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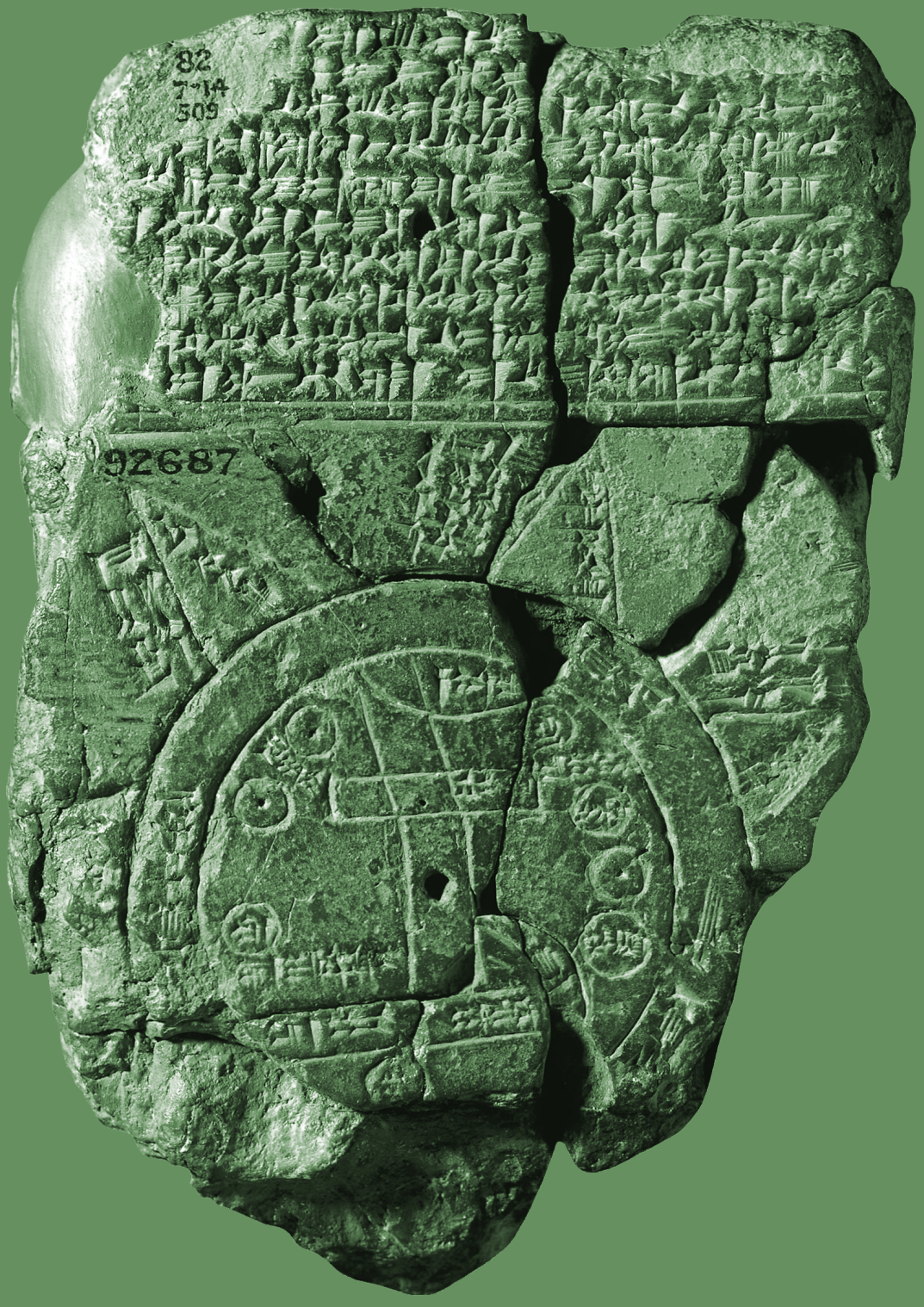

xšnaoϑrahe ahurahe mazdå
Detail from above the entrance of Tehran's fire temple, 1286š/1917–18. Photo by © Shervin Farridnejad

