

ON THE COPPER AGE IN ANCIENT CHINA I.

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It has been generally believed that, in ancient civilized lands, the material civilization began at the age, in which stone implements were made use of, then entered into the metallic age and has come up to our days, passing through the ages of copper, bronze and iron implements, time after time. Now, it has also been stated by the relics unearthed from old sites that in ancient China there existed the stone age. As to the beginning of the bronze age in China, it is now supposed to date back to remote antiquity, though its absolutely exact period of appearance has been yet unknown. This fact is certified by a good deal of remains of those days which now exist, and it has been properly recognized that, in Chou dynasty (周代), various kinds of very exquisite bronze implements had already been manufactured. Further, in Chou-Li K'ao-Kung-Chi (周禮考工記) which is considered to be written in former Han (前漢) or before that dynasty—namely Ch'in dynasty (秦代) or Chan-Kuo period (戰國時代)—the following sentence can be found:—

金有六齊。六分其金而錫居一謂之鐘鼎之齊。五分其金而錫居一謂之斧斤之齊。四分其金而錫居一謂之戈戟之齊。三分其金而錫居一謂之大刃之齊。三分其金而錫居二謂之削殺矢之齊。金錫半謂之鑒燧之齊。

The Chinese classics above cited, displays the following meaning—that is, for bronze there are six mixtures according to their uses.

| | | | | | | | |
|---|---------------------|---|--------------------------|------------------------|---|---------------------|-------------------------|
| 6 | Parts of copper and | 1 | part of tin, is used for | bells and vessels etc. | | | |
| 5 | " | " | 1 | " | " | socketed axe-heads. | |
| 4 | " | " | 1 | " | " | halberds. | |
| 3 | " | " | 1 | " | " | swords. | |
| 5 | " | " | 2 | parts | " | " | arrow-heads. |
| 1 | Part | " | 1 | part | " | " | plane or concave |
| | | | | | | | mirrors. ⁽¹⁾ |

This sentence makes us to infer that, in those days, according to the purposes in which bronze was employed, the proportions between

(1) Metallic tools which were used for taking fire focussing the sun-light.

Chin⁽¹⁾ (金) and tin in bronze were astonishingly well studied, and it may be said that the proportions of those two metals and the way by which those alloys were employed, mentioned in above sentence, are almost quite right from the standpoint of the alloyage of the recent time, although there exist a few points to be corrected. In another chapter of Chou-Li K'ao-Kung-Chi (周禮考工記), the following sentence can be found:—

凡鑄金之狀。金與錫黑濁之氣竭黃白次之。黃白之氣竭青白次之。

青白之氣竭青氣次之。然後可鑄也。

This shows us the casting process of bronze in those days. In these words, we can find that even in those ancient times, the coloured flame reaction was properly utilised to decide the best chance for casting (casting temperature): namely, ancient Chinese founders performed the casting at the time in which copper was molten entirely and evolved the blue flame of copper.

Conclusively, we can say that at the time in which Chou-Li K'ao-Kung-Chi (周禮考工記) was written, they had already possessed quite advanced knowledge about bronze. Besides this, it has been considered that iron weapons in China were appeared at first time at the end of Ch'un-Ch'iu dynasty (春秋時代) or at the beginning of Chan-Kao period (戰國時代), and gradually increasing the use of them. And the age in which the most parts of weapons were made of iron, was considered to be about at the end of former Han dynasty (前漢代); therefore we can conclude that during the intervals of Ch'un-Ch'iu dynasty (春秋時代), Chan-Kao period (戰國時代), Ch'in dynasty (秦代) and the upper age of former Han dynasty (前漢代) there was bronze-iron age, and after the end of former Han dynasty (前漢代) the pure iron age in China first took its appearance. In archaeology, as a rule, the ages of stone, copper, bronze and iron being classified according to the materials used for weapons, of course it must be said that bronze was not given up to use for every tools except weapons even after the end of former Han dynasty (前漢代).

As was described above, the existence of the stone and the bronze age in ancient China has been admitted with certainty. But the exis-

- (1) Chin (金)—Here Chin means not gold but copper, in ancient China the whole metals were denoted by this letter Chin, and it was classified by colour into three species so-called San-P'in (三品)—that is, Huang-Chin (黃金), Po-Chin (白金) and Ch'ih-Chin (赤金)—and a little after, into five classes called Wu-Chin (五金)—namely Huang-Chin (黃金), Po-Chin (白金), Ch'ih-Chin (赤金), Ch'ing-Chin (青金) and Hei-Chin (黑金) or Hsüan-Chin (玄金). But, in general with a few exceptions, it also means copper alone. Perhaps copper was the most universal and representative kind of metals at that times; therefore copper was denoted by this letter Chin (金).

tence of the copper age in China has been considered in question, and even if it has really existed, its annalistic age would be beyond our imagination, on account of the want of copper implements which have never been discovered up to the present time (the word of copper does not mean chemically pure copper, but it means copper which is not artificially mixed with tin. Therefore it is allowable for the existence of other metals than tin, as impurities or from other standpoints).

