of this canal into the sea. Rain or shine, Yu worked in the midst of his men. His face became sunburnt and his body wiry and thin. Even the hair on his calves wore away. But he was so dedicated that it was said that he had three times refrained from entering the door of his home when he was passing by. One story even has it that he happened to be passing the door when his wife was giving birth to his son Qi. He heard the baby crying, but in order to get the flood under control as early as he could, he continued walking (Birrell, 1993). Thus after thirteen long years of continuous efforts, Yu and his men succeeded in dredging all the rivers, big and small, and in doing away with the evil of the flood. Those who had gone to live on the hillsides or who had migrated to remote places could now come back to where they had originally lived. Under Yu's leadership, they tilled the land and planted crops and developed agricultural production. As a result, people were beginning to lead a good life.

4. Establishing Xia Dynasty

Yu was held in great reverence by all the tribes, who now addressed him as Yu the Great. Shun was convinced that Yu had both fine qualities and great competence and so recommended him as his successor. After the death of Shun, Yu became the head of the tribal confederation. Yu divided the land into "nine provinces" and "five zones of submission" that ran concentrically from the capital (Makeham, 2008, p.61). Later his own son Qi appointed himself as Yu's successor, and it was Qi who further consolidated the centralised authority by establishing the first dynasty – the Xia dynasty (ca. 2070–1600 BC). In the south of China, the countryside is far more broken up with mountains, and strong currents of the Yangtze and its branches. Until the mid-twentieth century, the Yangtze could only be crossed by boats, and the main north-south railway was disrupted and the trains had to be ferried across the river and reassembled on the other side, with the whole procedure requiring two to three hours. The isolation of the numerous, small populations caused by the rivers and mountains is reflected in the great variety of mutually unintelligible dialects spoken in different communities. Nevertheless, the necessities of irrigating their rice farms and controlling the flood waters, just like in the Yellow River valley, taught the inhabitants the need for cooperation and a higher authority to adjudicate the disputes and solicit fair shares in maintaining the water, such as building and repairing dikes. Of all the factors necessary for the successful cultivation of crops in preindustrial society, only water (as opposed to temperature and weather), to certain degree, could be controlled through human effort (Dreyer, 2010, p.41). The need for irrigation and flood control meant that a large quantity of water had to be channelled and kept within bounds.

Dikes had to be built and maintained, canals dredged regularly, and information relevant for navigation had to be compiled and distributed. This could be done only through the use of mass labour, which had to be coordinated, disciplined, and led. Effective water management required an organisational web that had power over the whole or at least the dynamic core of the country's population. Timekeeping and calendar making were likewise indispensable for the success of hydraulic economies: crops must be planted, irrigated, and harvested within fairly narrow periods of time. Systematic observation, careful calculation and collaboration and dissemination of necessary information were needed. Consequently, those who controlled the network of labourers, calculators, and disseminators were in very powerful positions. John King Fairbank (1981) points out that "the institution of compulsory corvée labor, the people at the behest of the government, became well established in China" because "irrigation ditches and river dikes must be maintained throughout their length", and consequently, "irrigation and flood prevention, to be effective, must be under central control" (p.29). The state had to be stronger than society, and hence China needed a strong centralised government. Thus, the significance of the establishment of the Xia dynasty has to be understood in this context. The Xia is believed to be the first prehistoric dynasty, lasting from about the twenty-first to the sixteenth century BC. Until scientific excavations were made at early bronze-age sites at Anyang, Henan Province, in 1928, it was difficult to separate myth from reality in regard to the Xia. But since then, and especially in the 1960s and 1970s, archaeologists have uncovered urban sites, bronze implements, and tombs that point to the existence of Xia civilisation in the same locations cited in ancient Chinese historical texts. Sceptics argue, however, that such discoveries are biased on a "circular logic that first assumes the existence of Xia and then identifies it with whatever sites best fits the predetermined parameters" (Makeham, 2008, p.62). At minimum, the Xia period, located at the nexus of legend and history, marked an evolutionary stage between the late Neolithic cultures and the typical Chinese urban civilisation of the Shang dynasty (1766–1122 BC).

