

Special Ops Camels: Dromedaries, Bactrians, and the Specialization of Animals in the Macedonian Army

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The Late Classical Macedonian army of Philip II and Alexander the Great is famous both for its nearly uninterrupted string of successes as well as its tactical diversity.¹ Like Philip II, Alexander frequently incorporated specialist troops into his deployment line or sent them on specific missions based on the anticipated skill set of his enemies, demands of the topography or climate. Both kings incorporated foreign units into the army as they expanded their empires. At the outset of Alexander's Asian Campaign in 334, his army included the allies Philip had drawn together: Hellenes with specialized skills, such as the Cretan archers, Agrianian javelin throwers, as well as Triballian, Odrysian, and Illyrian infantrymen, who were kept in distinct ethnic units.²

Alexander continued his father's policy in Asia. For example, he integrated Persian cavalry³ into Macedonian. He called upon soldiers with rock-climbing abilities while taking citadels in Bactria.⁴ The Scythian *hippotoxotai* whom Alexander drew into his army played a crucial role at the Battle of Hydaspes.⁵ Among the Assaceni in India, Alexander's foreign *hippakontistai*,⁶ Agrianians, and archers were placed together to guard the Macedonian phalanx's approach of city walls (Arr. 4.26.3-4). Near the end of his reign, Alexander's integration of non-Hellenic

¹ A bibliography for the Macedonian army under these two leaders is nearly infinite. For a recent bibliography on general studies of the Macedonian army, see Heckel (2016) Appendix B. Ferguson and Worthington (2024) present a modern study of ancient strategy and tactics, and English (2009), Sekunda (2012) and (1984), and Fuller (1958) present detailed studies of the Macedonian army, equipment, and strategy.

² Diod. 17.17.4, Heckel (2016), 278. See also: Ferguson and Worthington (2024), 63-68; Worthington and Roisman (2012); English (2009), 50-55, 60-88.

³ Heckel (2016), 277; Curt.7.3.4, 8.5.9; Arr.3.19.7

⁴ Arr. 4.19.1-3 refers to the siege of Oxyartes' citadel and one of the few attacks in which Alexander did not personally participate. Of the three hundred men who attempted to scale the precipitous rock, Arrian tells us 270 of them made it.

⁵ At the Battle of Hydaspes River, the *hippotoxotai* were launched against Porus' left wing in advance of the Companion Cavalry in order to harass either Porus' cavalry or elephant *agema* (Arr.5.16.4f); Heckel summarizes their contributions in the campaigns of 325 at 278 FN 67.

⁶ Heckel (2016), 277 has convincingly theorized that these mounted javelin men were not in fact Hellenes.

troops into Macedonian elite units like the Companion Cavalry and *Somatophylakes* aggrieved his men to a noteworthy extent and is used by some to explain the ‘mutiny’ in 324.⁷

The creative use of a wide range of military talent is one of the hallmarks of Alexander’s strategic brilliance. I argue that in Alexander’s case, this practice extended beyond the human participants in his campaign to the animals. Macedonian cavalry needs no introduction here, and traditional pack animals like oxen and donkeys are thoroughly assessed in Engels’ (1978) work. However, the Old World Camelid, including both *Camelus dromedarius* and *Camelus Bactrianus*, has received underwhelming attention in classical scholarship. Glover (1950) listed camels among the “curiosities” of ancient warfare but seemed otherwise unimpressed by them. Engels’ (1978) study of Macedonian logistics includes the dromedary, not the Bactrian, and concludes that their hardy reputation is overstated. He repeats as fact the 1894 assessment of British Major General Leonard that “[the camel’s] powers have been grossly exaggerated and the most culpable ignorance and negligence have been displayed”⁸ in the field use of the camel by British occupying forces in the 19th century. Recent zoological study and the 2014 complete sequencing of the camelid genome have proven that this is far from true. In this paper I argue that the ancients understood the unique capabilities of the camel, and that Alexander deliberately incorporated and deployed camelids based on the anticipated environmental and tactical difficulties of a campaign. In observing two specific uses of the camel, the trek to Siwah (331) and the departure from Nautaca (328/7), we shall find that the camel proved an invaluable and deliberately-maintained component of the Macedonian army due specifically to its unique evolutionary trajectory and ability to endure climatic extremes.