As is well known, however, many remains of copper implements were discovered in ancient Egypt and other civilized lands, and it is said that in Egypt copper implements were used during long times, but this metal having been found too soft, several methods of copper-hardening were devised by Egyptian and after long and elaborated studies, bronze was at last brought into the world. In ancient China, therefore, the appearance of the bronze age after the stone age, skipping over the copper age, as is generally considered, seems somewhat improper, regarded from the orders of transition of utilization of metals. Taking these points in consideration, author has always suspected that the copper age must also have existed in China like in Egypt, although it has not been confirmed.

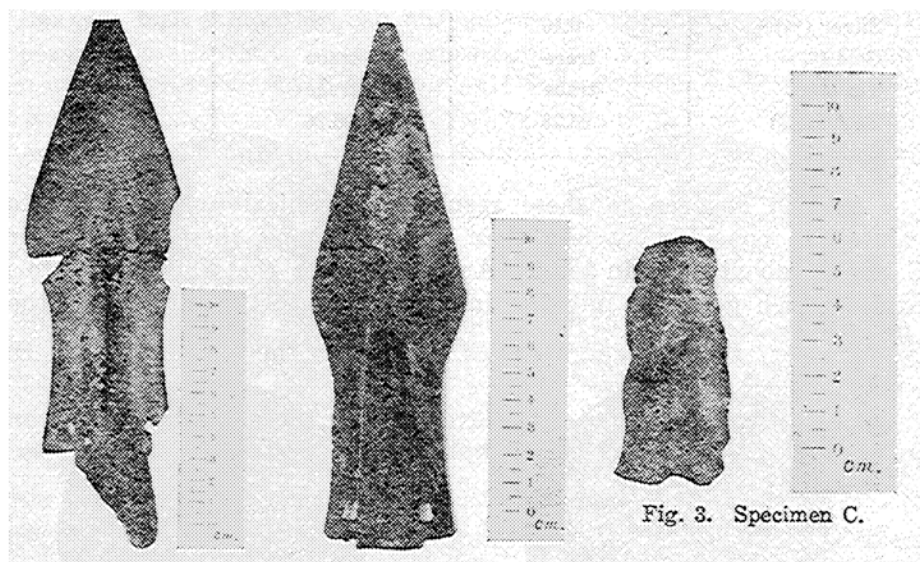


Fig. 1. Specimen A.

Fig. 2. Specimen B.

Fig. 3. Specimen C.

Quite recently author could have an occasion to carry out chemical studies of several crude spear-heads (Figs. 1, 2 and 3), for the kind deliverance of which he is very much indebted to the Archaeological

Institute of the Faculty of Literature of the Tokyo Imperial University. These spear-heads closely resemble with the relics recently unearthed from Yin site in Ho-Nan Province (河南省殷墟) in China. The results of the chemical analyses showed that these ancient Chinese spear-heads contain no significant amount of tin (indeed we could detect the metal only by arc spectral analysis, but as very faint lines). Now, author can conclude that these spear-heads must rather be called copper implements than bronze ones and thus he could here confirm that, in ancient China, there existed also the copper age like in ancient Egypt and other civilized lands. This will be in no less interest on the cultural history of China.

The results of the chemical analyses are as follows:—

| | Specimen A | Specimen B | Specimen C |
|--------------|------------|------------|------------|
| Sample (gr.) | 0.4770 | 0.4266 | 0.5020 |
| Copper (%) | 91.36 | 72.68 | 57.17 |
| Lead (%) | 2.90 | 22.38 | 26.78 |
| Iron (%) | 1.42 | 2.12 | 1.05 |
| Arsenic (%) | trace | 0.80 | trace |
| Silver (%) | 0.10 | 0.30 | 0.05 |
| Gold (%) | trace | trace | trace |
| Tin (%) | trace | trace | trace |
| Totals (%) | 95.78 | 98.26 | 85.05 |

As will be seen in these results of chemical analyses, the total values are considerably less than 100%; among these, the specimen C is only about 85% in total. Author believes that this is due to the oxides which goes far into the inner part of the material and, there-



Fig. 4. Specimen A (Surface).

