



The daily lives of early Tibetan farmers were preserved by the mud that swallowed their village 4000 years ago, but their origins are a mystery.

WHO ARE THE TIBETANS?

China and some scientists say they are Chinese. But others see a richer picture

By Jane Qiu

Even after 4000 years, the pose of the two skeletons, a woman and a child, is eloquent. Clutching the child to her breast, the woman looks to the sky as if seeking salvation. Nearby, a man lies on his stomach, his fractured legs folded backward. These and other poignant remains testify to the final moments 4000 years ago

of Lajia, a farming village at an altitude of about 1800 meters on the eastern edge of Tibet. Archaeologist Cai Linhai of the Qinghai Provincial Institute of Cultural Relics and Archaeology in Xining, who is excavating there, calls it “the Pompeii of the Tibetan Plateau.”

Lajia, on the upper reaches of the Yellow River, met its end when a mudflow engulfed it, perhaps triggered by an earthquake in the

seismically active region. But profound puzzles remain. Pottery and jade artifacts there appear to be derived from the Yangshao culture, widely considered the precursor of modern Chinese civilization. Were the victims of the apocalypse Han Chinese, or close kin? And what led their ancestors to settle on the harsh, low-oxygen “roof of the world”?

Like many questions of geography and migration, this one has political overtones. Seeking the high ground in disputes about Tibet’s historical relationship to China, the Chinese government has seized on recent findings that Tibetans and Han Chinese may have descended from a common ancestor, diverging only in the past several thousand years. “The Chinese government is keen to prove that Tibetans and Han Chinese are *tonggen tongyuan*—of the same roots and the same source—in order to justify its rule in Tibet,” says a Chinese archaeologist who requests anonymity for fear of political repercussions.

Some scholars say the evidence supports the government’s view. “Tibetans and Han Chinese are ultimately the same people, sharing a common ancestry that separated only very recently,” says Ren Xiaoyan, director of the Qinghai institute. Others disagree. “Tibet-

ans are not the result of a single ethnic group who moved to the plateau and subsequently became Tibetans,” says archaeologist Lü Hongliang of Sichuan University in Chengdu.

A spate of recent findings reveals that many different peoples sojourned on the great plateau. Archaeological evidence shows that nomads wandered up river valleys almost as soon as modern humans arrived in Asia. They came not just from the east—the Chinese heartland—but from the west and south as well. The Tibetan Plateau “may have been a surprisingly cosmopolitan place in prehistory—a melting pot for people from different directions,” says archaeologist Mark Aldenderfer of the University of California (UC), Merced. But which of those groups finally settled the plateau and became the present-day Tibetans?

Some genetic and archaeological studies support the idea that the people who met their doom at Lajia were recent arrivals from China. But other evidence points to a more complex and nuanced picture, suggesting that the nomads who ventured onto the plateau thousands of years earlier, from all across Asia, left a substantial genetic imprint on today’s Tibetans.

FOUR TIMES THE SIZE OF TEXAS, with an average elevation of 4000 meters, the Tibetan Plateau is one of the most forbidding stretches of our planet. Yet the modern humans spreading across Asia 40,000 years ago and more were apparently not daunted. River valleys running deep into the plateau’s heart “were probably quite a decent place to live,” even during the Last Glacial Maximum, a period of intense cold from about 28,000 to 17,000 years B.P., says Xu Baiqing, a climate and environmental scientist at the Institute of Tibetan Plateau Research of the Chinese Academy of Sciences (CAS) in Beijing. Game, wild barley, and other resources there “could have sustained small populations for a very long time.”

At Yushuiping, a site 2500 meters above sea level on the plateau’s southeastern edge in present-day Yunnan province, archaeologist Dong Guanghui of Lanzhou University and colleagues recently excavated what may be the earliest evidence of humans in Tibet: stone tools and butchered animal bones dating to between 39,000 and 31,000 years B.P. The findings, which have not yet been submitted for publication, say nothing about where those early arrivals came from. But at sites on the opposite side of the plateau, in western Tibet, stone tools resemble those from Nepal dated to 25,000 to 20,000 years B.P. The implication, Aldenderfer says, is that “people could move onto the plateau from the southern Himalayas.”

