

## TECHNICAL COMMENT

## ARCHAEOLOGY

# Comment on “Permanent human occupation of the central Tibetan Plateau in the early Holocene”

Dongju Zhang,<sup>1\*</sup> Naimeng Zhang,<sup>1</sup> Jian Wang,<sup>1</sup> Bibu Ha,<sup>2</sup>  
Guanghui Dong,<sup>1</sup> Fahu Chen<sup>1\*</sup>

Meyer *et al.* (Reports, 6 January 2017, p. 64) claim that permanent human occupation of the central Tibetan Plateau started in the early Holocene without the support of an agropastoral economy. By careful examination, we find that neither the archaeological evidence nor the travel cost modeling provided by Meyer *et al.* could support the permanent human occupation assertion.

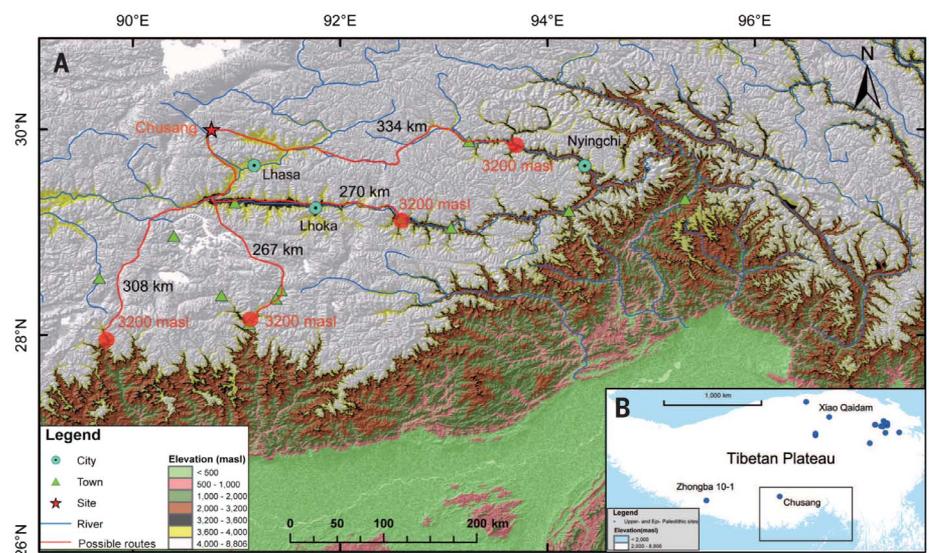
It is encouraging that Chusang, as one of the most disputed but important archaeological sites on the Tibetan Plateau (TP) (1, 2), was systematically related to the early Holocene by Meyer *et al.* (3). They also argue that Chusang provides evidence for permanent human occupation of the central TP by the early foragers. This is markedly different from the current models derived from more secure archaeological evidence collected at numerous sites on the northeastern TP (2, 4, 5). Hand- and footprints found in Chusang may indicate that prehistoric hunter-gatherers once reached the remote central TP in the early Holocene but are insufficient to suggest a permanent occupation, as asserted by Meyer *et al.* (3).

Successful prehistoric permanent human occupation of the cold, oxygen-depleted and resource-poor high-elevation TP is believed to have required a combination of successful physical adaptation, developed technological systems, and adequate food resources. Demonstrating permanent human occupation requires archaeological data including intense fire use, highly efficient tool kits, living structures, and a diverse array of plant or animal remains (4–7). If the new dates are reliable, other than the hand- and footprints, there is no archaeological evidence—either habitation structures or a diverse toolkit or floral or faunal remains—suggesting that human successfully occupied Chusang or surrounding regions on the high TP year-round in the early Holocene. Surface artifacts found in the vicinity of Chusang cannot be directly correlated with the hand- and footprints on the travertine in Chusang, and similar core-flake and blade-core technology found on the high TP (Xiao Qaidam and Zhongba 10-1) (Fig. 1B) have

been dated to as late as about 3000 years before the present (B.P.) (8, 9). Additionally, a number of early-mid Holocene sites on the northeastern TP (Fig. 1B) have much more substantial evidence of prolonged stays, although they are not considered to have been permanently occupied (2, 10–12). Thus, there is no direct evidence that the currently accepted model should be abandoned. That model holds that permanent human occupation of TP probably occurred only after 5.2 thousand calibrated (cal.) years B.P. and more certainly after 3.6 thousand cal. years B.P. and was facilitated by agriculture (2, 4).

Meyer *et al.* (3) base their conclusion about permanent human occupation only on a travel-cost model, which we find unconvincing. Their

assumption that the occupation of Chusang must have been permanent because it would be impossible to logistically supply a lower-elevation residential base is unfounded. There is no reason to suppose that Chusang was a logistical station or task-specific site related to a residential base camp located at less than 500 m above sea level along the TP margins. The premise of a minimum contiguous area of 25 km<sup>2</sup>, which eventually impels the potential source area to the extremely low-elevation TP margins (3), is not required for the survival of a foraging band (13). Even big cities and towns could survive in narrow river valleys of the central TP for more than 1000 years (Fig. 1A). It is more likely that Chusang was part of a series of seasonally occupied camps produced by a group of foragers moving from place to place between lower-elevation margins and the high TP during the year. A move of ~400 km would not have required a single move, although it could actually be at least 100 km shorter than claimed (3) (Fig. 1A), but was more likely a product of a number of much shorter moves. This pattern of seasonal occupation of lower-elevation sites during the winter months and higher-elevation sites during the summer months is known as “seasonal transhumance,” which is a settlement pattern found among many current TP pastoralists and probably among early-mid Holocene TP foragers, too (10). Furthermore, evidence from the northeastern TP suggests that one-way travel distance between early-mid Holocene foraging sites was as great as 947 km (10, 12, 14) (Fig. 1B), much longer than the most plausible eastern route (about 400 km) postulated in Meyer *et al.* (3). If distance from lower elevations is a factor in determining permanent occupation, which we and these other researchers think unlikely, then these sites may actually be the earliest permanent sites on the high TP because they date to as early as



**Fig. 1. Possible routes for foragers.** More possible routes for foragers to move between Chusang and the low-elevation TP marginal regions (A) and other Upper Paleolithic and Epipaleolithic sites on the TP (B).

<sup>1</sup>Key Laboratory of Western China's Environmental Systems (Ministry of Education), College of Earth Environmental Sciences, Lanzhou University, Lanzhou 730000, China.

<sup>2</sup>Tibetan Cultural Relic Conservation Institute, Lhasa 850000, China.

\*Corresponding author. Email: djzhang@lzu.edu.cn (D.Z.); fhchen@lzu.edu.cn (F.C.)

or earlier than Chusang. Archaeological studies also show that annual travel distance of more than 1000 km is common for prehistoric hunter-gatherers in other parts of the world (14, 15).

Local resource abundance is a necessary condition for hunter-gatherers' permanent occupation. Besides the cold and hypoxia issues, the low bioproductivity probably played a more important role in impeding year-round hunter-gatherers' occupation of the high TP. Unfortunately, we know very little about the hunter-gatherers' lives on the TP before the arrival of domesticated plants and animals, especially for the high central TP. Until we do, speculation on the nature of early-mid Holocene TP subsistence and settlement systems is just that, speculation, and more archaeological

surveys and excavations must be done to solve these arguments.

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