

Study on Wheat Utilization in the Bronze Age of Sichuan

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Keywords: Sichuan, Wheat, Archaeobotany, Bronze Age, Agriculture

Abstract: Wheat Was Introduced into Southwestern China Quite Late, Until the Shang Dynasty, It Can Be Found in the Archaeological Sites in Sichuan. as Can Be Seen from the Archaeological Evidence, Wheat in Western Sichuan and Eastern Sichuan Played Different Roles in the Agricultural Pattern of the Site. in the Eastern Part of Sichuan, Wheat Has Always Occupied Only a Small Share of All Crops and Did Not Incite the Original Agricultural System; While in Western Sichuan, after the Introduction of Wheat, Local Residents Quickly Accepted This New Crop. as a Consequence, the Original Crop System Was Broken, and the Agricultural Structure of Some Sites Even Turned into Wheat-Based Agriculture. in This Study, We Will Integrate All of the Discovery of Wheat in Sichuan in the Bronze Age, and Combine the Materials Found in the Surrounding Areas to Discuss the Sources of Wheat in Sichuan, and Explore the Translocation Pathways of Wheat in the Region, Try to Analyze the Differences in the Development of Wheat within the Region and the Driven Forces Behind Them.

1. Introduction

As the Second-Largest Crop in China, Wheat is Widely Cultivated Nationwide. However, Wheat Itself is Not a Native Crop. the Research on the Origin of Wheat Has Always Been a Hot Topic in Academia. Some Scholars Have Based on the Discovery of Wild Hexaploid Wheat and the Literature, Suggesting That Wheat May Originate from the Yellow River Basin or Shandong Province in China (Dong and Zheng, 2000; Zohary and Hopf, 2000). While with the Continuous Enrichment of Archaeological Materials, Scholars Tend to Believe That Wheat Originated from West Asia and Was Introduced to China Around 4000 Years Ago (Betts et al., 2014; Zhao, 2015). the Archaeological Remains of Wheat in This Period Are Concentrated in Northwest China (Li et al., 2007; Dodson et al., 2013). and There Are Sporadic Discoveries in East China as Well (Jin et al. 2008). It Could Be Even Later When Wheat Was Translocated into Southwest China, and the Chronology Was Concentrated in the Bronze Age. Although Barley Were Also Found At the Same Time, the Amount is Very Little and Only Can Be Seen in Several Sites. Therefore, Barley Will Be Regarded as a Whole Along with Wheat in Our Research.

The Selection and Cultivation of Wheat Are Subjected to Various Factors, in Addition to the Necessary Natural Conditions Such as Geomorphology, Light, Heat Resources and Precipitation, But Also Affected by Factors Such as Technology, Society, and Culture. on One Hand, the Research on Early Wheat Utilization in Sichuan Can Help Us to Clarify the Possible Translocation Pathways of Crops and It Also Conduces to Observe the Crop Choose Preferences of the Local Resident. on the Other Hand, We Can Explore the Spread and Radiation of Archaeological Culture Behind the Crop Itself.

2. Charred Wheat Discoveries in Sichuan

Recently, with the Promotion of the Flotation Method in Southwest China, a New Series of Archaeobotanical Materials Has Been Accumulated in Sichuan. in This Study, Totally Ten Bronze Age Sites Have Been Recorded for Their Wheat Remains (Figure 1). the Site Zhonghaiguoji(中海国际)is Located in Hejia Village, Jinniu District, Chengdu. Zhonghaiguoji Site Was Excavated in 2004-2005, Seeds from H26 is Used for Radiocarbon Dating, and It Shows the Date is 1510 Bc-1425 Bc and 1520 Bc-1425 Bc, 4 Wheat Grains Were Found (Chengdu Shi Wenwu Kaogu

Yanjiusuo, Cswky Below, 2014).

The Site Yongfucun(永福村)is Located in Yongfu Village, Wenjiang District, Chengdu. the Site Was Excavated in 2010. Yongfucun Site Occupied Two Phases from Baodun Culture to the Shi'Erqiao Culture (Ca. 1200-800 Bc). 9 Flotation Samples Were Collected, Only 3 Wheat Grains Were Found in the Shi'Erqiao Culture Deposit (Shi, 2012).