They may have arrived from the west, too.

Stone tools from sites in western Tibet—some dated to 20,000 B.P.—are similar to ones found in the Altai Mountains, in southern Siberia. The Altai may have also been the source of a genetic adaptation that was key to later settlement at high altitudes. In a study in *Nature* last year, a team led by Wang Jun, director of BGI in Shenzhen, and population geneticist Rasmus Nielsen of UC Berkeley showed that *EPASI*—a gene regulating the production of oxygen-carrying hemoglobin in the blood—might have originated in the Denisovans, an archaic hominin species whose fossil remains are found only in the Altai Mountains. They suspect that Denisovans and modern humans interbred near Tibet 50,000 to 20,000 years ago. The very earliest migrants might have carried the gene to Tibet, or it might have reached the plateau later, after spreading across Asia.

The early Tibetans would have been hunter-gatherers, chasing yaks and other game, as stone tools and animal fossils at the Yunnan site attest. Although some might have retreated to lower elevations in winter, other groups probably were year-round residents. “It simply would not be feasible for people to move up and down the plateau on a seasonal basis” if their settlements were in the heart of Tibet, Aldenderfer says. Prehistoric Tibetans “could seek refuge around the bountiful hot springs in western and central Tibet,” says archaeologist Hou Guangliang of Qinghai Normal University

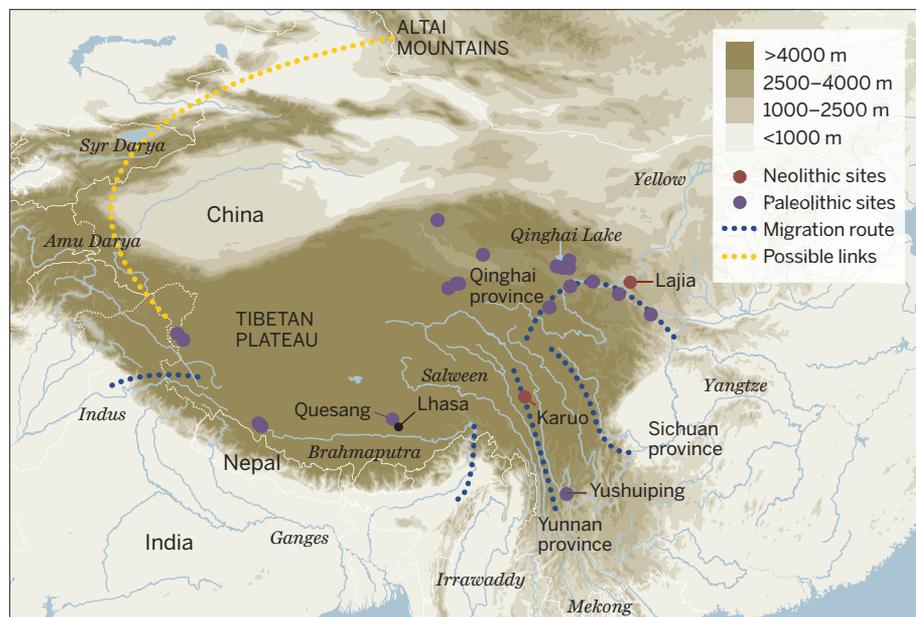
in Xining. They also warmed themselves at hearths; Hou and colleagues uncovered the oldest known fireplace on the plateau at Jiangxigou, a site on the southern edge of Qinghai Lake dating to 15,000 years B.P.

By 9000 to 6000 years ago, people probably lived year-round at Quesang, a newly excavated site near Lhasa, Tibet’s capital, at a dizzying 4200 meters above sea level. Quesang’s inhabitants would have had to travel at least 700 kilometers to descend from the plateau: too great a seasonal migration even for far-ranging hunter-gatherers, Aldenderfer says. Such sites indicate that people might have settled on the plateau—and began adapting genetically and culturally to the demands of life there—long before farming began, he says. “You don’t have to live everywhere or stay at the same spot to have a year-round existence on the plateau.”