After entering Egypt in 332, Alexander made plans to visit the famous oracle of Zeus-Ammon, located at Siwah, an oasis in the Libyan Desert (in modern Egypt, part of the Sahara Desert). This occurred in the autumn of 332/331.⁹ From Arrian, we know that Alexander’s party took the coastal route as far as Paraetionium, situated on the north shore of Egypt against the

⁷ Arr.7.6.2-5; Ferguson and Worthington (2024), Chapter 10 and associated notes for contextualizing the Opis Mutiny.

⁸ Engels (1978), 129.

⁹ Diod.17.49.3-6; Curt.4.7.6-17; Arr.3.3.3-6; Only Curtius specifies that camels were used, but horses would not have survived the journey. Find general narratives in, i.a., Worthington (2014), 180-182; Bosworth (1988), 71-74; Wilcken (1967) 121-124. Generally, the concern of historians has been *why* Alexander traveled to Siwah, what actually happened at the shrine of Zeus-Ammon, and how that information was used by the king and his Diadochoi, rather than *how* he arrived intact to the oasis. See e.g., Fredricksmeyer (1991); Howe (2015); Pownall (2021).

Mediterranean, and then moved southward into the continent's interior in a mostly straight shot to the oasis.¹⁰ This 7-8 day march is described by Engels as “the most arduous march undertaken by the Macedonian army until the Gedrosian Desert.”¹¹ Arrian and Curtius emphasize the environmental challenges of the region, stating that it was: “for the most part sandy and waterless” (Arr.3.3.3), and a “flat waste of barren sands” that was “hardly endurable even for those who were lightly equipped and few in number” (Curt. 4.7.6). While only Curtius (4.7.12) specifies that camels were used, the subsequent account proves that these are the only animals that could have survived the deep sands, scalding winds, and sapping heat of the Sahara.

Diodorus and Curtius claim that after four days of travel through the desert, the water supply gave out (Diod.17.49.3; Curt.4.7.15); Arrian adds the detail of a desert storm that obscured the route beyond recognition even for the local guides (Arr. 3.3.4). This was likely a *khamsin*, a severe desert windstorm that can last for over a month in duration in the open dunes of the Sahara and is known for rapidly dehydrating plants and animals.¹² Thereafter, all three sources confirm that the party experienced a period of drought that was brought to an abrupt and miraculous halt by rainfall, after which the men located the oasis at Siwah.¹³

If the march lasted between 7 and 8 days and water gave out on the fourth, for 3-4 days, Alexander's party must have relied on the unexpected rain and, possibly underground cisterns across a well-traveled route. However, even these points of relief would have been limited, as the march occurred just before winter, a dry time to travel because these months directly precede the rainy season.¹⁴ In his study, Engels sets a four-day maximum on working camels' travel between water breaks, making the sudden and unseasonable rainfall that Alexander's party experienced appear truly the miracle that Arrian makes it out to be (3.3.4).¹⁵ It is of this account that Engels claims that “this expedition also shows that a baggage train consisting entirely of camels is in no better logistic condition than one of horses and mules for a journey of four days or longer; for

¹⁰ Arr.3.3.3; Engels (1978), 61.

¹¹ Engels (1978), 59.

¹² On the *khamsin*'s impact, see Arnon (1992), 73.

¹³ Diod.17.49.3; Curt.4.7.14; Arr.3.3.4.

¹⁴ Walter and Stadelmann (1974), 224; Engels (1978), 60.

¹⁵ It is possible that Engels drew his figure from Arist.HA596a, who also places a 4-day maximum on camels' ability to withstand drought.

while camels can carry more, in four days they will also need to consume more food and water to stay alive.”¹⁶

This is an unfair assertion and underestimates the dromedary’s evolutionary resistance to the desert climate. The four-day fixation is an oversimplification of biology. In reality, the intervals at which camels must be watered vary based on: age, work, humidity, temperature and night/day fluctuation, and the type and quantity of fodder available to the camel. If a generalization must be made, Engels’ assertion that camels require water at *least* every four days applies only to the most grueling environmental conditions. More specifically, zoologists Gauthier-Pilters and Dagg note that the need to drink at “short, regular intervals” would be true in cases where the daily temperature met or exceeded 111 degrees Fahrenheit with a humidity of 14% or below, which is not generally the case in Egypt in fall or winter when the march occurred.¹⁷

The claim that dromedaries ideally require a minimum of 10 gallons of water per day seems high,¹⁸ because it does not allow for variation based on aridity and temperature or available forage. From their direct observations of dromedaries in the Sahara, Gauthier-Pilters and Dagg conclude that camels traveling with a heavy burden in high, arid heat may require 5.3 to 8 gallons of water per day. The wide range is due to the dromedary’s ability to conserve water through a number of different mechanisms, which will be considered here.

