

Alfalfa, Pasture and the Horse in China: A Review Article

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In his 1919 essay on alfalfa, Bernard Laufer identified the need for suitable fodder to help with breeding from the fine horses acquired from central Asia as the motivation behind the reported introduction of this crop from the Iranian plateau to China in 126 BC.¹ Since then, the domestication of horse and alfalfa and the acquisition, breeding and use of horses in China have been the subject of many articles. The importance of the horse in Silk Road trade and economies has also been much discussed.² Several of these have shown that, despite the introduction of this specialised fodder for horses, horse breeding remained unsuccessful throughout much of China's history and had been largely abandoned by the modern era. Yet, alfalfa production continued, albeit at a low level, and 80 local alfalfa varieties (landraces) have been identified in China to date.³ What Laufer could not have known in 1919 was that horse breeding in central China might well fail, not because of lack of suitable fodder but because of China's selenium deficient soil. Despite this discovery in the mid-twentieth century, surprisingly few scholars have considered the role of selenium in the history of horse breeding. Here I review the literature in general, concentrating on the period up to the Tang, and including some results of recent DNA analyses.⁴

In key article written in 1965 discussing the importance of the horse in China, Herrlee G. Creel (1905–1994) argued that: 'For some two thousand years China's foreign relations military policy, economic well-being, and indeed its existence as an independent state were importantly conditioned by the horse.'⁵ Yet China was not a land of horses, unlike Iran which, in a quote attributed to King Darius (c. 550–486 BC) and cited by Laufer, 'is abundant in horses' and 'does not tremble before any enemy.'⁶ Darius was himself an equestrian and, in the account given by Herodotus, gained the throne with the help of his horse.⁷ He duly erected a statue of himself on horseback with the

¹ Laufer (1919, 210-11). NB: I use China in this article, unless otherwise indicated, as a geographical rather than a political term and therefore do not include the regions of Inner Mongolia, Tibet and Xinjiang, which have only at times been part of the political entity and are geographically distinct.

² A recent, and very useful, contribution to the field discusses trade, breeding and art across Eurasia (Kauz et al (2009)).

³ Hu and Cash (2009, p. 6). In 1949, about 330,000 ha of alfalfa were grown in China, accounting for 1% of the national total arable land area.

⁴ Like all scientific techniques, DNA analysis is not infallible, but the issues mainly lie especially—as with humanities data—in the interpretation of results. I am not equipped to judge these, so give references to such articles with the caveat that their usefulness will become apparent with peer review and verification.

⁵ Creel (1965, p. 648).

⁶ Laufer (1919, p. 210).

⁷ The earliest domestication of the horse is widely accepted as being that of the Botai on the steppe in present day Kazakhstan. However, recent DNA analysis has shown that they only contribute 2.7% ancestry to the

inscription: ‘Darius, son of Hystaspes, by the virtue of his horse and of his groom Oebares, won the throne of Persia.’⁸ By contrast, Darius’s contemporary in China, Confucius (c. 551-479), would not have known how to ride a horse: it was not among the six skills considered essential for the gentleman, although he would have used a horse-drawn chariot. While rulers of the kingdoms of China in this period might also have led their armies from a horse-drawn chariot, they had no cavalry in their armies.⁹ The use of the horses for riding, initially for such cavalry, only appears to have been adopted among the kingdoms of northern China around the late 4th century BC in response to the rise of horse-riding neighbours on their north and northwestern borders, the Yuezhi to the northwest, Xiongnu to the north and Donghu to the northeast.¹⁰ Thereafter, both with the growth of the Xiongnu empire followed by successive Turkic and Mongolian steppe empires, the horse became essential to military life in northern China.

Creel cites first millennium BC Chinese sources that horses were judged and selected for their colour and size and argues that this is evidence for breeding programmes.¹¹ Eduard Erkes (1891–1958) also discusses the evidence in this early period, and notes the lack of any one horse-breeding centre.¹² Creel takes this as evidence of the lack of successful breeding and gives several examples of horses acquired by the various Chinese kingdoms from their steppe neighbours.¹³ Since textual sources suggest that some of the kingdoms of northern China at this time had armies with 3,000 chariots or more, considerable numbers of horses would have been required especially as there was probably a fairly high attrition rate.¹⁴

sample of modern horses tested (Librado et al. (2017)). This suggests that there was later domestication of other populations, possibly several separate ones, the ancestors of modern horses. Some suggest that one of these could have been in China (see Xie [Hsieh] (1959) quoted by Creel (1965, p. 652 n. 18) and for a recent update arguing for domestication event in east Asia more broadly (Ning et al. (2019)). This last article still accepts Przewalski as wild horses. More importantly, however, it includes Mongolia and the whole of present-day political China, ie including Inner Mongolia, Manchuria and Xinjiang, as part of east rather than north or central Asia.