The Site Yantang Village(燕塘村)is Located in Yantang Village, Xindu District, Chengdu. the Site Was Excavated in 2010. the Cultural Remains Indicate the Site Belongs to the Shi'Erqiao Culture.10 Flotation Samples Were Collected, and 2 Grains of Suspected Wheat and 1 Grain of Barley Were Identified (Shi, 2012).

The Site Xinyicun(新一村)is Located in the South of Shi'Erqiao Road in Chengdu. It Was Discovered in 1995 and Was Excavated Again in 2011. the Date of the Remains Could Be Dated Back to Shang and Zhou Dynasties to the Song Dynasty. 5 Samples Were Collected, and 2 Grains of Suspected Wheat Were Found in the Chunqiu Period Sample (Shi, 2012).

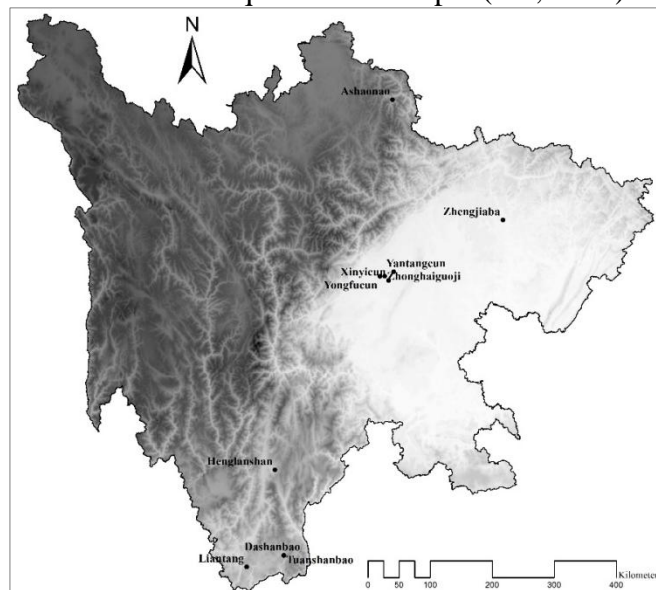


Fig.1 Sites Unearthed Wheat/Barley in Sichuan

The Ashaonao Site(阿梢垭) is Located in the Jiuzhaigou National Geological Park. It Occupied for a Long Time from the Neolithic to the Tang Dynasty. 12 Archaeobotanical Samples Were Taken in 2010. According to the Radiocarbon Dating Results Retrieved from Seeds and Charcoal, the Site Can Be Divided into 3 Phases, 1400-1000bc, 400-200bc, 200bc-1ad. the Subsistence in the Ashaonao Site Was Based on Wheat and Barley during the Whole Period (Guedes et al. 2015; Sichuan Daxue Kaoguxi et al. 2017).

The Henglanshan Site(横栏山)is Located on the Hillside of Jianxin Village, Southeast of Xichang City, Liangshan Yi Autonomous Prefecture (Xichang Shi Wenwu Guanlisuo, 1998). the Site Was Discovered in 1987. in 2011, Trial Flotation Work Has Been Conducted, 7 Samples Were Obtained. 2 Seeds of Genus Hordeum and 10 Wheat Grains Were Identified in the Samples. It is Worth Noting That Radiocarbon Dates on the Barley Seed Are 890 Bp-650 Bp, Which is Not Match Up to the Date of the Strata. the Researchers Speculate That the Seed Maybe Come from the Late Layer Caused by the Leak (Jiang et al. 2017). Moreover, the Wheat Has Not Been Dated Directly, the Chronology is Still Unclear. in 2013, 6 Flotation Samples Were Taken from the Neolithic Layer, Neither Wheat Nor Barley Was Found (Cswky et al. 2016).

The Liantang Site(莲塘)is Located in Lixi Town, Huili County, Liangshan Yi Autonomous Prefecture. Two Samples Were Obtained in 2014, and 2 Wheat Grains Were Found. the Site Was Dated by Radiocarbon Dates on Rice, Millet and Wheat. the Results Show the Site Was Occupied in 2210 Bc-2010 Bc, 2150 Bc-2020 Bc and 1480 Bc-1650 Bc (Cswky et al. 2016).

The Tuanshanbao Site(团山包)is Located on the East Bank of the Shenyu River in Huidong

County, Liangshan Yi Autonomous Prefecture. One Sample Was Collected from the Kiln Site during the Western Han Dynasty. Totally 112 Grains of Wheat, 4 Grains of Barley and 46 Pieces of Wheat Segments Were Found. Directly Radiocarbon Dates on Millet, Wheat and Barley Show the Site Was Occupied during 700-390 Bc, the Eastern Zhou Period (Cswky et al. 2016).