5. Development of Writing

Chinese writing may be the world's oldest continuously used script. According to legend, before writing was invented, the tribal people kept records by tying knots in strings. It was during the rule of these tribal chiefs that writing was invented. During this time, people also began to raise silkworms, cultivating and spinning silk, and so textile clothing replaced the animal skins and tree leaves worn up to that time. The invention of characters is traditionally credited to Cangjie, who, naturally, is a very important figure in ancient Chinese history (ca. 2650 BC). Apart from being accredited as the inventor of Chinese characters, he was an official historian of the Yellow Emperor. Legend has it that he had four eyes and four pupils, and that when he invented the characters, the deities and ghosts cried and the sky rained millet. From this, it can be seen that he is considered a legendary figure rather than a historical figure. According to legend, the early Chinese people were being terribly dissatisfied with the "string knot tying" method of recording information. Cangjie was given the task of creating characters for writing. Cangjie then settled down on the bank of a river, and devoted himself to completing the task at hand. After devoting much time and effort, however, he was unable to create even one character.

One day, Cangjie suddenly saw a phoenix flying in the sky above, carrying an object in its beak. The object fell to the ground directly in front of Cangjie, and he discovered it to be an impression of a hoof-print. Not being able to recognise which animal the print belonged to, he asked for the help of a local hunter passing by on the road. The hunter told him that this was, without a doubt, the hoof-print of a pixiu (a Chinese mythical hybrid creature), it being different from the hoof-print of any other beast alive. His conversation with the hunter greatly inspired Cangjie, leading him to believe that if he could capture in a drawing the special characteristics that set apart each and every thing on the earth, this would truly be the perfect kind of character for writing. From that day forward, Cangjie paid close attention to the characteristics of all things, including the sun, moon, stars, clouds, lakes, oceans, as well as all manners of bird and beast. Consequently, he began to create characters according to the special characteristics he found. Before long, he had compiled a long list of characters for writing. To the delight of the emperor, Cangjie presented to him a complete set of characters. The emperor then called the head of each of the nine provinces together in order for Cangjie to teach them this new writing system (Sima Qian, n.d.; also see Fang, 2012 and Birrell, 1993).

No one is able to verify this legend, but Yu the Great's organisation and coordination of a large number of labourers for flood management across vast areas seems to support the evidence of some sort of written means of communication, as it is hard to imagine that he could accomplish the task only using only oral communications. Late Neolithic pots (ca. 4800–4000BC) also sometimes have marks on them that some scholars believe are early forms of writing. Thus, it is believed that the bronze vessels bore witness to the early stage of Chinese writing development. These vessels were made for offering food and millet wine to ancestors during court rituals. By the end of the Shang period, some of them began to bear very short inscriptions, generally consisting of two or three characters that formed a clan-name. Writing must have been invented much earlier, but the early stages of its development cannot be traced, probably because writing was done on perishable materials like silk, wood, or bamboo. Not until the oracle bones from the Shang dynasty, however, is there solid evidence of full sentences. Oracle Bones are the earliest example of Chinese writing we have, dating from the late Shang period (ca. 1200 BC). They are called oracle bones because the writing deals with divination and is carved on bone – ox scapula and tortoiseshell. Hence they are called in Chinese "shell-bone script". The oracle bones have taught scholars much about the Shang dynasty. About 150,000 of these were found, mainly in Anyang, Henan Province in 1928. There are about 3,000 ancient ideographs so far identified, about half of which are recognizable as precursors of modern Chinese characters. Oracle Bone Script is one of the oldest known forms of Chinese written language.

According to recent archaeological research, some of them can date back as far as 4,800 years ago. It is believed that the diviner wrote the question he wanted answered on one the bones. A heated rod was then inserted into in the bone until the bone cracked, producing lines or cracks that could be interpreted to provide the answers. After the cracks were read, they were typically inscribed using a bronze knife, in what is known as "shell-bone script". Sometimes the prognostication and the outcome were also recorded. The oracle bones are the earliest known significant corpus of ancient Chinese texts, and contain important historical information such as the complete royal genealogy of the Shang dynasty. These records confirmed the existence of the Shang dynasty, which some scholars, doubted until the discovery of these bones (Fang, 2012, p.17). The bones or shells were first sourced, and then prepared for use.