Over time, a hunter-gatherer lifestyle gave way to pastoralism: raising sheep and domesticated yaks. In *Quaternary Science Reviews* last year, ecologist Georg Miede of Philipps University of Marburg and colleagues suggested that the vegetation in Tibet began to change 8000 years ago as the herds multiplied. They cited several lines of evidence, including pollen from lake sediments, to show that the dominant grass species in Tibet emerged about 8000 years ago. They also documented charcoal in the ancient soil layers, along with a decline of forest pollen, suggesting that early colonizers of Tibet burned

The high frontier

Archaeological sites dot the Tibetan Plateau, showing that people arrived more than 30,000 years ago and may have been year-round residents by 6000 years ago. More than 3800 Neolithic sites (not shown) record the spread of farming.



forests to convert them to grasslands.

But sustaining larger settlements meant growing food: a daunting challenge on the parched, cold plateau. Paradoxically, an episode of global cooling may have triggered the key adaptations.

Today the high-altitude valleys of Tibet are carpeted with barley. But the first farmers grew a different crop: millet. At Karuo, a village at 3100 meters that is the oldest broadly accepted permanent settlement in Tibet, Sichuan University's Lü and colleagues recovered millet dating as far back as 5000 B.P. Karuo, on the upper reaches of the Mekong River, was a good spot for farming, Lü says—"a warmer and wetter part of the plateau."

Settling the colder and drier northern plateau, however, apparently required different crops. In a study published last month in *Science* (16 January, p. 248), Lanzhou University's Dong, archaeologist Zhang Dongju, and climate scientist Chen Fahu, along with colleagues, radiocarbon dated charred grains from 53 sites on the northeastern Tibetan Plateau. The dates showed that up until about 3600 B.P., people lived below 2500 meters and their crops were almost exclusively millet. But later settlers ventured higher onto the plateau and grew mostly barley and some wheat.

"This is counterintuitive," Dong says. "Barley and wheat need more time to mature than millet, and so would not seem to be a wise choice for the frigid high plateau where the growing season is short." Yet those grains are more resistant to frost than millet. Dong and colleagues think a global cooling beginning about 4500 B.P. and lasting for a

millennium may have driven a shift to these new cereals, imports from the Near East. They in turn allowed farmers to colonize to higher elevations. "Wheat and barley not only helped them survive the big chill," Chen says, "but expand their range to the heart of the plateau."

Conventional wisdom holds that people would have migrated onto the plateau en masse during a warming phase, when vegetation would have been lush. But the new proposal is gaining traction. "This strikes me as a very compelling scenario of why you'd get a rather late permanent colonization of the plateau," says P. Jeffrey Brantingham, an archaeologist at UC Los Angeles who was not involved in the study.

WHO WERE THESE PIONEER FARMERS?

Historical records only begin with the reign of Songtsan Gampo, a warrior who united Tibet's tribes in the 7th century C.E., while myths trace the origin of the Tibetans to the union of an ogress and monkey on the Gangpo Ri—a holy mountain 180 kilometers south of Lhasa. But lately, geneticists have started to pierce the haze.

"A hallmark of Tibetans that distinguishes them from other Asian populations is their ability to thrive in lofty mountains without getting altitude sickness," says Su Bing, a population geneticist at CAS's Kunming Institute of Zoology. Most Tibetans live above 3500 meters, where air contains 40% less oxygen than that at sea level and rates of low birth weight babies and infant mortality are several times higher. "You really need to have many generations of

people spending most of the year on the plateau to develop physiological adaptations and pass down adaptive genes," Su says.

To trace the history of those adaptations, a team led by BGI's Wang sequenced the coding region of 92% of the genes in 50 Tibetans and 40 Han Chinese. In at least 30 genes, they found, a variant common in Tibetans is rare in the Han. In the most extreme case, a variant of *EPAS1*—the gene linked to high-altitude adaptation—was present in 87% of Tibetans but only 9% of the Han. A group headed by UC Berkeley's Nielsen then tested various scenarios of population history—with different assumptions about population sizes, divergence time, and the amount of gene flow between peoples—to see which best explained Wang's results. "We found that a divergence time of 2750 years ago could best reproduce the pattern of genetic variations," says Nielsen, who with Wang and colleagues published their findings in *Science* in 2010 (2 July, p. 75).