The Dashanbao Site(大山包)is Located on the Slope Near the Top of the Mountain in Huidong County, Liangshan Yi Autonomous Prefecture. Two Samples Were Collected during the Western Han Dynasty in 2015. There Are 7 Grains of Wheat Were Identified, and the Radiocarbon Dates Measured by the Seeds is 410-200 Bc (Cswky et al. 2016).

Zhengjiaba Site(中坝)is Located in Langzhong City, Which is Settled on the First Terrace of the Jialing River Basin. 188 Flotation Samples Were Taken from the Strata of the Shang and Zhou Dynasties. Millet is the Most Ubiquitous Crop in the Site, Barley is Very Rare, Only Accounts for 0.55% in All Crop Remains (Yan et al. 2013).

3. Discussion

3.1 Wheat Cultivation in Sichuan

By outlining the whole map of Bronze Age wheat in Sichuan, we found that there are completely different strategies for crop selection in eastern Sichuan and western Sichuan. In eastern Sichuan, the natural conditions are more capable of developing rice farming. At the same time, Rice can maintain the rapid development of the population and economy in the region in terms of both production and scale. Therefore, the rice-based agricultural structure has gradually stabilized and it is difficult to be broken by exotic crops. However, In western Sichuan, the mountainous landforms and the relatively scattered settlements are not suitable for the development of single-type agriculture on a large scale. The introduction of wheat can be combined with the original nomadic and small-scale farming to increase grain yield. In addition, the cultivation and harvest time of wheat do not coincide with millet, so that arable land can be used efficiently. Besides, wheat can be processed into powder, and made into various types of food, Which could be portable and stored for a long time. This character make it compatible with the mobility of the nomadic people, that's why it can develop rapidly in the western Sichuan and became the main crop in northwestern Sichuan in the Eastern Zhou dynasty.

Obviously, agriculture structure in the mountain-based areas of the region, the crops show a mixed pattern. Even though in the plain areas, it's not an absolutely single crop pattern, the primary and secondary are very distinct. Wheat appeared earlier in the mountainous areas and played a more important role. For example, subsistence in the Ashaonao site was dominated by wheat remains, while the Chengdu Plain has already begun to contact wheat during the Shang and Zhou Dynasties. However, the number is very small, and it has never shaken the solid position of the rice, showing the lower acceptance of exotic crops by residents in the plains.

Mountain residents are more easily to accept new crops and promote them quickly, while in the plains, the stable, relatively high-yielding agricultural landscape is hard to break. The reason may be that the residents in different living environments have different cognitions about new crops. Under the conditions of immature cultivation and management techniques, the updated crop system faces greater risks for the plain areas. And the new crops can be tentatively planted in different mountainous landscapes without affecting the original crop system. At the same time, among the various food sources of mountain, grain cultivation is only part of it, the risks brought by Planting a new crop will not put too much pressure on the source of their subsistence.

Most of the sites which unearthed plant remains in the mountainous areas of western Sichuan show similar utilization of plant resources in a vertical perspective. The resource catchment is relatively small and is a vertical structure. However, in the eastern Sichuan, the structure of plant resources is relatively stable, especially for the crops, the rice-based agriculture account for a large proportion, foxtail millet and broomcorn millet occupied a very small proportion. The weeds found in the site are mostly farmland weeds, the proportion of edible wild plant resources is small, which reflects that the plant resources of the site are mainly derived from cereals. It's worth noting that

kiwifruit seeds were found in the Zhengjiaba site, Boluocun site, Chujiacun site, and Xinyicun site. The kiwifruit is not suitable for growing in the plain area, and may come from the surrounding mountainous areas. Similarly, the bone of musk deer found in Shi'erqiao site may also come from the surrounding mountains. It indicates that the resource catchment of the ancestors in eastern Sichuan is centered on the site and the surrounding region, and extends to the far mountainous areas.

Generally, there are significant differences between the east and west part of Sichuan in terms of the acceptance and promotion of wheat. In the western mountainous areas, the ancestors accept the wheat more quickly, and the wheat can also be quickly developed into a staple crop in the region. In the eastern part, although wheat crops have been introduced, they have not received sufficient attention and have not been promoted within the region.

