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# 14. Calf mortality and milking: was Tony Legge right after all?

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In the year when Sherratt (1981) proposed that domestic animals in southwest Asia and Europe were initially managed for meat and later for milk and other 'secondary products', Tony Legge (1981a) argued that high levels of infant calf mortality at Bronze Age Grimes Graves in eastern England implied management of adult female cattle for milk. In identifying similar calf mortality in the earlier Neolithic of the north Alpine margins, where later prehistoric assemblages exhibited older slaughter more consistent with exploitation for meat, Legge proposed the opposite temporal trajectory to Sherratt, but placed explanatory emphasis on local environmental conditions rather than diachronic advances in animal husbandry. While Sherratt's model drew some approval from prehistorians, Legge's argument, and his similar interpretation of more indirect cattle mortality data from Neolithic southern England (Legge 1981b), was immediately and repeatedly challenged by zooarchaeologists, principally on the grounds that cows of primitive breeds will not let down milk in the absence of their calf (e.g. Clutton-Brock 1981; Entwistle and Grant 1989; McCormick 1992). True to character, Legge stood his ground (1981c; 1987; 1989; 1992).

One of us (Halstead 1998), drawing largely on ethnographic information from Greek herders of sheep and goats and secondarily on British sources dealing with cattle, subsequently argued that reluctance to let down milk is more common in livestock stressed by poor diet or unfavourable temperatures and can be overcome if herders invest sufficient effort in coaxing difficult animals. Indeed, ethnographic and historical accounts of reluctant let down list some remarkable counter-measures (e.g. stuffing the dead calf's hide, smearing a surrogate calf with the adoptive mother's dung, or 'cow-blowing'). Balasse (2003) responded that cattle, especially those of non-dairy breeds, have a much lower proportion of their milk in easily accessible cisternal (as opposed to less accessible alveolar) storage than sheep and goats and that, accordingly, cows of 'primitive' breeds, such as the Salers and Aubrac of upland central France, cannot be milked in the absence of their calf. In consequence, some zooarchaeologists now accept high levels of infant mortality as optimal for milk production in sheep and goats, but treat a peak of mortality around the end of lactation

(‘post-lactation slaughter’) as the hallmark of milking in cattle (e.g. Balasse et al. 2000; Vigne and Helmer 2007).

This contribution begins with a critical evaluation of Balasse’s argument, inter alia highlighting the dangers of treating traditional cattle breeds from agriculturally marginal regions as representative of early domesticates. The second section presents original oral-historical data on management of traditional, unimproved cattle in early and mid-twentieth century Greece. In conclusion, we argue that Tony Legge’s original thesis was essentially correct.

## The management of Salers and Aubrac cattle in upland central France: changes and contradictions

Balasse (2003, 5) reports that ‘[I]n the case of the Salers and Aubrac cattle breeds, it is simply impossible to get the milk without the presence of the calf.’ These breeds from the French Massif Central are typical upland cattle, characterised by resilience to harsh conditions more than high productivity in milk or meat, but they may be misleading models for early European domesticates. The Salers was subject to selective breeding, for conservation and improvement, from at least the early nineteenth century (Grognier 1831; Durand 1946, 210-11), and the establishment of herd books for the Aubrac in 1894 and the Salers in 1908 (Jussiau et al. 2006, 126 table 6.1) presumably involved further selection of ‘ideal’ characteristics. For example, the ideal reddish colour of Salers cattle may have become more standard over the last century and Aubrac cattle exhibit significant changes in colouring and conformation over this time-span (Rousseau and Dubois 2011). Moreover, rearing of both breeds in the nineteenth century primarily for labour and to a lesser extent milk (e.g. Grognier 1831) has given way during the twentieth century to dual exploitation for milk and beef (Durand 1946, 213, 220-1) and latterly to production mainly of beef. In sum, although unquestionably rustic, Salers and Aubrac cattle have been subject to significant changes over at least the last two centuries in appearance, management goals and performance and cannot uncritically be accepted as proxies for early domesticates.

Despite changing management and thus selective pressures, herders of Salers cows around Salers itself and of Aubrac cows further south around Chaudes Aigues, interviewed in 2008, believed that their early twentieth-century forebears had also faced problems with let down in both breeds and that milking in the presence of the