⁸ Herodotus (III.3.17) from translation by Aubrey de Séincourt (2003).

⁹ Archaeological evidence suggests that the horse-drawn chariot came into China around 1200 BC and that it only started to be adapted for war in the first millennium BC (see Shaughnessy (1988)).

¹⁰ Erkes (1940, pp. 52-4). *Shiji* 110:6. trans. in Watson (1958 2: p. 159). For a review of the military in the Zhou period see Theobald (2000). For a discussion of this adoption of cavalry see Di Cosmo (2002: 134-8). Di Cosmo also notes that the Zhao king is said to have instructed his military to wear ‘the foreigners’ dress’ (*hufu*), ie. clothes suitable for riding. *Hufu* was to become an elite fashion statement in 8th century China.. For a depiction of horses in a tomb from this period see Cooke (2000, p. 119).

¹¹ Creel (1965, p. 654).

¹² Erkes (1940, p. 36).

¹³ Creel (1965, p. 656).

¹⁴ Yang (1994, p. 89) cited by Theobald (2018). Theobald also cites sources which say the kingdom of Chu had 10,000 chariots in the early first millennium BC. This number seems to have reduced by the Warring States period (475–221 BC) but Theobald notes one source which records that one side in the battle of Lingqiu, still had 2,000 chariots.

The Yuezhi were pastoralist peoples who lived in the Hexi corridor until pushed out by the Xiongnu from 176 BC. Some scholars have argued for their Scythian origins from the northwestern steppe and their identification as Tocharians, but others dispute this.¹⁵ As well as noting their equestrian archery skills, the near contemporary historian, Sima Qian (139–86 BC) recorded that Lou, a Yuezhi ruler, sold horses to the Chinese in return for silk and cattle.¹⁶ Sima Qian also notes that the Xiongnu had two special breeds of horses and that these were brought into China in the 3rd century BC.¹⁷ Creel cites Egami Namio (1906–2002) who proposed that one of these breeds was ‘the aryan horse originally bred on the shores of the Aral and Caspian Seas.’¹⁸ Edward Schafer (1913–1991) likewise suggested they were horses from this region, often referred to as the Turkoman or Tukmenian horses, assumed to be the ancestors of the Akhal-Teke breed.¹⁹ This would not be surprising as the Xiongnu territory extended to the areas where these horses were found.

Analysis of DNA from remains of thirteen stallions in Scythian burials at Arzhan and Berel dating to 700–300 BC showed considerable genetic diversity, with horses bred for the development of their forelimbs but also for their mammary glands—confirming the use of mare’s milk from this period.²⁰ DNA analysis has also been done recently on horses remains in north China and the steppe, also finding considerable diversity, and concluded that they ‘are most closely related to the Mongolian horses.’²¹

The existence of at least two breeds of horses in China is further supported by two distinct types depicted in pottery statues of horses from the Han dynasty, a point noted by Laufer and reiterated by

¹⁵ See Enoki et al (1994) for the link with the Scythians, Benjamin (2007), for more recent discussion and Wei et al (2013) for an argument against the link between the Yuezhi and Tocharians.. Also Thierry (2005) for the reliability of the Chinese histories, our main textual source for the Yuezhi.

¹⁶ Benjamin (2007, p. 32). See also Benjamin (2000) for a general discussion of the Yuezhi in Chinese sources.

¹⁷ Creel (1965, p. 658).

¹⁸ Egami (1951). Egami was, of course, the proponent of the horse-rider theory of Japan, since much challenged, that Japan was conquered in the 4th and 5th centuries AD. by a horse-riding culture originally of the steppe but by then in the Korean peninsula.

¹⁹ Schafer (1963, p. 66). For a reference to modern breeds of horses with their historical antecedents see Hendricks (2003). The Akhal-Teke is discussed on pp. 4–10 where she describes it ‘as probably the purest descendant of the ancient Scythian horse.’ (p. 8).

²⁰ Librado et al. (2017).

²¹ Cai et al (2009). The authors describe this as Northern China, but four of the sites are north and east of the Ordos so ecologically in steppe territory and for much of the period under discussion, not under Chinese rule. It is important to be precise about this. The authors also conclude that the Chinese horse was not descended from the Przewalski. They presumably went to press before results were published showing that the Przewalski is a descendant of the first domesticated Botai horse gone feral (Gaunitz et al. 2018). Furthermore, that most modern horses owe little to this lineage, suggesting later domestication event(s).