Their sourcing is significant because some of them (especially many of the shells) are believed to have been presented as tributes to the Shang, which itself provides valuable information about diplomatic relations of the time. We know this because notations were often made on them recording their provenance (e.g. tribute of how many shells from where and on what date). For example, one notation records that “Que sent 250 tortoise shells”. These notations were generally made on the back of the shell’s bridge (called bridge notations), the lower carapace, or the tail edge. Scapula notations on ox bone were near the socket or a lower edge. Some of these notations were first written with a brush, and then carved with a knife, proving (along with other evidence) the use of the writing brush in Shang times. Unlike the tortoise shells, scapulae are assumed to have generally come from the Shang’s own livestock, perhaps those used in ritual sacrifice, although there are some records of cattle sent as tribute as well, including some recorded via marginal notations.

The bones or shells were cleaned, and then prepared by sawing, scraping, smoothing and even polishing, to create convenient, flat surfaces. The predominance of scapulae and later of plastrons is also thought to be related to their naturally formed large, flat surfaces that needed minimal preparation. There is also speculation that only female tortoise shells were used, as these are significantly less concave. Pits or hollows were then drilled or chiselled partway through the bone or shell in orderly series, with the shape and depth helping to determine the nature of the crack that would appear. At least one such drill has been unearthed at Erligang, exactly matching the pits in size and shape. The shape of these pits evolved over time, and is an important indicator for dating the oracle bones within various sub-periods in the Shang dynasty. The number of pits per bone or shell varied widely. So far, more than 150,000 fragments constituting about 7,000 scapulas and plastrons have been discovered. Over a quarter came from a single location, strongly suggesting a deliberate “safe deposit” for storage. Among the three thousand identified characters, about half have been “deciphered”, revealing that “the Shang people had some knowledge of astronomy, knew precisely the length of the year, had invented intercalary month, and divided the day into periods” (Sullivan, 2008, p.20). The age of the bones spans some 3,000 years, dating from the late fourth millennium BC Longshan Neolithic culture to the Zhou dynasty (1046-221 BC). But it was the Shang who standardised the use and valued them as instruments of record.

	oracle bone <i>jiaguwen</i>	greater seal <i>dazhuan</i>	lesser seal <i>xiaozhuan</i>	clerkly script <i>lishu</i>	standard script <i>kaishu</i>	running script <i>xingshu</i>	cursive script <i>caoshu</i>	modern simplified <i>jiantizi</i>
rén (*nín) human								
nǚ (*nraʔ) woman								
ěr (*nəʔ) ear								
mǎ (*mraʔ) horse								
yú (*ŋa) fish								
shān (*srān) mountain								
rì (*nit) sun								
yuè (*ŋwat) moon								
yǔ (*waʔ) rain								
yún (*wan) cloud								

6. Conclusion

According to the theory of hydraulic economies as discussed above, the state had to be stronger than society, and hence China needed a strong centralised government and an effective writing system for communication and recording and keeping information. Although phonetic systems would make this task easier, the system of ideographs or logographic writing had its advantage to communicate with a wide range of peoples whose spoken languages were different to one another. The so-called “shell-bone script”, which belongs to the Shang dynasty, authenticates what is said in the Cangjie legend, vindicating the textual tradition of China, validating the claim of the centrality and superiority of the Yellow River valley as the cradle of the Chinese civilisation. Nevertheless, we have to understand the capricious nature of the survival of relics, which are often found accidentally. Should a lack of evidence in terms of archaeological discovery be taken as proof that a part civilisation never existed, or simply that little to nothing of it survived? Is it reasonable to argue that Chinese writing suddenly began in the Shang period? Or is it more sensible to infer that writing must have occurred earlier in the Xia period, but on perishable materials such as bamboo, wood and silk? Because of the linkage of this ancient writing to the contemporary writing, the archaeological discovery of these bones and plastrons handsomely acknowledges the claim, beyond any doubt, of China’s three to four thousand years of continuous civilisation. Literacy is always an ally of political control and moral cultivation, facilitating communication across an expanding realm. The Xia and Shang periods marked the beginning of China’s dynastical cycle, in which an emerging new dynasty would unify the country, with its centralised rule leading to a period of high development and success, only to be followed by a period of decline, chaos and confusion. And so the cycle continued, with crisis making way for a new dynasty to emerge.

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