Front Cover: Obverse of the 6th Century BC "Babylonian Map of the World" (*Imago Mundi*). © The Trustees of the British Museum

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The King's Spear: A Note on Bronze Weapons and Weapons Manufacturing in the Ur III Period

Xiaobo Dong
(University of Liverpool)

Abstract

This paper focuses on three texts from Ur dated to the 15th year of Ibbi-Suen's reign. It investigates the production of a bronze weapon associated with the king (^{uruda}gag-si-sa$_2$ zabar), enhancing our understanding of the metallurgical technology of the Ur III period. The study discusses the raw materials, the forging process, and the process of recycling the metals used in the weapon. The texts suggest a possible standardization of the production of bronze weapons by the Sumerians, while the recycling of bronze fragments reflects the specialization of the craftsmanship during the Ur III period.

Introduction

The Third Dynasty of Ur (ca. 2112-2004 BC, commonly abbreviated as Ur III) was the last unified dynasty established by the Sumerians. The Ur III dynasty is one of the most well-documented periods in ancient Mesopotamia, having produced at least 120,000 economic and administrative cuneiform tablets. Despite this impressive array of texts, much of the period remains obscure, such as the state's military history. As evidenced by royal inscriptions and year formulae, military conflicts were a regular part of life during the Ur III period, but few details, about this history, have been found in the administrative record.[1]

1- For an overview study of military elements in Ur III, see recently Patterson 2018, with additional references; see also Maeda 1992; Lafont 2009; Garfinkle 2014 and 2021.

There are many weapons that have been recorded from the Ur III period.[2] This focuses on a special kind of weapon typically described by the postpositive attributive "šu-lugal".[3] This expression can be translated as "(in) the hand (of) the king," possibly referring to a weapon that belonged to the king. An alternative interpretation would be "(for the) royal hand," meaning that it was independent from the actual device. This would possibly mean that it was a measurement of "royal" quality.[4] Both interpretations would associate the weapon with the king, either as a weapon that the king used or owned or as a weapon made to his specifications.

There are only eight texts that contain this modifier in reference to the king's weapons. They provide us with the following forms:[5]

1. gag-si-sa$_2$ šu-lugal
2. gag-si-sa$_2$ ^{ĝeš}nu-ha-an-ni šu-lugal
3. gag-su-um im-ba šu-lugal
4. gag-su-um im-ba ^{ĝeš}nu-ha-an-ni šu-lugal
5. gag zu$_2$ zabar šu-lugal
6. šukur zabar 15 še šu-lugal

Based on an analysis of the existing text content, it seems likely that some weapons of the types listed above would have been associated with the king, even when not followed by the term "šu-lugal." Three texts from Ur, all dated to Ibbi-Suen's 15th year as king, record the production process of one kind of weapon that may be classified as "šu-lugal." The weapon is referred to as "^{uruda}gag-si-sa$_2$ zabar" in these texts, which we may translate here as "standard bronze spearhead."[6]

Bronze for Weapon Construction

The role of copper in alloys holds an important place in the history of metallurgy. The first evidence for human exploitation of copper was found at the Neolithic site of Cayonü Tepesi in south-eastern Turkey (ca. 7250-6750 BC).[7] However, it was not until the fourth millennium BC that metal production began in earnest. From the fourth millennium BC to the late Bonze Age, copper arsenic alloys were produced and used throughout the Near East.[8] Since tin is found in limited quantities in nature, especially in the Near East, tin-copper alloys (bronzes) are commonly believed to be synthetic.[9] Though tin bronzes were introduced during the middle of the third millennium (ED III, 2600-2300 BC), it was not until 1500 BC that

2- For the study of various weapons in ancient Mesopotamia, see e.g. Schrakamp 2009 and 2011.