Creel.²² Since their articles, other horse figures from this period have been discovered, including cavalry horses from the burial pit of the First Emperor of the Qin (221-207 BC), standing 13.2 hands high.²³ However, despite the acquisition of horses and breeding programmes, a Han official Chao Cuo 晁錯 (ca. 200–154 BC), remarked that: ‘In climbing up and down mountains and crossing ravines and mountain torrents, the horses of China cannot compare with those of the Xiongnu.’²⁴

A decade later the Han emperor Wu (r. 140-87 BC) sent a mission led by Zhang Qian (d. c. 114 BC) to seek a military alliance with the Yuezhi against the Xiongnu. The Yuezhi, pushed out of the Hexi by Xiongnu incursions, were thought by the Chinese to be living to the north of the Tianshan, on the Xiongnu’s western flank. In fact, by the time Zhang Qian reached here—he was delayed after being captured and held by the Xiongnu for over a decade — it was to find the Yuezhi had moved further west to Bactria, the region south of the Amu Darya. Zhang Qian’s mission has become famous, although it failed in its primary aim, for the examples and intelligence of goods he took back. These including alfalfa seeds and descriptions of horses in the Ferghana valley, described as ‘blood-sweating horses’ (汗血馬). Around a thousand of these horses were subsequently acquired by Emperor Wu around 100 BC, although only following a military campaign which imposed considerable cost to China.²⁵

There has been much discussion about their breed, with broad consensus that they were also the Turkmenian ancestors of the Akhal-Teke. If Egami and Schafer are correct and the Xiongnu also had this horse, the Chinese would have seen them earlier. A particularly striking gilded bronze horse from the imperial burial of Emperor Wu at Maoling near Xian, discovered in 1981, shows clear characteristics of the Akhal-Teke horse of today.²⁶ Even if such horses had been previously acquired from the Xiongnu, the discovery of another source of such horses, with the potential for larger and cheaper supplies, would have been important.

²² Laufer (1909) and Creel (1965, p. 664). Also see Desroches and Rey (1995), Fang (2017) and Druml (2009), the last for the discussion of what he calls the ‘representative horse’, bred for elite mounts and exemplified by the Tang-period horse depicted in tomb statues.

²³ Cooke (2000, pp. 125-6).

²⁴ *Hanshu* 49-10b, quoted in Creel (1965, p. 657).

²⁵ The histories record that 3000 horses were sent, but that 2000 of them had died by the time they reached the border of China at Yumenguan. See Dubs (1944, II. p. 132).

²⁶ Cooke (2000, pp. 136). Also shown is a jade winged horse with rider, excavated in 1966 from Weiling, also near Xian (p. 137).

There has also been considerable discussion among scholars on the attribution, ‘blood-sweating.’ The most plausible explanation, and one probably now generally accepted, is that this was due to a parasite. Bonnie Hendricks, in the entry for the Akhal-Teke in her encyclopedia of horse breeds, cites Louise Firouz, a horse breeder, who confirms that this parasite is only found in Gorgon and Fergana rivers.²⁷ The parasite breaks through the horse’s skin in late spring, causing the bleeding. Firouz also identified a breed of ponies in same area which has been linked with the Caspian, long thought to be extinct. But this was a pony and, as Hendricks points out, would not fit with the Chinese descriptions of a tall horse. The blood-sweating would have continued to be evident after the horses were taken to China as, even when moved to a different region free from parasites, it takes about four years for the parasite to be cleared from the horse’s system.

Incidentally, as Hendricks also notes, Turkmenian horses had been acquired centuries before by King Darius and then by Alexander the Great (356-323 BC). Indeed, the latter’s famous steed, Bucephalus, was possibly of Turkmenian blood.²⁸ They ‘were taller and swifter than most other breeds of that time.’²⁹

The Chinese must have hoped that these horses could be bred to produce a line which were an improvement on their ordinary stock. The discovery of a specialised horse fodder, alfalfa, grown in central and west Asia must have been welcomed to help with this programme. We know of at least one horse breeder from this time, Ma Yuan (馬援 14 BC - AD 49) formerly a general under the Han who raised cattle, sheep and horses in the northwest border of China, specifically in the Longxi region in the Hexi corridor.³⁰ However, evidence shows that the Han continued to acquire many horses from its northern neighbours.

In the period following the Han, north China was ruled by various regimes and the lands they controlled included some of the steppe and the Hexi corridor to the north and northwest of China, traditional horse pasture lands. Creel’s article skates over this period but a recent article by Shing Müller considers the horses of one of these regimes, the Northern Wei (386–584), ruled by the Tuoba Xianbei.³¹ They were renowned for their cavalry, even among their horseriding neighbours such as the Xiongnu. Müller notes, they ‘took advantage of the vast Mongolian steppes as pastures

²⁷ Hendricks (2003, p. 7. See also p. 5 for an image).

²⁸ Hendricks (2003, p. 5).

²⁹ Hendricks (2003, p. 5). Described by Druml as a ‘plateau thoroughbred’ type (2009).

³⁰ Creel (1965, p. 659), de Crespigny (2006, p.658).

