RICHARD W. BULLIET

Afterword: Camels and Deserts

In the summer of 1967 the thought struck me that in my many years of studying classical Arabic I had never encountered any reference to a wheeled vehicle. This thought prompted me to wonder whether the long history of Middle Eastern chariots and ox-carts so vividly portrayed in the Bible and uncovered by Egyptian and Mesopotamian archeology had come to an end before the Arab conquests of the seventh century. Pursuing this further, I concluded that wheels did, indeed, disappear from the region in late antiquity and that the reason for their disappearance was the cost advantage that the pack camel enjoyed vis-à-vis the ox-cart, which was explicitly attested by documents of the Roman era. I published this thesis in *Annales: économies, sociétés, civilisations* in an article titled "Le chameau et la roue au Moyen-Orient" (Bulliet 1969). This left me, however, with a chronological problem. Since there was no reason to suspect that the economic efficiency of camel transport improved dramatically during the Roman period, why did the competition between the camel-driver and the carter play out at that particular time instead of a thousand years earlier or later? To answer this question I began to investigate the history of camel use and domestication.

Given the geographical diversity, topical variety and scientific detail of the excellent articles contained in this collection, and in particular its contributions to the understudied history and status of wild and domestic Bactrian camels in Parts I-III, it may not be obvious that the literature available for studying camels 45 years ago was very sparse and often quite non-scientific. Aside from Joseph Freiherr von Hammer-Purgstall's monumental 1854 collection of Arabic camel-related vocabulary mentioned in the introduction – a work that unfortunately lacks source references and examples of usage – the outstanding research of Knut Schmidt-Nielsen on the physiological characteristics of North African camels stood out both for the rigor of his scientific method and the importance of his findings (Schmidt-Nielsen 1997). However, I could find no parallel research on two-humped camels, which lived in a strikingly different climatic zone. The best of what was available about either species dealt primarily with veterinary matters: A. S. Leese (1927) and H. E. Cross (1917) in English, Ivo Droandi (1936) in Italian, G. G. Curasson (1947) in French and Victor N. Kolpakow (1935) in German, though originally probably in Russian. These works reflected the veterinary problems that Europeans faced in dealing with military and transport matters in their colonial possessions. Other authors wrote more directly about these matters: A. G. Leonard (1894) in English, C. Cauvet (1925, 1926) in French and M. A. Vitale (1928) in Italian. Historical questions, from the origins of domestic camel populations down to 19th century experiments with acclimatizing camels to various habitats around the world, were touched on by a much larger number of authors, but seldom in a fashion that highlighted the importance of camel history *per se*.

My own book on camels, *The Camel and the Wheel* (1975), and my two subsequent publications dealing with camel harnessing, "Botr et Baranès: hypothèses sur l'histoire des Berbères" (1981), and the hybridization of one- and two-humped camels, *Cotton, Climate, and Camels in Early Islamic Iran: A Moment in World History* (2009) were similarly devoted to somewhat narrow topics – no camel folklore, no camel religious rituals, no camel gods or demons, no camel food taboos, no camel stew recipes, no camel symbolism, no camel art motifs, no camels as embodiments of moral virtues, no famous war camels. If I had delved into these more expansive topics, however, I would have been hard pressed to muster the substance of a book. Compared with any other large domestic animal, the affective associations of the camel are remark-

ably few, except among actual camel breeding populations such as those discussed in this book in articles devoted to Mongolia (Lang, Chuluunbaatar), Arabia (Bakhsh et al., Gingrich), and Algeria (Fischer).