3- Note here giš-ŠU.LUGAL = MIN(*ni-mit-tu*$_2$) ša$_2$ šar-ru (*MSL* 6: 127). For the meaning of *nemettu* as (among other things) some type of (divine/ritual) staff, see *CAD* N^2: 164.

4- Paoletti 2012: 159.

5- *PDT* 1 0635 (*CDLI*: P126051), *AUCT* 1 321 (*CDLI*: P103166), *AUCT* 1 696 (*CDLI*: P103541), *TIM* 06 35 (*CDLI*: P134040), *TIM* 06 37 (*CDLI*: P134042), *TIM* 06 40 (*CDLI*: P134045), *TIM* 06 42 (*CDLI*: P134047), *TIM* 06 43 (*CDLI*: P134048).

6- The Sumerian word "gag" translates as "nail" and, by extension "arrowhead". However, considering the considerable weight of this weapon (see below), as the translation "spearhead," or simply "spear", may be more appropriate in our context.

7- Scott 2002: 4.

8- As it is impossible to determine whether an arsenical copper is natural or artificial, the term "arsenical bronze" is avoided in favor of the term "alloy" (see Moorey 1994: 242).

9- Much attention has been paid to the sources of tin in ancient Mesopotamia (e.g. Dayton 1973; Muhly & Wertime 1973; Crawford 1974; Muhly 1985).

tin bronze replaced copper arsenic alloys completely.[10]

Though both Sumerian and Akkadian have a varied terminology to distinguish different qualities of copper, they cannot be identified with any precision among archaeological materials.[11] Textual information on the copper and bronze industries becomes more widespread from the Ur III period onwards. However, the written evidence from this period is almost entirely limited to the city Ur and the end of Ibbi-Suen's reign.[12] Direct, detailed records of the bronze smelting process during the Ur III period are rare. Therefore, any records offering insights into the production of bronze objects are very important.

UET 3 486 (_CDLI_: P136808), Ibbi-Suen 15/v/1

1.	4(diš) ma-na 5(diš) gin_2 uruda	4 mina (and) 5 gin_2 copper, (= 2,042 grams)
2.	^{uruda}šen sumun kal-kal-ge-de_3	is fully melted in a copper vessel,
3.	4(diš) gin_2 igi-3(diš)-gal_2 nagga	4 (and) 1/3 gin_2 tin, (= 36 grams)
4.	mu ^{uruda}gag-si-sa_2 zabar-$še_3$	for the sake of the standard bronze spearhead.
5.	ki dingir-su-ra-bi_2-ta	From DINGIR-su-ra-bi,
6.	a-hu-wa-qar	Ahu-waqar,
7.	šu ba-ti	received.
8.	iti ki-siki-^{d}nin-a-zu u_4 1(diš) ba-zal	(In) the month of ki-siki-Ninazu, on the 1st day. (= Ur month 5)
9.	mu …	The year … … IS 15

It is possible that copper smelting occurred in crucibles in Ur and other southern Mesopotamian sites. A significant number of crucibles have been unearthed in many sites across Iran throughout the fourth and third millenniums BC.[13] The copper vessel recorded in the second line of our text may be one such crucible.

The copper to tin ratio in the text is about 56.5 to 1, which would mean that the bronze contained roughly 1.7% tin. The use of bronze with this copper-to-tin ratio for forging weapons may have caused some confusion among scholars, as the amount of tin is too low to have any meaningful impact on the alloy. Modern bronze typically has a copper-to-tin ratio of 9:1, but in antiquity the proportions varied, possibly due to the difficulties involved in controlling the exact ratio.[14] According to P. R. S. Moorey, "both with tin and arsenic the lower limits for an international alloy are arbitrarily set, usually at about 2 or 3 per cent for tin (though much lower figures may reasonably be argued)."[15] Other scholars have suggested that tin concentration ranges from low (~2 wt. %) to high (> 10 wt. %).[16] As demonstrated by Henri Limet,

10- For an overview of the Mesopotamian bronze metallurgy, see De Ryck, *et al.* 2005.