³¹ Müller (2009).

and perfectly managed their horse supply. Despite numerous military campaigns with unavoidable losses, the Xianbei were about to rebuild within a short term a new cavalry with an immense numbers of warhorses. The Chinese on the contrary were always in want of horses.³² A history of this period notes that there were two million horses in north China under the Xianbei.³³ Many of these were acquired from their neighbours after successful campaigns and were settled in their pastures of the Hexi and the Ordos, the latter within the arch of the Yellow river. A contemporary text also describes the planting method and importance of alfalfa as a fodder.³⁴

Interestingly, as Muller goes on to explain, as the Xianbei moved their political centre south from Datong to Luoyang on the Yellow River in the late 5th century, they also moved many of their horses and tried to acclimatize them to the hotter and more humid climate. New pasture was set aside in Heyang, on the northern bank of the Yellow River and 100,000 war horses were kept there. However, their numbers gradually declined. Müller puts this down, as have many before her, to the increasing demands of their pasture for agriculture. This was almost certainly a factor, but probably not the only one, as I discuss below. The situation was exacerbated as the government ceded control of some of the northern pasturelands and they moved into private ownership, the owners then becoming suppliers of horses to the state. She also notes that ‘the few known persons serving these horse-herding posts during Northern Wei times were all either of Xianbei or of other steppe origins, who could undoubtedly bring in their expertise in matters of horse affairs. Yang Chun, mentioned above, would have been the only minister of Chinese origin for the Imperial Stud under the Northern Wei.’³⁵ The lack of appropriate skills and expertise among Chinese officials is another reason often given for the failure of China’s horsebreeding, as discussed below. But Müller is arguing that by this time horses had become part of elite cultural life, not just military and it is difficult to believe that such skills could not be acquired.³⁶ She concludes that the Xianbei were responsible for the prominence of horses in Tang life and art: ‘the esteem and status of horses deeply rooted in the Xianbei societies had obviously been transformed into a new tradition in paintings of Tang times. Besides, certain customs of Tang times are reminiscent of the nomadic way of life of the Xianbei... The esteem of the Xianbei towards horses fused into the way of life of Tang society and greatly influence the Han Chinese of the following centuries.’³⁷

³² Müller (2009, p. 182).

³³ *Weishu*, quoted by Müller (2009, p.183).

³⁴ *Qi Min Yao Shu* of the Northern Wei Dynasty (386-589) described the planting method and feeding value of alfalfa.

³⁵ Müller (2009, p. 187).

³⁶ Müller notes that it was possible to rent a horse in Luoyang (2009, p. 185).

³⁷ Müller (2009, p. 193).

There are two other factors to consider in this. The first is that the Tang rulers probably had some Turkic ancestry, which would also have its legacy of horsemanship, and we do not know what role this played in their love of horses. Secondly, during the southern dynasties, many more ethnic Han moved to the far south. A Tang writer noted that ‘South of the Chiang [Yangzi River] there are neither wolves nor horses’³⁸ Yet studies suggest that horses found in these areas of China today, the Baise and Jinjiang, are indigenous to what are now Guangxi and Fujian provinces.³⁹ Hendricks states that the Baise was used in local wedding ceremonies from 20 BC and mentions a local horse market and bronze horse statues discovered in 1972 and 1980 which resemble the Baise today.⁴⁰ In the second century BC a Chinese general of the Qin had moved there and established himself as king of the Southern Yue (Nanyue).⁴¹ During the rule of his grandson, when many ministers opposed becoming subject to the Han empire and attacked a Han mission, the Han sent a military force south which defeated this group. Interestingly, however, the tomb of Zhao Mo, the second King of Nanyue, contained no horse accoutrements and it is not clear how much horses played a role in life in south China at this time. Nor is it clear whether the horses of this region were used in breeding programmes further north.⁴²

When much of China was united under the Sui (589-618) and then Tang dynasties (618-907), with the main capital at Chang’an, the situation regarding horse stock for these new regimes was dire. Creel notes that at the start of the dynasty, the Tang was said to have had only 5,000 horses but that ‘a vigorous breeding programme increased this to 700,000 within a few decades.’⁴³ He does not give a source for this information nor where it took place, but this certainly seems to indicate successful breeding. He also notes that Arab horses were introduced to China at this time, but that horses from the Turkic empires to the north continued to be the main stock.

³⁸ Duan Chengshi (d. 863) quoted by Schafer (1963, p. 119).

³⁹ For the Baise see Hendricks (2003, pp. 58-60). She does not have an entry for the Jinjiang, but it is found in Rousseau (2017, p. 355). However, recent results from DNA analysis (Ma et al. (2019)) conclude that ‘The results showed that the... Jinjiang horses shared a similar genetic background with Baise horses.’ See also Chin (2009) for a discussion of horse markets in the southwest of China during the Song period, where he notes that a local revolt in 1052 and its suppression ‘not only introduced mounted combat skills into mainland southeast Asia, but also made it clear that good quality war horses could be obtained from this region.’ (p. 210).

