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Correspondence

Reply to correspondence received from Cheng-Bang An, Ph.D.; Weimiao Dong; Hu Li; Yufeng Chen regarding “Origin and spread of wheat in China” John R. Dodson, Xiaoqiang Li, Xinying Zhou, Kelian Zhao, Nan Sun, Pia Atahan (2013), *Quaternary Science Reviews* 72, 108–111



Our recent publication reported on over 30 new radiocarbon dates on wheat seeds from a variety of locations across northern China. We noted, where we had data, that wheat first appears where millets were already well-established crops, and our data and other available reliable data seems to indicate wheat was first introduced into Gansu and appeared to spread east and west from there over a few centuries. We recommended more data is needed to test this and in particular from Xinjiang. We are disappointed that An et al. failed to provide any evidence to test our hypothesis.

Firstly, much of the evidence cited by An et al., including in the paper An et al. (2010) is based on archaeological associations with mainly pottery. This approach necessarily results in very coarse ages as the cultures may span across hundreds if not thousands of years. The other problem with this approach is that the age of many of these cultures is often poorly defined, even though the generalised sequence in time and space is well understood in many cases. The example quoted from the Longshan period from Shandong illustrates this problem very well. An et al. claim this is the most secure date for wheat in China, yet the Longshan period is said to have occupied anything between 3000 and 1900 BCE. Unless there is a direct date on a reliable indicator of wheat itself all we can say is that it occurred somewhere in a very broad time frame. The other ages quoted by An et al. (including in Table 1) are also based on cultural associations, suffer the same time uncertainties and thus preclude themselves from the main argument.

We accept there is controversy about the dates from the Donghuishan site, however it remains that these were dates on wheat seeds. The argument that this cannot be interpreted as wheat unless there is an accompanying archaeological analysis does not make sense, unless the various arguments are based on a native occurrence of wheat in the area before it was domesticated. There is no sound biogeographic argument in support of *Triticum* or closely related taxa being native to China (see analysis in Betts et al., in *Quaternary International* (2013)).

We acknowledge that our data show a range of ages for wheat seeds in some sites, suggesting it has been in use for some time, and of course it is a dominant crop in places at the present day. Our model of spread however is based on the oldest obtained

ages from the sites we studied and published reliable ages from elsewhere in China.

We find it remarkable that An et al. conclude that wheat appeared contemporaneously across a region as large as China. It is worth observing that large parts of China are unsuitable for growing wheat. The paper by Betts et al. (2013) reviews reliable dates for wheat domestication from the Near East, across Central Asia and into China. This pathway took thousands of years, and it is unlikely that wheat come into the last third of the region all at about the same time. Indeed this is not clear even in the An et al. Figure 1. In our paper we noted that wheat appeared to be introduced in regions where millet was already grown. Millet production continues strongly in some regions to the present day. One could surmise wheat would have to be immediately regarded as a greatly superior crop to have widespread and rapid uptake contemporaneously across China. Indeed the evidence suggests wheat was added to agriculture in China gradually, and broadened the options for farmers.

In summary, we put up a hypothesis for place of introduction and spread for wheat at the eastern end of Asia, and asked for efforts to gather more data to test this idea. Unfortunately the commentary in the correspondence from An et al. falls way short of this.

References

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