That remarkably recent date has met deep skepticism. "It contradicts too many things we know about Tibet," Lü says, among them the evidence of farming settlements like Karuo, which dates from at least 2000 years earlier. Others take issue with the *Science* paper's methodology. "The sample size and population coverage are too small to tease out the complexity of the population history of Tibet," says Jin Li, a population geneticist at Fudan University in Shanghai. Nielsen's best fit scenario, which assumes a population of 288 Han Chinese and 22,642 Tibetans at the time of the split, also strikes many as implausible. "This simply can't be true," Su says.

"You can tweak the model to give you the pattern of genetic variations you want, but this doesn't necessarily mean that the scenario is realistic," Nielsen says his team has revised its models and now thinks that Tibetans and Han Chinese probably separated 5000 to 3000 years ago.

Linguistics also suggests that the Tibetan and Chinese people share a common, but more distant, root. By comparing features such as sounds, dialects, and word order, William Shi-Yuan Wang, a linguist at City University of Hong Kong, constructed a family tree in 1998 that places the Tibetan-Chinese split at about 6000 years ago. George van Driem, an expert of Himalayan languages at the University of Bern, argues for a similar divergence time. After analyzing how the languages evolved over time—as new words emerged



Excavations at the 151 locality near Qinghai Lake have revealed elaborate wooden huts where early Tibetans may have sheltered themselves from the cold climate 9000 years ago.



Global cooling helped expand the range of cold-hardy barley, here being winnowed near Gyangtze in southern Tibet, to the high plateau 3600 years ago.

and old ones dropped out—he suggests that the first Tibetan speakers emerged in western Sichuan province, on the eastern edge of the Tibetan Plateau, about 7000 years ago.

But Su postulates a more complex and much earlier origin for Tibetans. In a series of papers in *Molecular Biology and Evolution* between 2011 and 2013, his team reported sequencing DNA from 6109 Tibetans from 41 villages across the Tibetan Plateau. They found Tibetan-specific sequences on the Y chromosome and in mitochondrial DNA that are absent or occur at very low frequencies in other Asian populations. Based on known mutation rates, Su suggests that the sequences began evolving 30,000 to 20,000 years ago, among early nomads who had settled on the plateau.

Sequence diversity can also track past population bottlenecks and expansions. In their DNA data, Su's team found signs that Tibet's population grew fourfold between 10,000 and 7000 years ago. Those arguing for a close kinship between the Tibetans and the Han may be at least partly right, Su says. "The data point to a second wave

of migration, probably of Han Chinese, into Tibet," he says. "The newcomers most likely bred with earlier settlers, giving rise to present-day Tibetans."

Existing genetic data won't be enough to sort out the puzzles. Researchers agree that they need more extensive archaeological data from the heart of the plateau, larger genetic studies, and clues from ancient DNA. "We are still looking for a good specific model of the history of Tibet," Nielsen says.

REGARDLESS OF THEIR ORIGINS, Tibetans never were isolated in their mountain fastness. They remained part of Eurasia's human melting pot, with new arrivals adding to the mix. "People normally see mountains as barriers," says Xinyi Liu, an archaeologist at Washington University in St. Louis. But in prehistory as today, he says, they entice people from the lowlands with their rich natural resources, such as plants and game, tool-making materials, firewood, and, most important, water.

Over the past decade, archaeologists have documented numerous prehistoric settle-

ments along what archaeologist Michael Frachetti, also of Washington University, calls the Inner Asian Mountain Corridors, from Central Asia and the Himalayas to Tibet and the Altai Mountains. Around 5000 B.P., "you begin to see unquestionable connections" with clear signs of trade, he says.

These mountain corridors may well have been the precursors of the Silk Road, the overland trade routes linking China to South Asia, the Near East, Central Asia, and Europe starting around the first century B.C.E. The mountains were conduits for the exchange of genes, goods, and ideas, says Martin Jones, an archaeologist at the University of Cambridge in the United Kingdom.

Tibet was the heart of that cultural nexus. "It's been a magnet for peoples from different directions for tens of thousands of years," Aldenderfer says. If that's the case, today's Tibetans emerged from a prehistoric cosmopolitanism that, no matter which way the political winds blow, cannot be attributed to a single culture or ethnicity. ■

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