⁴⁰ Hendricks (2003, p. 59). Unfortunately, she gives no references for this information.

⁴¹ Curiously, a modern statue in front of Heyuan Railway Station in Guangdong shows him on horseback, one of the few such depictions of a ruler in China.

⁴² Interesting, there is evidence that the rulers of Bengal obtained some of their horses from what is now the borders of southwest China (Chakravarti (1999, pp. 202-3)). They also seem to have sent horses to China (pp. 204-8). Maritime trade in horses is further discussed by Chakravati (1991), Beckwith (1991) and Ptak (1990, 2009)

⁴³ Creel (1965, p. 665).

The Tang controlled the bend of the Yellow River and the Hexi corridor, traditional pasture lands. In his discussion of stockbreeding ranches under the Tang, Jonathan Skaff shows that they were established mainly to the west and northwest of Chang'an.⁴⁴ Some of these were in the eastern part of the Hexi corridor, with a ranch at Lanzhou being the furthest west. Importantly, some of the fodder seems to have been brought in from outside these areas. There is also evidence of alfalfa being grown in the vicinity of the ranches from the early eighth century.⁴⁵

Growing from this modest start, Tang domestic supplies of horses fluctuated from a known high of around 700,000 in the mid-seventh century to a low of 240,000 in the early eighth century. After reaching another peak by 731, herd numbers plummeted three decades later when most of the borderland ranches were lost during the An Lushan rebellion.⁴⁶ As Skaff notes, 'By the ninth century, a dynasty that once had hundreds of thousands of mounts was struggling to maintain a breeding herd of several thousand horses.'⁴⁷

The purchase of horses by the Chinese from the Uyghurs after their military help to the Tang in regaining control of the eastern capital, Luoyang, in the An Lushan rebellion is a relatively well-documented and discussed period. Trade in horses was part of the war reparation, with horse markets established along the border. The Chinese bought them with silk, reportedly forty bolts for each horse.⁴⁸ The amounts of silk acquired were too great for use by the Uyghurs, and they traded the silk on to the Sogdians who, in turn, traded it to peoples further west.⁴⁹

The Uyghur empire ended in 840, with many Uyghurs moving into north China and others establishing kingdoms in the Tarim Basin and Hexi Corridor where, presumably, they continued horse breeding.⁵⁰ In 929 the Duyuhun and Tanguts—who succeeded them in control of the Hexi corridor—sent regular embassies to the Chinese court, taking horses and receiving silk, thus increasing trade under the guise of tribute. It was pointed out by the Chancellor in 929 that when the cost of hospitality for these embassies was added to the price of the silk given for the horses then

⁴⁴ Skaff (2017, p. 38).

⁴⁵ Skaff (2017, p. 42). Li Shangyin, a poet of the Tang Dynasty (618-907), wrote in his poem 'Mao Ling' "alfalfa flowers cover the near suburbs".

⁴⁶ As Creel notes, before his rebellion, An Lushan had been given extensive responsibility for cavalry horses of the Tang and ensured many of the best were sent to his base in preparation for his actions. (1965, p. 666).

⁴⁷ Skaff (2017, p. 46).

⁴⁸ Creel (1965, pp. 665–6), MacKerras (2000, pp. 203-5).

⁴⁹ For discussions on the extent and economics of this trade see Skaff (2012, pp. 241-71) and Beckwith (1991).

⁵⁰ See Drompp (2005) for a history of the Uyghurs during this period, also referring back to the horse trade.

the total exceeded double the actual worth of the horses.⁵¹ But the emperor held that the empire ‘was plagued by a constant insufficiency of horses and that merchants were permanently engaged in trying to secure them. Now that the Barbarians are bringing horses of their own volition, how can one speak of expenses?’⁵²

The same story of breeding programmes failing to produce enough horses for China’s needs continues, and thus their continuing import by land and sea.⁵³ A Horse Trading Office was established in the 12th century Song dynasty (960-1279), with horses paid for by tea rather than silk, thus starting a system which was restored in the Ming and Qing with Tea and Horse Offices.⁵⁴ This trade has given rise to the labelling of the route through southwest China as the Tea-Horse Road.⁵⁵ Nevertheless, a memorial to the emperor by Song Qi (998–1061) noted that China had a large number of cavalrymen but ‘only one or two out of ten had a horse to ride.’⁵⁶

Inbetween, of course, the Mongol Yuan dynasty (1279-1368) ruled China. They had the expertise and experience of horse breeding and could rely on raising stock on steppe pastures, part of their territory, establishing breeding centres.⁵⁷ They also set up a horse-breeding ranch on Jeju Island, off the Korean peninsula.⁵⁸ But still, as Jagchid and Bawden note, whereas on the steppe each man had several horses, riding one with others following, in China ‘Mongol soldiers are reported at times to have no horses at all, and a requisition could produce as few as 47 horses from a whole province.’⁵⁹ And they conclude that ‘The Mongols were able to establish their empire because of their abundance of horses... [but] they were unable, from the imperial centre in China, to acquire enough horses to back a regular and realistic horse policy which would have given them the necessary mobility always to act successfully against rebels, and retain the unity of the empire. Without horses,

⁵¹ Sinor (1972, p. 175).