One such measure is eating, whether forage or pre-packed supplies. Camels would have been allowed to forage on their own during pauses in the march, making use of small oases en route, a point with which Engels agrees.¹⁹ This would in fact allow camels to conserve and increase necessary body water content, making the journey less deadly than imagined. The often salty desert plants aid in this process, as salt is used to facilitate the transportation of water through the kidneys and recycle urea.²⁰ Gauthier-Pilters’ and Dagg’s study shows that camels in the Sahara may not even drink during the cool months of the year, as they can obtain sufficient moisture from their food.²¹ The Al Murrah and Rwala Bedouin Arab pastoralists of the Sinai

¹⁶ Ibid., 63.

¹⁷ Gauthier-Pilters and Dagg (1981), 50-8; and meteorological data in Zahran and Willis (1992), 18-20.

¹⁸ Engels (1978), 129.

¹⁹ Engels (1978), 62.

²⁰ Valisco (2012), 154-6; see also Wu et al. (2014), 12-13, 15. Gauthier-Pilters and Dagg (1981), 38.

²¹ Gauthier-Pilters and Dagg (1981), 50; Nowak (1999), 1078-1081, Schwartz (1992), 111-12.

Peninsula report that in the winter months, lush foliage tides the camels over in lieu of water.²² While the conditions of the Libyan Desert on a march are far harsher, such testimony is indicative of the camel's ability to absorb and retain water from fodder. Even in the worst heat of the summer months, the plants drinn (*Aristida pungens*) and tahara or Cornulaca (*Cornulaca monacantha*) may be found growing in the dune valleys of the Sahara.²³

However, temperature in the Sahara is less of a problem than aridity, which accounts for the majority of water loss in a human or camel body, and this is especially so in the case of a *khamsin*, or large-scale desert sandstorm. Because of the heat of the surface sand, temperatures during such a storm may rise to 115 degrees Fahrenheit, sapping moisture from the body very quickly.²⁴ Alexander's party may have taken shelter behind protective fabrics, but pack animals other than dromedaries are unlikely to have survived. While humans can withstand a loss of only 12% of their body weight in water, camels can survive a loss of 40%,²⁵ higher than almost any other animal. Not only does this occur at a slower rate in camels than other pack animals,²⁶ but camels have a number of thermoregulatory measures in place to prevent it. Such measures include short wave heat reflection, conductive and convective cooling during the night for recovery,²⁷ and a non-homeothermic system, which allows internal body temperatures to fluctuate rapidly without sending the animal into shock; other beasts of burden do not have this ability.²⁸

It should be noted too that typically, dehydration in camels is pre-empted by hyperhydration, a practice that would cause immediate diuresis in most animals but allows water retention in dromedaries, who can maintain a state of hypo-osmotic red blood cells over long periods in

²² Valisco (2012), 159-160. On ancient camel nomads, who would have had roughly equivalent, if not as scientific, a knowledge base of dromedary capabilities, see Castillo in Snell (2005), 126-140.

²³ Gauthier-Pilters and Dagg (1981), 31-2; Walter and Stadelmann (1974), 218-19.

²⁴ Gauthier-Pilters and Dagg (1981), 21; Engels (1978), 62.

²⁵ Ibid., 74-75.

²⁶ A study by Schwartz and King in 1983 revealed that camels lose body weight at less than one fourth the rate of ovines and bovines, and the 2014 camelid genome sequencing has proven this true with DNA: heat stress produces an uptick in aquaporin genes, which slow metabolism and enhance the retention of water in the body. See: Schwartz (1992), 21-23; Wu et al. (2014), 16-19 for a detailed discussion on water reservation in the camel in renal medullary osmosis. Cf. Yagil (2000), 55.

²⁷ Dahlborn (2000), 21-23; Schwartz (1992), 22-23; Gauthier-Pilters and Dagg (1981), 71-74.