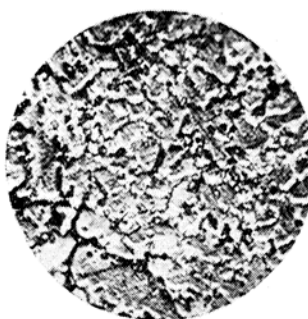


Fig. 5. Specimen A (Etched surface).

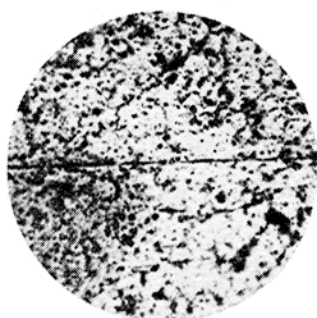


Fig. 6. Specimen A (Cross section).

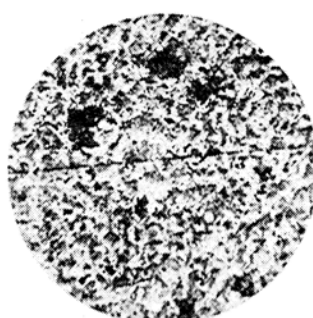


Fig. 7. Specimen A (Etched cross section).

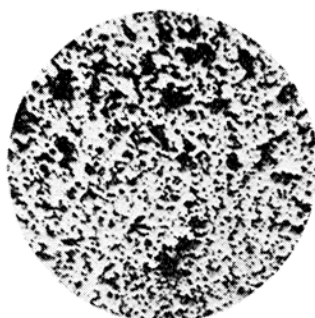


Fig. 8. Specimen B (Surface).

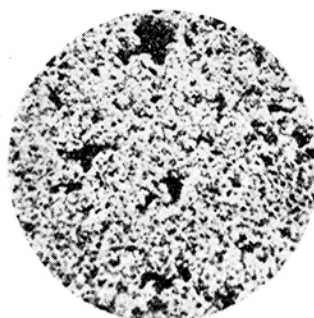


Fig. 9. Specimen B (Etched surface).

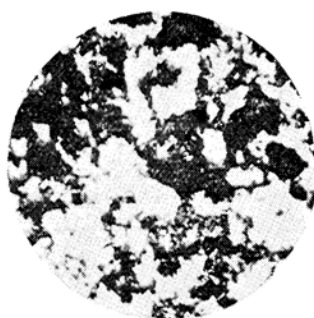


Fig. 10. Specimen C (Surface).

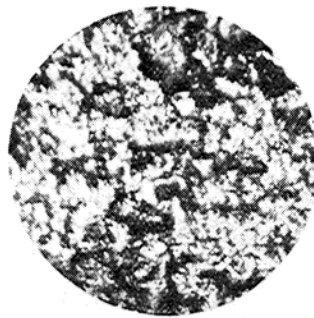


Fig. 11. Specimen C (Etched surface).

fore, a considerable amount of oxygen should be added to the elements above analysed. This can also be confirmed by the metallographical photograms (enlarged 100 times and etched by the solution of ammoniacal hydrogen-peroxide). It may be considered that the oxides in these specimens were produced by the following two causes: (1) as the technique of casting was still in its infancy in those days, oxidation

was not properly prevented at the time of melting, and (2) the materials have passed so long time as many thousand years, so that oxidation took place unartificially.

As for lead which is contained often in considerable quantities in the samples, it is hardly possible to think that it came from copper ores and it must rather be considered that this metallic element was artificially added in order to increase the fluidity of molten copper and to make the casting more easy. It will be no doubt that the other metals than copper and lead detected in the samples are contained as impurities which were impossible to be eliminated by the primitive metallurgical technique of those ancient days.

In conclusion, the author expresses his sincere gratitude to Prof. Dr. Y. Shibata, Prof. Dr. S. Katō and Prof. Dr. K. Kimura for their kind guidances, and to Prof. Dr. Y. Harada, Dr. K. Komai and Dr. N. Egami in the Archaeological Institute of the Faculty of Literature of Tokyo Imperial University, who offered the invaluable specimens for his chemical research, and also to Prof. Dr. T. Mishima for the trouble of taking the metallographical photographs.

Summary.

(1) Three specimens of ancient Chinese spear-heads which are said unearthed from Yin site (殷墟) were analysed, and it was found that they consist mainly of copper added with certain quantities of lead and contain no significant amount of tin.

(2) From the chemical studies, all these spear-heads are by no means of bronze and they are regarded as the first pure copper implements ever discovered in China.

(3) The prevailing opinion which negates the existence of the pure copper age in ancient China must thus be abandoned, and the existence of the copper age in China must be admitted.

(4) It is supposed that if these specimens were actually manufactured in Yin dynasty (殷代), the pure copper age in China existed at about Yin dynasty (殷代), and the beginning of the bronze age followed that age.

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