⁵² Sinor (1972, p. 175).

⁵³ For this period see Chin (2009) and, for horses by sea, Ptak (2009).

⁵⁴ For the Ming, see Rossabi (1970) and Schottenhammer (2009) for the Qing.

⁵⁵ Creel (1965, p. 668), Sinor (1972, p. 175), Rossabi (1970), See also note 43 above, which notes this route being used for transport of horses to Bengal for several centuries before this.

⁵⁶ Creel (1965, p. 667). Also see Chin who discusses the horse trade in the Song, noting that ‘the territory inherited by the by the Song empire was small in comparison to that governed by the Tang... the major pastures in the north had already been occupied by the semi-nomadic Khitan.’ and goes on to note that further pastureland territory in north China was later taken by the Liao. (2009, p. 205).

⁵⁷ Xu (2013/5). Xu also considers the perception and importance of the horse in the Yuan and gives good a bibliography for this period. Also see Jagchid and Bawden (1965) and Smith (2009). The last is particularly interesting about the Mongol armies campaigns in the horseless south China, and their decision to breed heavier horses.

⁵⁸ Robinson (2019: 281-2). NB, It is referred to in his article as Tamma Island — the island was ruled by the Tamna until 1404.) For a very interesting relatively modern account of the Mongolian horse culture and firsthand experience of breeding, see Larson (1930).

⁵⁹ Jagchid and Bawden (1965, p. 250).

Mongol armies, ... were unable to assert their powers fully and the Mongols, having conquered China with the horse, soon lost the superior mobility which would have given them control over the whole empire.’⁶⁰

Sowerby suggests that the Chinese ceased to attempt to breed horses ‘within China proper’ after the Yuan, relying entirely on trade and on ranches in the northwest.⁶¹ As Schottenhammer notes, the Ming established two offices concerned with horse breeding, Court of the Imperial Stud and Horse Households, based in the northwest.⁶² But, as she also points out, by the end of the fifteenth century, only a few decades after their establishment, the Chinese were forced to start buying horses from private traders at frontier markets. The Qing continued this practice, although managed some breeding in traditional areas, such as their newly conquered territory such as Xinjiang and Inner Mongolia, both heartlands of horse breeding.⁶³

The continued inferiority of the Chinese horse continued to be noted. This from the 16th century Jesuit, Matthew Ricci, also quoted by Sinor: they ‘have countless horses in the service of the army, but these are so degenerate and lacking in martial spirit that they are put to rout even by the neighing of the Tartars’s steeds and so they are practically useless in battle.’⁶⁴

There is a firm consensus among these scholars, therefore, on the inability of persistent and successful horse breeding in the geographical are of China. Most of the above cited articles give two major reasons for the inability of the Chinese to breed and train enough horses of sufficient quality for battle: first, the lack of pastureland with, they argued, suitable land always being taken for agriculture and, secondly, the lack of expertise among the Chinese.⁶⁵

Exemplifying the second of these is Creel, who writes:

⁶⁰ Jagchid and Bawden (1965, p. 264). For a more recent discussion on Mongol cavalry see Smith (2009).

⁶¹ Sowerby (1937, p. 284) quoted in Creel (1965, p. 668)

⁶² Schottenhammer (2009, p. 1).

⁶³ Schottenhammer (2009).

⁶⁴ Sinor (1971, p. 172), from Rossabi (1970, p.139).

⁶⁵ ‘For a number of reasons, among which the lack of extended grassland is the foremost, the Chinese were unable to supply their own army with a sufficient number of good quality horses...’ (Sinor 1971, p. 174). See also Creel (p. 669). On lack of skills, Creel writes: ‘Some Chinese, certainly, became outstanding horsemen. But it is hard to avoid the impression that to Chinese in general the riding horse remained something strange, almost foreign in nature... there is little to indicate that they brought real zest and seal to the task,’ (pp. 670-1) Of course, this is something of a chicken/egg situation - if they had been successful in horse breeding, might have felt differently. Skaff gives other reasons for particular failures, such as raids and corruption, but these are not sufficient to explain the long-term failure (p. 44).