Moreover, unlike cattle, horses, donkeys, sheep, goats and pigs, which have spread throughout the globe, camels continue to be bred and utilized only in their native habitats or, in the case of Somalia, the Sahara and the Canary Islands, in habitats that share the climatic extremes of Arabia and Inner Asia. (The camels of Australia are feral descendants of imported working animals that were set free early in the 20th century. They are neither bred nor used, except in tourist situations.) Thus, despite the fact that camels are remarkably strong, easy to feed, and gifted with incredible endurance, they have not enjoyed a worldwide spread. Though many efforts were made to introduce camels to other lands, including Italy, Spain, Poland, Texas, British Columbia, South Africa, German Southwest Africa, Nyassa province in Portuguese Mozambique, Céara state in northeast Brazil, Java, Jamaica, Peru, Venezuela and Cuba, all such experiments eventually failed. The camel might conceivably be compared with the yak or the reindeer in its enduring association with particular environments, but unlike yaks, which are high-altitude, low-temperature substitutes for cattle, or reindeer, which are similarly adapted to life in frigid climates, camels are the world's strongest pack animals and thus had an economic utility that was universally recognized in the era before mechanized transport. Hence the innumerable experiments with importing them to exotic locations.

The question therefore arises: Why has such a useful animal remained so limited in its cultural manifestations and so restricted in its geographical range? Though I cannot propose a definitive answer to this question, I will suggest two lines of inquiry. First, the camel's limited cultural impact relates to its comparatively late period of domestication. And second, the economic utility of the camel derives from its ability to sustain itself in extremely barren environments but is undermined under other circumstances by its long maturation period.

As the origins of domestication are currently understood – and this is a highly fluid field of study – domestic ungulates, that is, hoofed animals, divide into two chronological groups: early domesticates and late domesticates. Domestic forms of cattle, pigs, sheep and goats seem to have come into being some ten to eleven thousand years ago. Horses, donkeys, water buffalo and camels, both one-humped and two-humped, seem to have undergone domestication four to five thousand years later. Given the substantial time gap between these incidents of domestication, it is not surprising to find major differences between the uses to which the early domesticates and the late domesticates were put. These uses can be broadly divided into two categories: affective and economic. Economic uses include exploiting animals for meat, milk, fiber and labor. Affective uses are less obvious, but they include considering animals as symbols, as objects of veneration or divine representation, as sources of aesthetic pleasure and as pets.

The early group of ungulates, at the outset of their domestic exploitation, had comparatively high levels of affective utility and low levels of economic utility. Though their meat was consumed, milking, wool shearing, plowing and vehicle pulling, referred to by scholar Andrew Sherratt in his much cited article (Sherratt 1981) as secondary products, emerged only slowly, with several millennia elapsing between first domestication and evidence of these uses. And even meat consumption had a strong affective basis insofar as most slaughtering was highly ritualized through the institution of blood sacrifice. These early domesticates also appear with great frequency in artistic representations, myths (e.g., the primal cow of Norse cosmogony), religious symbolism (e.g., "behold the lamb of God"), manifestations of divinity (e.g., most Egyptian deities, Zeus as a bull, Verethragna as a boar) and human-animal hybrids, (e.g., minotaurs, fauns, satyrs, etc.).

The later domesticates are far less likely to be represented as gods, though they may be used by gods (e.g., horses pull the chariots of the gods, donkeys bear prophets on their backs). The consumption of their meat and milk is less likely to be ritualized, their use as sacrificial animals is minimal and they seldom serve as exemplars of moral virtues or failings. The tropes of the

noble horse, stubborn mule, and stupid donkey are not as deeply embedded in cultural imagery as the raging bull, the nurturing cow, the lecherous and satanic goat, the greedy and unclean pig and the docile and pathetic sheep that must be cared for.

What the later domesticates do primarily is provide labor for plowing, carrying riders and burdens, pulling wheeled vehicles and operating mechanical devices such as wells, mills and irrigation wheels. The appearance of the late domesticates also coincides roughly with the origins of the Old World urban civilizations in Egypt, Mesopotamia, the Indus Valley and the North China plain, all of which utilized animal labor for plowing, transport and other purposes. The early domesticates, by contrast, appear at roughly the same time as domestic wheat and barley in the Fertile Crescent. Some scholars look upon these as linked developments, but the relationship of animal domestication to grain growing is far from proved. Some regions with great herds of domestic cattle, notably the Sahara prior to its desertification after 5000 BCE, seem not to have practiced agriculture; and New World civilizations that did depend on grain crops such as maize and quinoa had no domestic animals other than the dog.