3.2 Candidate Routes of Transmission of Wheat into Sichuan

From the perspective of archaeobotanical materials, wheat or barley appeared in Sichuan quite late. After the wheat has been translocated from West Asia to China and then into Sichuan. There may be many candidate transmission routes. One possible route is from Gansu to western Sichuan. Which has more evidence to support; another one is from the east edge of the Qinghai-Tibet Plateau southwards to Yunan and then back to the north.

Liu et al. has measured and analyzed the wheat unearthed from 21 sites in China, India, Pakistan and Kazakhstan in the second millennium BC (Liu et al. 2016). The results of the dating show that in the 1665~1518 cal. BC the residents who lived in eastern edge of the Qinghai-Tibet Plateau have already begun to take advantage of wheat, which is also the earliest wheat found in Tibetan plateau. As for the source of wheat, there are still two candidate ways. One is from the Inner Asia mountain corridor on the northern edge of the Qinghai-Tibet Plateau to the Tianshan mountain and then translocated to Hexi Corridor. From the chronology of wheat, it is likely the wheat translocated southwards to Sichuan after it arrived into Hexi Corridor.

The typical example for the Yunan pathway is Haimenkou site in Jianchuan County, Yunnan province. The radiocarbon dates show the wheat come to the site in 3100 BP, along with the simultaneous cultural relics such as painted pottery, which has closely relationship with the Qijia and Xindian cultures in Gansu and Qinghai (Yunnan Sheng Wenwu Kaogu Yanjiusuo et al. 2009). Besides, The Dadunzi-Lizhou cultural distribution area connects the north Yunnan and the southwest Sichuan, and may also facilitate the exchange of crops like wheat.

Another possible wheat translocation pathway started from the Yellow River Basin to the Guanzhong plain and Jiangnan plain and then went to the eastern Sichuan. The earliest evidence of wheat in the Yellow River Basin appeared in Zhaojiazhuang site. The direct dating results were 2500-2270 BC. Nevertheless, wheat is relatively rare in the Yangshao and Longshan period sites in the Central Plains, and most of them have not been directly dated. Until the Shang and Zhou Dynasties, the number of wheat in the Central Plains has been increased. Wangchenggang site in Dengfeng city found 191 grains of wheat in Erligang period deposit (Zhao and Fang, 2007). In pre-Zhou period, Wangjiazui site found 120 wheat grains (Zhouyuan Kaogudui, 2004). Following the Pre-Zhou period, Baligang site in southwest Henan discovered 6 grains of wheat and 13 pieces of spikelet. Radiocarbon dates show the date of these wheat are about Western Zhou dynasty (Deng and Gao, 2012).

Compared with millet, the quantity of wheat is relatively less, but it can be seen that the importance of wheat is increasing from the Neolithic to the Shang and Zhou Dynasties. The Qinglongquan site in the Jiangnan Plain discovered wheat remains in the Shijiahe culture period. In Xiawanggang Site, two grains of wheat were found in the Wangwan Phase III and 17 grains of wheat were found in the Western Zhou Dynasty (Tang, 2014). However, like the southwestern Henan region, the Shijiahe culture ancestors in the Danjiang River basin in northwestern Hubei Province are also the millet-based subsistence, but wheat began to appear during this period, maybe the result which lead by the Shijiahe culture eastwards to Sichuan.

4. Conclusion

There are two different patterns of crop compositions in Sichuan during Bronze Age. One is the rice-millet mixed agriculture and the other is the rice-millet-wheat mixed agriculture when wheat appeared at around 1500 BC. From the perspective of the long-term agricultural development in southwest China, the plains and mountains respond differently to the impact of exotic crops. The plains are relatively conservative, stable and less susceptible to the impact of the exotic crop. However, the mountain is totally another situation. The crop system in the mountain is more susceptible to the new species, and the crop system changes faster. This is particularly evident in the spread of wheat. Although wheat began to show up in the Chengdu Plain during the Bronze Age, the number is very small; While some sites in western Sichuan started to plant wheat as staple crop. The area of arable land in western Sichuan is limited, When developing agriculture and animal husbandry, it is necessary to consider labor costs, production and consumption. The multiple use of wheat enables it to develop rapidly in the western Sichuan where agriculture and animal husbandry are equally important.

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