'It is hard to avoid the impression that to Chinese in general the riding horse remained something strange, almost foreign in nature. Horses, and horsemen, were in general associated with the border areas of the north and west. It is a striking fact that the grooms and handlers of horses appearing in Chinese art seem almost always to be depicted as non-Chinese.'⁶⁶

Skaff points out that considerable expertise is required for successful breeding:

'The importance of knowing how to breed and train horses should not be underestimated ... it required specialized knowledge. ... Preparation for warfare adds further difficulties before the horse is an 'animal of "flight" rather than "fight,"' yet for warfare it must be trained to 'face loud noises, leap fences, charge into crowds, and gallop at man's command, often to its own destruction.'⁶⁷

But I find the argument of the lack of expertise unsatisfactory. First, there were large numbers of Turkic, Sogdian and other peoples among the Chinese population with the required skills who could have been employed. As Skaff notes for the Tang period horse breeding, 'personnel generally had birth and career patterns connections to North China or the China-Inner Asia Borderlands... In the provinces ... men had origins in borderland regions, and often were Sogdian and other ethnic minorities.'⁶⁸ Secondly, skills can be learned, given incentive and the government certainly had reason to provide incentive given their need. And, despite Creel's argument, we see Chinese involved in horse breeding. For example, in their article on horse breeding on the steppe during the Yuan, Jagchid and Bowden quote a report by a Song envoy which states that, of the horse herdsman, seven in ten are Chinese.⁶⁹

This argument is also undermined when looking at the period of the Mongol Yuan dynasty in China which also struggled to breed sufficient horses in China proper. As Creel notes: 'Under the Yuan dynasty (1280-1367) large numbers of Mongols came to live in China, and one might suppose that

⁶⁶ Creel (1965, p. 670). It is interesting that similar arguments have been proposed for unsuccessful horse breeding in India. So, for example, from Major-General Crawford T. Chamberlain, 1874: 'I ask how it is possible that horses could be bred at a moderate cost in the Central Division, when everything was against success. ... 1st, to a damp climate, altogether inimical to horses; 2nd, to the operations being intrusted to a race of people inhabiting a country where horses are not indigenous, and who therefore have no taste for them.' (Yule and Cordier 1993, p. 350)).

⁶⁷ Skaff (2017, p. 35) quoting Downs (1961: 1193-5, n. 1192) and Creel (1970: 161). Also see Thomas Druml's very interesting article discussing the three major types of horse of this period (2009), including breeding for elite riding of the type represented in Tang art, which he calls the classical riding horse.

⁶⁸ Skaff (2017, pp. 47-8).

⁶⁹ Jagchid and Bawden (1965, p. 249) quoting from folio 16V of the *Heida shilue* (黑韃事略), a work mainly by Peng Daya 彭大雅 describing his 1233-34 embassy to the Mongols for the Song dynasty. See also Skaff, on Wang Delun, one of the ranch directors, who was ethnic Han (2017, 19, p. 51).

the technique of breeding cavalry mounts would have become well-established in China. But there seems to be no evidence that it did.⁷⁰

The argument about the lack of pasture is also not entirely compelling given that the government, given the need, could have ensured that land was set aside for this.⁷¹ China, as we have seen, also had alfalfa, a crop ideal for building strength, a quality Chinese-bred horses seemed constantly to have lacked. However, it is not essential or even necessary for successful horse breeding. As several authors point out, the Mongols rarely feed their horse with fodder. Sinor cites advice given to the Franciscan John of Plano Carpini in Kiev in advance of his journey to Mongolia concerning his horses: ‘they would all die, for the snow was very deep and they would not know how to dig up grass from under the snow like the Tartar horses, nor would he be able to find anything else for them to eat since the Tartars have neither straw nor hay nor fodder.’⁷²

Therefore even with alfalfa, pasturelands, good breeding stock and specialist horse breeders from neighbouring Turkic and Mongolian lands, successive Chinese regimes failed to produce sufficient horses for their needs. But, in a sense, these scholars were correct in that the lack of suitable pasture is perhaps the major reason for the failure of horse breeding in China. But the reason for its unsuitability was only identified in the twentieth century. And this has not found its way into most literature on the subject nor as yet, as far as I know, has been fully discussed. It provides a much more compelling explanation for the consistent failure of horse breeding in China and one which could not have been known nor easily remedied at the time. This is the fact that there is selenium deficient soil across much of China coupled with the necessity of selenium for horse health. In Richard Stone’s words, ‘nowhere in the world are selenium levels as low as in a swath of land that arcs from Tibet in the southwest to Heilongjiang in the northeast.’⁷³ Alfalfa could not have substituted for this deficiency: in other parts of the world where there is low selenium, it is now added to alfalfa fodder as a supplement.

