ANCIENT METALLURGY IN VIETNAM: AN ETHNO-ARCHAEOLOGICAL INVESTIGATION

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ABSTRACT

The Bronze Age in Vietnam was a formative phase in social development constituting the change from Neolithic farming villages to Iron Age proto-states. New technologies such as metallurgy played a central role in this development. Vietnamese archaeologists have established indigenous metalworking in the Red River Valley as early as the Dong Dau period (between 2850 and 3250 uncal. BP). This paper describes the archaeological evidence for indigenous metalworking in Vietnam, along with the results of recent ethnographic research in three contemporary metal casting villages in Vietnam which provide new insights into the technology and the organisation of labour during this important period of Vietnamese prehistory.

INTRODUCTION

In Vietnam, the period from the latter part of the first millennium BC and the first centuries AD was marked by increasing social complexity, evidenced by the emergence of elites and craft specialization. These socio-economic changes are linked to the development of wet-rice agriculture, which produced the surpluses required to support craft specialists. The same period of prehistory was also marked by improved pottery and stone working techniques as well as the development of metallurgy in three different regions of the country. These were Trung Trung Bo (north Vietnam) with the Dong Son culture, Nam Trung Bo (south-central Vietnam) with the Sa Huynh culture, and Dong Nam Bo (southeast Vietnam) with the Dong Nai culture.

Craft specialization at the village level is a notable feature of the Red River Valley where specialization and trade have been traced back to the prehistoric period. Moreover, villages specializing in small-scale crafts such as stone working, pottery, paper making, rice husking, textile manufacture and metallurgy still exist in densely populated districts on the outskirts of Hanoi, where the earliest archaeological evidence for craft specialization has also been identified. This paper discusses the results of some recent ethnoarchaeological investigations into the processes involved in metalworking in the three metalworking villages of Vo, An Long and Che Dong. The research gives us a better understanding of the development of metallurgy and the organisation of metal production in Vietnam during the prehistoric period.

THE ARCHAEOLOGICAL EVIDENCE FOR INDIGENOUS METALLURGY

Two principal centres for indigenous metallurgical production have been identified in Vietnam: one is located in the Red River Valley of north Vietnam and a second in the Dong Nai Valley of southeast Vietnam. The earliest archaeological evidence for indigenous metal production in north Vietnam comes from Dong Dau sites in the Red River Valley, which are now dated between 2850 and 3250 uncal. BP (see the paper in this volume by Nguyen Quang Mien). Archaeological evidence for indigenous metalworking comes from mining sites and the specialized tools used in the casting process. Prehistoric mining sites with evidence for the extraction of cupreous ores have been identified in the Son Dong district of Bac Giang Province, and in Da Chong and Yen Cu in Hoa Binh Province.

The earliest casting mould to be found in Vietnam comes from Gom Mountain and is associated with a C14 date of 3950±250 uncal. BP. Large numbers of sandstone casting moulds have also been found at the sites of Dong Dau and Thanh Den, together with cupreous arrowheads, socketed spears, axes, chisels and fish hooks. Excavation at Thanh Den in Dong Dau district, Vinh Phuc Province, yielded 60 casting moulds, the largest number found thus far in any Red River region site. Thanh Den has 14 radiocarbon dates ranging from 3730±50 to 2500±90 uncal. BP. The moulds from Thanh Den are made of sandstone and terracotta. The concentration at this site has led scholars to conclude that Thanh Den was the main centre for metallurgy in the Red River region during the Early Bronze period. Casting moulds of the same type have also been recovered from the Go Mun period sites located in Ca Village, Phu Tho province as well as in Vac Village, Nghe An Province.

At the end of the Bronze Age and the beginning of the Iron Age in the south, indigenous metallurgy was centred in the Dong Nai River Valley. Dong Nai sites have produced more than 174 complete casting moulds and 24 fragments, 80% of which date to the first millennium BC. Excavations at the site of Doc Chua (Tan My village, Tan

Uyen district, Song Be Province) have produced 76 casting moulds, the largest number found in any site in Vietnam or elsewhere in Southeast Asia. The earlier of the two layers in this site is attributed to the Bronze Age, the second to the Iron Age. Two uncalibrated radiocarbon dates for Doc Chua are 2495±50 and 3145±150 BP. Casting moulds have also been found in large numbers in many other sites in the Dong Nai Valley. Excavations at Bung Bac produced 38 complete moulds, with smaller numbers recovered from Nui Gom, Dau Giay, Cu Lao Rua and Phu My.

The metalworkers in Doc Chua prepared sandstone moulds in two parts which fitted together exactly. These were joined together and secured with twine for the bronze pouring, then taken apart for future re-use. Cupreous slag and crucibles have also been found at Lang Ca in Phu Tho Province, at Thanh Den and Dong Dau in Vinh Phuc Province, at Dong Son in Thanh Hoa Province, and at Ru Tran and Go Me in Dong Nai Province. Remains of ancient furnaces have also been found at the sites of Dong Dau, Thanh Den and Luy Lau. Because of their material composition, furnaces do not often survive in the archaeological record and pits are often all that remains of the technology. The furnace from Dong Dau measured 1 metre in height (including the base).

Japanese archaeologist Nishimura Masanari has also found a piece of a terracotta mould used for manufacturing a Dong Son bronze drum during his excavations at Luy Lau (Bac Ninh Province) in 1999. This was part of a piece mould, of the type generally linked to Shang and Zhou sites in China.