11- Reiter 1997: 149-204 and 288-343.

12- In addition to bronze-making, the texts from archives in Ur offer detailed information on various (precious) metals and metal objects, as well as the overall administrative structure of the craft industry in Ur III period (see in particular Limet 1960; Loding 1974; Neumann 1987; for the two archives in Ur during Ibbi-Suen, see also Widell 2003: 98-101).

13- For more on the crucible, see Tylecote 1992: 20-21; see also Moorey 1994: 243, with further references.

14- Moorey 1994: 251.

15- Moorey 1994: 242; see also Moorey 1972 and 1982.

16- De Ryck, *et al.* 2005: 267.

the tin levels in the bronze found in a craft archive at Ur ranged from 9% up to 17%.[17] On the other hand, laboratory testing of two bronze chisels from the Ur III period revealed very low tin levels (1.7% and 0.3% respectively).[18]

The low amounts of tin in the copper, reported in the textual documentation, can perhaps be explained by the fact that the products were often manufactured from scrap metal that already contained tin.[19] Nevertheless, it is still true that the low tin levels in the bronze, reported in our text, would have produced weapons of very low quality. This can be compared to another text from Ur, also from Ibbi-Suen's 15th year, which records the production of a bronze knife for killing sheep (gir$_2$-udu-uš$_2$). It had a copper-tin ratio of 7 to 1.[20] Thus, it may be that the weapon listed in *UET* 3 486 was not intended for use at all; perhaps it was intended for a ceremonial or cultic role.[21]

Weapon Manufacturing Technology

The production of bronze as a raw material and the manufacturing of weapons are two separate processes. Commercial transactions related to bronze as a raw material are rarely found in the texts. Therefore, it seems that bronze was often prepared on the spot from copper and tin by craftsmen and then distributed by court officials to palace artisans to produce tools and weapons.[22] Our textual record of the manufacturing process of the "standard bronze spearhead" offers some interesting information.

***UET* 3 447 (*CDLI*: P136769), Ibbi-Suen 15/iii/7**[23]

1.	1(u) 2(diš) 2/3(diš) ma-na 5(diš) gin$_2$ zabar	12 2/3 mina (and) 5 gin$_2$ bronze, (= 6,375 grams)
2.	^{uruda}gag-si-sa$_2$ 3(diš) ma-na	3 mina (for) standard bronze spearhead, (= 1,500 grams)
3.	a-la$_2$-bi 1(diš) ma-na bar-bi 5/6(diš) ma-na	1 mina (for) its handle, 5/6 mina (for) its "tail/butt", (= 500 grams / 417 grams)
4.	^{uruda}gag-si-sa$_2$ 2(diš) 1/2(diš) ma-na a-la$_2$-bi	2 1/2 mina (for) bronze standard spearhead, its handle, (= 1,250 grams)
5.	5/6(diš) ma-na bar-bi 2/3(diš)^{ša} 1(diš)	(is) 5/6 mina, 2/3 mina(for) its "tail/butt" for 1 (object), (= 417 grams / 333 grams)
6.	u$_3$ ^{uruda}<gag>-si-sa$_2$ 2(diš) ma-na a-la$_2$-bi	and 2 mina (for) the standard bronze spearhead, its handle, (= 1,000 grams)
7.	2/3(diš)^{ša} bar-bi 1/2(diš) ma-na 1(diš)-še$_3$	(is) 2/3 mina, 1/2 mina for its "tail/butt" for 1 (object). (= 333 grams / 250 grams)

17- Limet 1960: 58.

18- Levey & Burke 1959; Levey 1959: 196-211.

19- For a more thorough discussions on this topic, see Tylecote 1992: 18.

20- *UET 3* 429 (*CDLI*: P136751).