²⁸ Yagil (2000), 52; Schwartz (1992), 21-23.

anticipation of a drought.²⁹ It seems reasonable to assume that the Macedonians' guides would have allowed the pack camels to hyperhydrate at Paraetonium (Arr.3.3.3) and again at Siwah before the return. Thus, it is less surprising that reports of Bedouin pastoralists riding camels right *through a khamsin* describe the riders as facing backwards against the wind, covers thrown up over all exposed skin, while their camels continue on in a straight line, likely using translucent eyelids and long lashes to maintain a visual on the path.³⁰

This summary of dromedary evolutionary adaptations is meant to correct Engels' underestimation of the camel's abilities to survive in the open desert and to emphasize that zoologists and present-day camel breeders are in agreement regarding the astounding capabilities of the animals. The dromedaries Alexander and his party used to reach Siwah may have encountered a lucky rainstorm en route, but ultimately, they survived because they had *evolved* to do so. Horses or mules could not have done so. Thus it is unsurprising that Alexander thereafter incorporated the camel into his army. Camels appear as pack animals after Gaugamela (Arr. 3.15.4; Curt.3.3.25), and during the sack of Persepolis (Diod. 17.71.2; Plut.*Alex.*37.2; Curt.5.6.9); these may be dromedaries, Bactrians, or a mix of the two based on their function as pack animals.³¹ Dromedaries were employed as messenger animals when Alexander sent Parmenion the fatal news of his son's execution (Diod.17.80.3; Strabo 15.2.10); Curtius specifically notes that dromedaries were used because of their ability to move through the desert (7.2.18). Even Alexander's "Successors" maintained dromedaries in their armies. Antigonus obtained them from Arabs to assist in his failed invasion of Ptolemaic Egypt and to help transport supplies.³² Demetrius Poliorcetes captured some 700 camels during his invasion of Nabataean Arab territory, (Plut. *Demetr.* 7.7), and in later generations Seleucid kings, such as Antiochus Megas III, incorporated camel-mounted riders into their multi-ethnic armies (App.*Syr.*6.32).

Like the dromedary, the Bactrian camel, too, played a role in saving lives of Alexander's soldiers amid a catastrophic march. In the late winter of 328/7, Alexander's army departed from Nautaca in Sogdiana, believing a brief rise in temperature to be indicative of the break of spring.

²⁹ Dahlborn (2000), 25. On the abilities of camels to rebound quickly from water loss and recover from drought, see Schwartz (1992), 143 *contra* Engels (1978), 129

³⁰ Manley and Abdel-Hakim (2006), 98.

³¹ On the theory of a dromedary-Bactrian crossbreed prior to the Parthian Period, see Potts (2007), 157ff.

³² Diod.20.73-74; Worthington (2016), 165-166; Champion (2014), 124-129.

However, this “false spring” gave way to winter once more. Curtius provides a detailed account of what happened, and the storm is alluded to in Arrian.³³ While the army marched, a hailstorm accompanied by an abrupt drop in temperature eventually forced the column to scatter to the forest to seek shelter. By nightfall, some 2,000 men had frozen to death. Presumably, so had the pack animals with rations, as Curtius claims that the men faced starvation (8.4.19) and that in response Alexander promised his men that he would “make good all that had been lost” (Curt.8.4.18). A survey of meteorological studies of the region in the 20th century proves Curtius’ claims plausible. Holt (1988) has shown that the “false spring” phenomenon was commonplace prior to recent climate change, and abrupt hail and ice storms have been known to freeze grazing animals to death in the Pamirs.³⁴ Curtius’ casualty figures are not at all unrealistic.

In response to the disaster, the Sogdian satrap Sisimithres sent emergency supplies to Alexander’s men. Curtius tells us that he sent “many pack animals and 2,000 camels, besides many flocks and herds” (Curt. 8.4.19), which “saved the soldiers both from loss and from hunger” (ibid). This highlights the value of camels as military transport units. To repay Sisimithres for his generosity, Alexander gifted him with 30,000 head of cattle seized from the Sacae, but the sources make clear that the pack animals, *and the camels*, Alexander kept.

Remarkably, Engels makes no mention of the Macedonian use of camels here despite his insistence that the region around Nautaca presented a logistical problem due to severe winters and late harvests.³⁵ While the camels’ role as transporters of supplies is not particularly action-packed, it is nevertheless crucial. Just as Alexander had incorporated dromedaries into his army after their steadfast journey through the Sahara, he hung onto the 2,000 Bactrian camels after Nautaca, likely as a safeguard against the risk of future hailstorms and loss of animals.