Elemental analyses show that the earliest bronzes in the Vietnamese archaeological record are alloys of copper (Cu) and tin (Sn), while those from the Iron Age are alloys of copper, tin and lead. In the early Bronze period (Dong Dau, Go Mun cultures) there were four basic alloys, namely copper and arsenic, copper and tin, copper and antimony, and copper, tin and antimony. Pure copper was in use in the Dong Son period, together with 11 different alloys of bronze involving various combinations of copper with tin, arsenic and lead.

CONTEMPORARY BRONZE CASTING VILLAGES

Research was undertaken into the bronze casting equipment and techniques employed in three contemporary bronze casting villages in Vietnam. The village of Vo is located in Gia Luong district, Bac Ninh province, and has been producing cupreous metals for at least 100 years. The metalworkers (all male) do not smelt ores, but recycle bronze by re-casting small broken pieces. They produce bronze statuettes, bells, and small bronze screws.

Charcoal is used as fuel in the furnaces. Because it consists of almost pure carbon, it is ideal for the purpose as it promotes a strong reducing atmosphere. The villagers do not use bellows; instead, they heat the metal in a small earthen furnace constructed above ground level. The lower part of the furnace contains the fuel and a crucible, and casting moulds of clay are fired in the upper section. The furnace design is simple but very efficient in terms of thermal energy. The maximum capacity of the foundry is 200 kg and the firing temperature in the furnace is over 1600^0 C.

Metallurgical processes involve specialist knowledge and in Vo Village access to technical knowledge is strictly controlled. Metallurgical knowledge is restricted to village members; outsiders who wish to learn metallurgy must perform particular ceremonies before they are accepted as members of the group. In this way, technological knowledge remains secret and owned by the group. This binds the metalworkers together; they practice rituals together and often support one another through difficult times.

The second village, An Long, is a casting village situated on the banks of the Luoc River in Quynh Phu district, Thai Binh Province. The technology used by the villagers of An Long differs from that described above. Here, the moulds are made from semi-permanent materials such as bamboo and wood. A good mould can be re-used about 30-35 times before it becomes useless. At An Long, the villagers also use furnaces that are of simple design, but here they use bamboo tube bellows with cotton wad pistons, and clay tuyeres. With this design, the crucible used to melt the bronze is not completely covered, and consequently the melting temperature is not usually as high as that obtained in a closed furnace (normally from 1200^0C to 1600^0C). The craftsmen calculate the temperature of the furnace by the colour of the smoke.

The technology used by the villagers of An Long is very close to that used by Early Metal Age groups in the Red River Valley. The modern bronze workers use simple bamboo tools, and casting technology is very similar to that used by Early Bronze metalworkers. Moreover, the shape of bronze cooking vessels cast in the village of An Long is similar to the shape of ancient bronze drums.

The third village, Che Dong in Dong Son district, Thanh Hoa province, has similar casting practices to An Long. Both use re-usable moulds to cast the same types of cooking vessels, and in Che Dong they also use bellows. There is one important difference, however, between Che Dong and the other casting villages. The walls of the cooking vessels made in Che Dong are much thinner than those from An Long, and closely resemble Bronze Age drums with handles. To cast these vessels, the craftsmen have to pour the bronze directly out of the crucible into the mould while it is still very hot. An open air furnace situation is better suited for this task than a covered kiln-like furnace, since the process of pouring bronze is very quick, taking only a few minutes. This is the main difference between the methods used in Che Dong and the methods used in Vo Village.

CONCLUSIONS

The research shows that the organisation of production into small specialized villages remains one of the most important principles of social organisation in many

traditional villages of Vietnam. The archaeological evidence shows that it represents one of the first expressions of division of labour with the population divided into farmers, craftsmen and traders.

Metallurgy requires specialized chemical knowledge and practical skills. The ethno-archaeology shows that limiting technological knowledge to a small number of expert metalworkers represents an efficient means of increasing production and trade. Each specialized village retains its competitive advantage by keeping the knowledge secret. Village regulations not only strictly controlled production but each metalworking group controlled distribution with its own trade regulations which were strictly enforced. In this way, group ownership of the village land and the technology provided a stable background for economic and social development in traditional societies.

Our research established that trade villages have close blood relationships i.e. the relationship between Che Dong and An Long or Bang Chau village (Binh Dinh) is based on shared origins; they all originated from Dai Bai (Vo village – Bac Ninh).

The ethno-archaeological investigations show the significance of bronze metallurgy to the development of the first kingdoms in Vietnam. The local leaders were known as the "kings of metallurgy". The early rulers had considerable economic and military power. The states of the Hung King and the Thuc King developed in the period of Dong Son culture when craft specialization was well established in Vietnam; all of these kingdoms, including the Dian and Nam Viet kingdoms, had their foundations in bronze metallurgy.

Bronze tools excavated from archaeological sites in the Red River and Dong Nai regions show an important correlation between advances in metallurgy and advances in riziculture. The bronze sickles recovered from the site of Go Mun, for example, would have been far more efficient in rice harvesting than stone or shell tools used for the same purpose. The bronze tools would have enabled the stalks of rice to be cut cleanly and more quickly, thereby avoiding loss from falling grains.

The bronze axes cast at Doc Chua would have facilitated land clearing in the hilly areas of the Dong Nai valley which are used to grow rice and the coastal muddy regions of the delta around Bung Bac where these tools were also cast. Bronze weapons such as javelins and arrows cast at indigenous casting sites would have improved hunting and fishing dramatically.

The bronze tools also provided the ancient people with the means to undertake other handicrafts. For example, bronze axes and chisels enabled wood to be cut more efficiently, faster and more beautifully. Vestiges of wooden houses on stilts were found at Bung Bac and Cai Lang. The ethno-archaeological evidence described in this paper highlights the important socio-economic role that indigenous metallurgy has long played in Vietnamese society.