On the basis of these differences between early domesticates and late domesticates it can be argued that a major threshold in the history of animal domestication was crossed sometime around 4000 BCE, when economic utilities associated with animal labor surpassed affective utilities as the principal benefit of animal husbandry. Though pigs were always kept for food and acquired no secondary uses, changes in herd configuration among other early domesticates, for example increases in the proportions of females and gelded oxen, point to strategies designed to maximize milk, wool and labor. Among the later domesticates, leaving aside water buffalo, meat and milk consumption are traditionally pretty much limited to the peoples who do the herding, though articles in this volume by Iqbal, El Zubeir and Younan and Mwangi indicate contemporary changes in these consumption patterns. With respect to camels, despite the long-standing debate over when and where they were first domesticated, a debate that is advanced by the contributions to this volume by Burger, Trinks et al., Dostal and Uerpmann and Uerpmann, most theories place camels on the later, economic utility side of the 4000-BCE threshold. Hence it is not surprising that camels, like water buffalos, play comparatively diminished roles in the ritual and imaginative lives of the peoples who mainly use their labor, particularly when those peoples are not themselves breeders but rather purchasers of draught and pack animals.

However, even given this understandably lower affective profile for camels, the extraordinary strength and carrying ability of camels would seem to have destined them to widespread use over a much broader geographical expanse. At least this seems to have been the motivation behind the many efforts to export them to other lands. In all likelihood, the failure of these transplantation efforts was rooted in the economics of maintaining a sufficient camel herd to ensure a regular supply of work animals. Unlike cattle, which mature in one year, or horses, which mature in three years, camels mature in six years. Though camels may be put to work when they are three to five years old,[1] age at sexual maturity governs the rate of reproduction of the herd. This suggests that the investment in the production of a useful camel may not compare favorably with that for a more rapidly maturing species.

By investment I do not mean the cost of fodder and stabling. In many environments, camels graze in desert or semi-desert landscapes and consume no purpose-grown fodder. Nor in those landscapes do they compete with some other productive exploitation, such as farming or more intensive pasturing. Moreover, they do not require stabling. Investment instead takes the form of human dedication to herd growth and maintenance, in most cases with an associated need to migrate with the herds across barren lands. It is possible, of course, to raise camels on a farm and feed them like other farm animals. But then they would often be competing with other farm

[1] Practice likely varied from one region of camel use to another and may have been comparatively early in Australia, where, contrary to the practice in most nomadic camel-breeding societies, the male animals were usually gelded (McNight 1969).

animals for grazing and fodder while taking years longer to reach the age of reproduction and useful labor.

If herding conditions do not take advantage of wasteland and instead put camels in competition with other domestic animals in farm or ranch settings, why would a stockbreeder producing animals for the labor market prefer camels to, say, mules, oxen or donkeys? Given the time and expense required to bring one camel to maturity, he could produce two mules, three oxen or three donkeys. This might conceivably make sense if the immediate labor market specifically required camels, for example if there were a demand from caravan organizers for animals that could withstand climatic extremes too stringent for a mule or a donkey, whether Saharan and Arabian heat and aridity or Central Asian snow and cold. But under these circumstances, it would seem unlikely that camels would be bred in farm or ranch settings. A more sensible system would be to raise the camels in a desert, even a very distant desert, and then walk them to market, as is still done with Sudanese camels sold in Cairo and was historically done by brokers who ranged the Arabian Peninsula buying animals from the tribes and walking them to Basra or Damascus for sale.