21- Note *TIM* 06 37 (*CDLI*: P134042) from the reign of Šulgi, where 14 gag-si-sa$_2$ šu-lugal are listed with various other objects as nig$_2$ pi-lu$_5$-da, indicating a cultic function of the weapons (Sallaberger 1995: 20; for an edition of the text, see Paoletti 2014: 527).

22- Moorey 1994: 245, with additional references.

23- Note the identical *UET* 3 759 (CDLI: P137083), dated 10 days later than our text.

8.	ki ur-gu$_2$-edin-na-ta	From Ur-guedinna,
9.	a-hu-wa-qar	Ahu-waqar,
10.	šu ba-ti	received.
11.	iti ses-da-gu$_7$ u$_4$ 7(diš) ba-zal	(In) the month of eating piglets, on the 7th day. (= Ur month 3)
12.	mu ...	The year ... ... IS 15

One tentative possibility, would be to understand a-la$_2$-bi as "its handle," and bar-bi as "its tail/butt." This interpretation of the terms would perhaps find some support in the recovered spearheads and reconstruction of the complete spear from the Royal Cemetery of Ur. The spear's "head" and "tail/butt" were made from metal, and metal was also used for reinforcement and decoration on the surface of the wooden rod, the "handle."[24]

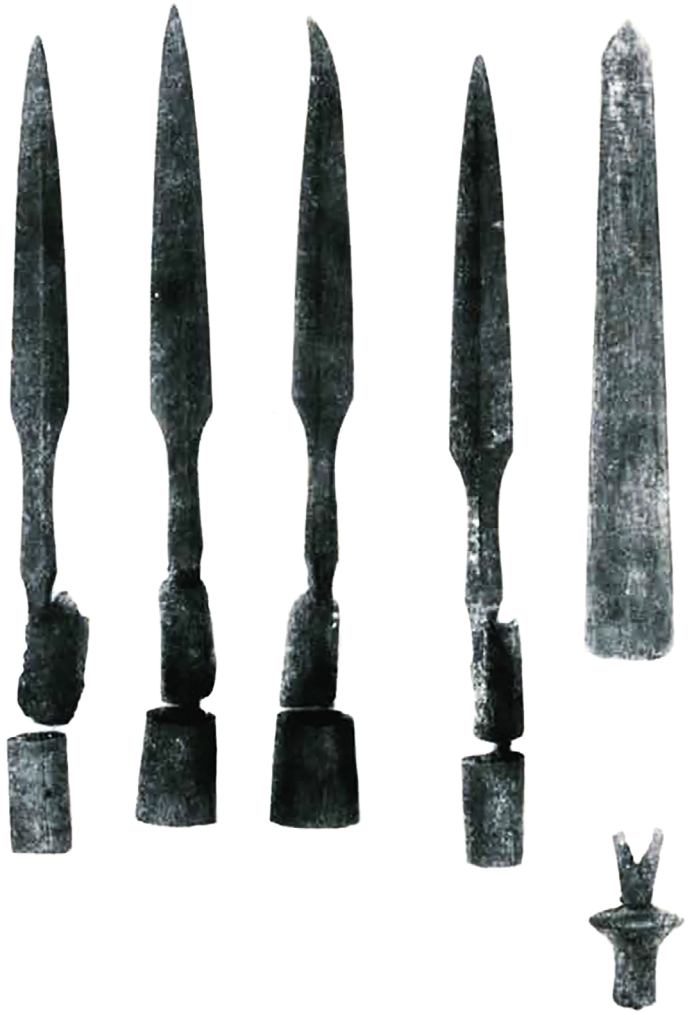

Fig. 1. Spearheads and the "tail/butt" from the Royal Cemetery of Ur (ca. 2600 BC).[25]

24- For the archaeological report of the cemetery, see Woolley 1934.

25- From Woolley 1928: 15.