What recommended the Bactrian camel to Alexander? Like the dromedary, the Bactrian can withstand long periods of drought and famine, and it has many of the same metabolic and thermoregulatory abilities. However, it is also well suited to extreme cold. Bactrian camels can still be found in North-East Afghanistan, and their thicker winter coats and darker tinted hair enable them to absorb and retain heat from the sun. Shorter legs than a dromedary and a stout

³³ Curt.8.3.7; alluded to in Arr. 4.21.10.

³⁴ Holt (1988), 72 n. 90.

³⁵ Engels (1978), 106-107.

body make them ideal pack animals,³⁶ especially in comparison to Alexander's horses, whose hooves Curtius tells us were worn down in the Sogdian region, prompting him to change mounts throughout his travel (Curt. 8.2.34-36). In addition to their resistance to cold and famine, Bactrian camels can bear weights of 600 lbs. or more.³⁷ Like all camels, they possess an impressive economy of locomotion through which their energy expenditure does not rise in direct response to increased weight, but actually plateaus because of the arch principle, enabling them to carry more without proportional energy intake.³⁸

Likely for these reasons, the Bactrian camel was highly prized in Sogdiana and Bactria. Sisimithres' access to a herd of 2,000 is impressive. For bovines and ovines, the number 2,000 is not particularly astounding, but camels have a significantly lower rate of reproduction.³⁹ The accumulation of a herd of presumably greater than 2,000 indicates the Bactrian camel's regional significance, which may shed further light on why Alexander kept them. Certainly, the animal appears prominently in the East Staircase of Persepolis' Apadana as a form of tribute⁴⁰—for Alexander, too, it represented the breadth and diversity of an empire now directly under his control. The animal was of both tactical and iconographic significance.

Despite Xenophon famously balking that a *kalos k'agathos* (Cyr.7.1.49) would never deign to mount a camel, Alexander did not hesitate to cross the Libyan Desert on one. More critically, the Macedonian adoption of camels into their military menagerie as useful pack animals falls into the broader pattern of Philip and Alexander's creative use of non-Macedonian tactics, weaponry, and specialized fighters as necessitated by climate and terrain. The camel can be considered a military animal without being made into a combatant,⁴¹ as it enhanced Macedonian tactical versatility in a way that enabled Alexander's army to achieve its strategic goals—the evidently

³⁶ Gauthier-Pilters and Dagg (1978), 3; Nowak (1999), 1078.

³⁷ Potts (2004), 147.

³⁸ Youself, Webster, and Youself (1989), 1087; Rose (2000), 44-47.

³⁹ Unlike bovines, camels reach maturity at a later age and have longer gestation as well as nursing periods. Compare Aristotle *HA* 540a13 and 546b1 to Chaudhary (2000), 466-7; Schwartz (1992) 49-64. Age of maturity for camels is 4-5 years, versus 1-1.5 years in cattle, and nursing period is 2 years, versus 3-8 months in cattle.

⁴⁰ Llewellyn-Jones and Lewis (2018), 172 provide a clear sketch of these, which are Bactrian.

⁴¹ Its dual functionality is perhaps best exemplified by Cyrus' ingenious deployment of camels against Lydian cavalry at Thymbra in the 6th century (Hdt. I.80). However, camels 'going to war' need not mean fighting in it. Indeed, Aristotle acknowledges the camel's capacity to go to war when he specifies that they are shod for the process, their feet encased in *karbatinai* (Arist.499a 13-30); for commentary: Llewellyn-Jones and Lewis (2018), 177.

highly-public visit to Siwah and a successful departure from the heights at Nautaca en route to India.

As I have shown, dromedary and Bactrian camels' unique evolutionary capacities are best highlighted not through anecdotal evidence from non-native occupying forces of the Middle East, but rather through zoological and genetic studies that most accurately capture their abilities. When overlaid across the ancient sources that describe, but often presume, such knowledge, it becomes clear that the camel was highly-valued and specifically utilized by the Macedonian army. Now all that remains is for classical scholarship to remove camels from Glover's "curiosities" category and acknowledge them as the highly valued and specialized operatives that they were.

Draft