An economic comparison between camels and elephants is suggestive. Zoo and menagerie practice gives ample proof that Indian elephants reproduce successfully in captivity, and elephants have been used historically throughout India and mainland Southeast Asia as sources of labor and for military purposes. Yet they always seem to have been bred in the wild and then tamed after capture. The reason for this is that they eat enormous amounts of vegetation and take ten years to mature. It would therefore be foolish to spend ten years feeding one in anticipation of using its labor when that same labor could be procured by an elephant hunt followed by a period of training. In the case of wild one-humped camels, which once lived in desert wastes where, like elephants in a forest, they had no natural predators, training an animal captured in the wild to carry a load should not have been terribly difficult. The difficulty would have lain in finding the animals in the desert wastes, a problem that does not arise with elephants. Hence the greater rationality of herding over wild capture, despite the camel's long maturation period.

The absolute economic superiority of desert-bred, and hence nomad-herded, camels is confirmed by an article published in 1985 by scholars from the University of Pennsylvania and the Pakistan Agricultural Research Council (Heston et al. 1985). It provides a rare example of the monetary costs involved in using camel labor. The following chart lists the typical expenses and income in rupees of a person renting a pack camel:

Feeding costs:	
200 working days	0
165 non-working days	0
Medicines	200
Cost of harness	50
Amortization of camel cost	1350
Revenues	12,000
Return to labor/owner	10,400

Source: Heston et al. 1985:132

These findings, combined with the observation that Pakistan's camel population rose from 719,000 in 1955 to a million by 2006, and quintupled in the desert province of Baluchistan, led the authors to the following:

> One conclusion is that the camel can compete successfully against other work animals and/or machinery in several ecological situations. Wherever there are no direct feeding costs for camels, their num-

> ber is likely to dominate that of all other work animals, except perhaps that of donkeys. . . . It is our conjecture that if it is necessary to incur feed costs for camels, they cannot compete in traditional tasks like sugarcane crushing and drawing a Persian wheel for irrigation. In these areas the machine is likely to be more cost effective in view of the pricing of machinery and fuels (Heston et al. 1985:130–131).
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> The camel will continue to find several ecological niches for itself in Pakistan, including head-to-bumper confrontations with the Suzuki in the crowded streets of cities like Karachi (ibid.:123).

Extrapolating from a single case is always hazardous, but the economic logic seems irrefutable. The outstanding strength, tractability and stamina of the camel understandably recommended it to experiments in relocation. But the costs of raising such slow-maturing animals in non-desert habitats would inevitably be greater than the costs of breeding horses, mules, oxen or donkeys. And raising camels in desert environments without having pastoral nomads to keep track of them and channel them to camel markets was always difficult.

Australia, which today has zero nomads but tens of thousands of camels, might seem to provide an exception to this. But most of their ancestral stock was imported to Australia from India, an estimated ten to twenty thousand animals between the 1880s and 1907 (McNight 1969:56–61). A few local experiments with selective breeding did take place, largely employing the know-how of immigrant camel men called "Afghans." But given that the somewhat sketchy Australian livestock censuses rarely counted more than 10,000 camels, it seems apparent that most of the animals used by explorers, surveyors, gold prospectors, railroad builders, haulers and farmers came from imported stock (ibid.:72–76). Thus the feral camels that now roam the Australian outback are mostly the descendants of imported animals that were freed into the wild after mechanization made their labor obsolete. In other words, a Baluchistan-bred camel might still compete with a Suzuki mini truck in Karachi, but not in Perth, where the cost of importation would have to be added.

In sum, it makes economic sense that camels have continued to be associated with deserts and nomads even though their natural capabilities as laboring animals exceed those of any other domesticates. Given its slow rate of maturation, the camel is competitive as a source of labor only if it can be raised in the zero-cost environment of desert grazing or if it is put to work under climatic conditions that other domestic animals cannot endure. Despite innumerable experiments in transplantation, this limitation has prevented it from following in the hoof-prints of cattle, horses and donkeys and becoming a ubiquitous element in the world's pre-industrial energy picture. The result, for better or worse, has been an irreducible association with deserts, nomads and exotic locations.

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