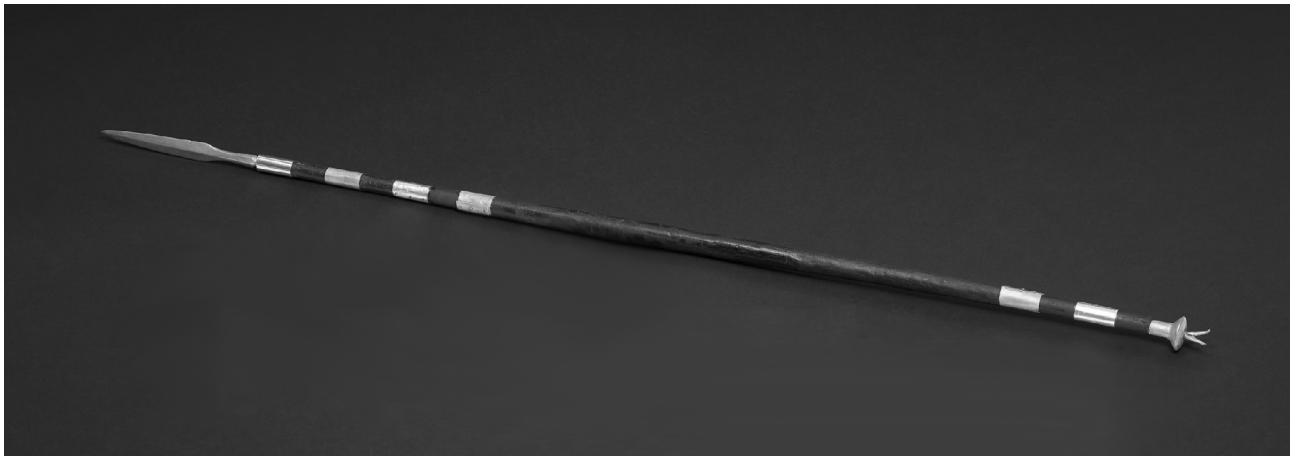

Fig. 2. Reconstruction of a spear from the Royal Cemetery of Ur (ca. 2600 BC). ©The Trustees of the British Museum

It is interesting to note that the ratio between the head and the handle is 3 to 1, whereas the "tail" (bar-bi) equals the weight of the handle minus 10 gin_2. This seems to indicate that technical standards were applied in the forging of these weapons. These fixed technical standards suggest, that the Sumerians may have practiced some degree of standardization in metal smelting and forging during the Ur III period.

UET 3 447	Head (weight)	Handle (weight)	"Tail" (weight)
Lines 2-3	180 gin_2	60 gin_2	50 gin_2
Lines 4-5	150 gin_2	50 gin_2	40 gin_2
Lines 6-7	120 gin_2	40 gin_2	30 gin_2

Finally, if we compare the weight of the raw material with the weight of the forged weapons, we can see that the bronze listed as a raw material in the first line weighs 765 gin_2, (6,375 grams), whereas the total weight of the different parts added together (lines 2-3, 4-5, 6-7) is 720 gin_2 (6,000 grams). In other words, 45 gin_2 (375 grams) of bronze disappeared during the production. This may have been lost in the heat treatment. A certain amount of weight is lost when metals are smelted. This can be caused by various factors, such as vaporization or residual metal on the smelting vessel. According to the calculations based on this text, the raw material lost in the forging process was about 5.9% of the total.

The final point of concern is the actual weight of these weapons. These weapons are so heavy that they could never have been fired from a bow. This is why "^{uruda}gag-si-sa_2 zabar" is translated as "standard bronze spearhead" rather than as "standard bronze arrowhead" in this study.[26]

26- For other contexts where the translation of gag as "arrowhead" may be more appropriate, see Paoletti 2012: 157.