Selenium was identified in 1817 but it was only in the 20th century that its importance to human health was understood following experiments on rats and farm animals. In 1935 Chinese scientists

⁷⁰ Creel (1965, p. 668). See also Smith (2019, p.69) who cites a debate on whether to convert agricultural land in northern China into pasture.

⁷¹ Although as Smith points out, at this time the need for additional pasture was not pressing and the conversion would have made it impossible to support the army (2009, pp. 69-71).

⁷² Sinor (1972, p.171) from Dawson (1966, p. 52). See also Sinor (1972, p. 177), where he quotes a source from 1221: ‘they never feed them with fodder ... they pasture them on the steppe according to whether the grass is green or withered ... They never give them beans of grain at all.’

⁷³ Stone (2003).

named an illness ‘Keshan disease’ after a county in Heilongjiang Province in the northeast of China where an outbreak occurred. It was later found to be prevalent from southwest to northeast China and in 1973 selenium deficiency was recognised as a factor in its aetiology.⁷⁴ It had a fatality rate of over 80%.

The importance of selenium for animals, including horses and cattle, has also been extensively explored and was identified as a cause of illness in cattle by 1934 although its essentiality was not recognized in western literature until 1957.⁷⁵ The effects of selenium deficiency have been found to be similar in humans and animals.⁷⁶ It leads to myopathy which ‘results in weakness, impaired locomotion, difficult in suckling and swallowing, respiratory distress, and impaired cardiac function.’⁷⁷

As far as I have been able to discover to date, Russian scholars were certainly among the first to make this link between selenium-deficient soil and the failure of horse breeding in China. Jasper Becker noted this link in his 2008 book on Beijing following a conversation with Professor Lev Gumilyev in 1992.⁷⁸ Johan Elverskog, in his 2011 book, *Buddhism and Islam on the Silk Road*, is the only scholar I have found subsequently writing on horses in China to note this citation.⁷⁹ Most others, including myself, had not picked up on this.

If we interpret, for example, Skaff’s data in light of this, we get a more nuanced story. Some of the Tang ranches were in the selenium-deficient band, notably those closest to then capital, Chang’an. The supply of hay from other areas, some possibly from outside this band, might have alleviated the problem at times. Other factors, such as the bad winters, undoubtedly exacerbated the problem. But the fact remains that it would have been very difficult to sustain a successful breeding programme

⁷⁴ Ge and Yang (1993).

⁷⁵ Sindeeva made the connection between selenium toxicity and animal disease, thought to be the reason for the observation in Marco Polo of horses/animals dying from eating a certain plant in the Tangut empire, in the northwest. (1959: p. 213, Latham (1958: p. 90)). Sindeeva’s book was translated into English and published in 1964, the same year as Rosenfield and Boath also put this link in English print.

⁷⁶ Koller and Exon (1986).

⁷⁷ Subcommittee on Horse Nutrition et al. (1989. pp. 17-18).

⁷⁸ Becker (2008, p. 18). The information about Gumilyev was given in personal communication with the author. I have yet been unable to find any earlier reference to this in Russian scholarship and do not know whether Gumilyev was the first to make this connection or whether it was first proposed by other Russian scholars.

⁷⁹ Elverskog (2011, p.196). This applies to most European language and Chinese language literature. I have not done a full search of Russian and other literature. Although I had heard of the selenium link, I had not been able to find any reference to it and thus also failed to reference this in my chapter on horses in my 2018 book.

in some of these ranches without sufficient selenium-rich fodder supplied from outside. The local production of alfalfa might have helped, but not solved the fundamental issue.

By the 20th century when these data were available, horse-breeding had been more or less abandoned in China and alfalfa was no longer a major crop. However, the need in China for alfalfa started growing in the twenty-first century with the increase in farming of dairy cattle. Between 2004 and 2009 alfalfa imports from the US to China increased from 127 to almost 75,000 metric tons.⁸⁰ This is despite the increase in internal production of alfalfa in China, from 330,000 hectares in 1949 to 2 million hectares in 2005.⁸¹ The importance of adding selenium to cattle feed has also been realized by Chinese scientists, both for the health of the cattle but also to produce milk with a higher selenium content so as to supplement the human diet. However, a horse breeding centre established in 2016 to provide thoroughbreds for a nascent racing industry, was situated in the Ordos in Inner Mongolia. The reasons for this decision echo those given for the long failure of horse breeding in geographic China, namely this was grassland ‘the perfect nature conditions’ and ‘the cultural affinity for horsemanship among local Mongolian ethnic communities.’⁸² It seems that, even with selenium, the experience of the past two thousand years is not readily challenged.

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⁸⁰ Hu and Cash (2009, p. 3, Table 1.2)

⁸¹ Hu and Cash (2009, p. 8).

⁸² Wang 2016.

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