Recycling Bronze Fragments

Our final text *UET* 3 450 appears to reference the process of recycling bronze scrap to make new weapons.[27] The text records the recycled slag used for the spearheads, but does not include the new raw materials that would have to be added in the production process. As a relatively complete and routine metallurgical process, there is significant documentation of re-manufacturing metals during the Ur III period.[28] The recycling of tin bronze during the third millennium BC, has also been evidenced from several sites in Mesopotamia: the low concentration of tin in the copper arsenic alloys of Tell Beydar (ED III); at Susa, the tin concentration in the copper arsenic alloys increases simultaneously with the increased use of tin in bronze.[29]

***UET* 3 450 (*CDLI*: P136772), Ibbi-Suen 15/iii/17**

1.	3(diš) gin_2 su_3-he_2	3 gin_2 bronze slag, (= 25 grams)
2.	mu zabar ^{uruda}gag-si-sa_2 3(diš)-$še_3$	for the sake of 3 standard bronze spearheads.
3.	ki dingir-su-ra-bi_2-ta	From DINGIR-su-ra-bi,
4.	a-hu-wa-qar	Ahu-waqar,
5.	šu ba-ti	received.
6.	iti ses-da-gu_7 u_4 1(u) 7(diš) ba-zal	(In) the month of eating piglets, on the 17th day. (= Ur month 3)
7.	mu ...	The year ... ... IS 15

As for the three officials mentioned in these texts, Ahu-waqar, with the title of "šabra," was the well-known overseer of the institution. He acted as a supervisor for every phase of the operation.[30] There is no mention of DINGIR-su-ra-bi (IS 15/ii-IS 16/viii) or Ur-guedinna (IS 15/i-IS 23/xii) in the lists of workers in the overall bureaucratic system. They may just have operated as suppliers of raw materials.[31]

Conclusions

This article, has argued that the Sumerians of the Ur III period had relatively mature and standardized technologies, as well as a sophisticated management system for smelting bronze raw materials, forging bronze weapons, and recycling bronze fragments. In response, the Sumerians of this period kept parts of different materials in a modular and specialized form of preservation. All in all, the above research suggests a deeper understanding of Sumerian metallurgical technology and weapon manufacturing during the Ur III period.

27- Considering that *UET* 3 450 and *UET* 3 759 are dated to the same day (Ibbi-Suen 15/iii/17), it is possible that the bronze fragments recorded in *UET* 3 450 came from the forging activity recorded in text *UET* 3 759.

28- Limet 1960: 45 and 145.

29- De Ryck, *et al.* 2005: 267.

30- Loding 1974: 18.

31- For the worker lists in Ur, see Loding 1974: 20-26 and 197-225; for the organization and administration of craft in Ur, see Loding 1974: 17-20; Neumann 1987: 75-86.

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Participants & Addresses

(Alphabetically)

Xueting Chao
University of Liverpool
Archaeology, Classics and Egyptology
United Kingdom

E-mail: Xueting.Chao@liverpool.ac.uk

Jacob Dahl
University of Oxford
The Oriental Institute
United Kingdom

E-mail: jacob.dahl@orinst.ox.ac.uk

Parsa Daneshmand
University College London
Department of History
United Kingdom

E-mail: parsadaneshmand@yahoo.com

Xiaobo Dong
University of Liverpool
Archaeology, Classics and Egyptology
United Kingdom

E-mail: Xiaobo.Dong@liverpool.ac.uk

Zhiyun Guo
Northeast Normal University, Changchun
Institute for the History of Ancient Civilizations
China

E-mail: 451156749@qq.com

Changyu Liu
Zhejiang Normal University, Jinhua
Department of History
China

E-mail: assyrialiu@yahoo.com

Xiaoli Ouyang
Fudan University, Shanghai
History Department
China

E-mail: ouyang@fudan.edu.cn

Michaela Piccin
North-West University, Potchefstroom
Department of Theology
South Africa

E-mail: michela.piccin@yahoo.com

Xianhua Wang
Shanghai International Studies University
Institute for the Global History of Civilizations
China

Email: xw212@shisu.edu.cn

Magnus Widell
University of Liverpool
Archaeology, Classics and Egyptology
United Kingdom

E-mail: m.widell@liverpool.ac.uk

Jiarui Zhang
Fudan University, Shanghai
History Department
China

E-mail: 469164524@qq.com

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