calf had long been the norm. Nonetheless, the statement that Salers and Aubrac cows cannot be milked in the absence of their calves, although widely repeated by both scientists (e.g. Martinet et al. 1999) and herders, must be qualified. Interviewees on the Massif Central reported that young cows milked for the first time posed the greatest problems of let down, as also noted in the scientific literature (Bruckmaier 2005, 270), and responded poorly to measures adopted (mostly in the past) following loss of a calf: clothing a substitute in the dead calf's skin (Salers and Aubrac), putting salt on a substitute calf to encourage licking by the cow (Aubrac), stroking the cow to mimic the calf (Aubrac), confining the cow with a substitute calf so that the latter suckles and takes on a familiar scent (Aubrac), and blowing into the cow's vagina (Aubrac). These measures were evidently fairly commonplace a few decades ago and, with the exception of cows calving for the first time, seem to have been reasonably successful. Indeed, for the early nineteenth century around Salers, Grognier (1831, 33-37) reports that it was normal practice in larger herds (of twenty or more cows) for many calves to be slaughtered two weeks after birth and for those retained each to be suckled by two, three or even four of the cows milked for cheese production. The availability of pasture determined how many calves were retained and raised to adulthood – the females as replacement cows and especially the males for sale as draught animals – and Grognier does not mention problems of let down among cows deprived of their own calf. Presumably, since the early nineteenth century, either Salers cows have been selected for reluctant milk let down or, perhaps more plausibly, changes in the relative value of milk/cheese and meat or in the availability of human labour have made herders less willing to invest the effort necessary to overcome any such problem. Either way, milking an Aubrac or Salers cow in the absence of her calf is not impossible and, in the presence of a substitute, perhaps not even difficult.

Balasse's point of departure is that cows have only a small proportion of their milk in accessible cistern storage (and the long-term effect, if any, of human selection has presumably been to enhance this proportion). Suckling calves indeed seem able to exploit more fully the less accessible alveolar stores than can human milking (e.g. le Neindre et al. 1976) and rustic cows such as the Salers are less willing than specialist dairy breeds to let down in response to stimulus from herders rather than their own offspring (Martinet et al. 1999, 362). Delayed slaughter of prehistoric calves, therefore, may well have enabled more thorough exploitation of the milk-producing

potential of their mothers than culling soon after birth. We have no a priori grounds, however, for assuming that prehistoric herders wished to maximise total milk extraction rather than the availability of milk for human consumption or perhaps to minimise the associated labour costs of herding, providing shelter or collecting fodder. As argued elsewhere (Halstead 1998), maximising models are invaluable heuristic tools, but a problematic basis for predicting past human behaviour. The importance of variable husbandry priorities in shaping how cattle are managed is further highlighted by oral-historical evidence from Greece.

**Managing unimproved cattle in Greece**

In Greece, sheep and goats have traditionally dominated dairy production. In the first half of the twentieth century, the indigenous 'wild' (i.e. un-improved domestic) cattle of Greece were widely used for ploughing, while sale to urban butchers of any calves not needed as replacement draught animals could provide a significant cash income. Milk production from cattle expanded following introduction from the 1950s onwards of dual-purpose (milk/beef) Swiss Braunvieh and later of specialised dairy Holsteins (Georgoudis et al. 2003). A few wealthy landowners introduced improved dairy cattle from abroad a little earlier, but high maintenance (especially before widespread adoption, also post-war, of industrial fertilisers) and capital costs largely prevented wider dissemination. The indigenous cattle were regionally variable in appearance, size and to some extent productive qualities (e.g. Kugler 2010), but had overwhelmingly undergone far less selection for milking over the previous century (and almost certainly much longer) than the Aubrac and Salers of the Massif Central. Although also perhaps problematic as models for prehistoric domesticates, therefore, indigenous Greek breeds may shed useful light on the feasibility of milking rustic, non-dairy cattle.

Rearing cattle in early and mid-twentieth century Greece was rather easier in the cereal-growing lowlands of the north than in the more arid south, where suitable pasture was sparse and short-lived and where cultivated stall-fodder – even cereal straw – was scarce. Both ownership of draught cattle and rearing of calves (as replacements for the yoke or for sale) were much more commonplace, therefore, in northern than southern Greece. For similar reasons, milking of indigenous cattle was not unusual (if clearly secondary to dairy exploitation of sheep and goats) in northern Greece, but rare in the south. Here we examine informants' accounts of managing

indigenous cattle – especially whether, how and why cows were milked. For the sake of brevity, we focus on the southern island of Kythera and the Pieria lowlands of northern Greece.

**Kythera**

Most elderly (octogenarian and older) informants from villages on Kythera declared that indigenous cows were not milked. Many did not have a cow to milk because they had too little land to support more than a donkey and the odd house-goat or -sheep. Some cultivated sufficient land to warrant ploughing with draught cattle, but used bought castrated male oxen rather than self-reproducing cows, variously attributing this to scarcity of pasture, human labour or byre space. Others owned, but did not milk, cows. For example, Vretos in Fratsia for many years kept two small indigenous cows that ploughed and worked on the threshing floor, and each bore one calf per year for sale, while stall-fed only cereal straw to supplement seasonal grazing. They had 'udders like a goat' and could not suckle their calves for more than two to three months. They had so little milk that 'nobody milked them even if the calf died young', relying instead on sheep and goats for dairy produce. Later he acquired multi-purpose Kean cows (an improved rustic type) that worked as well as the local breed, bore bigger calves with more meat, and also produced more milk than the latter needed so that they could be milked while suckling for five or six months. A Kean cow could usually be milked even if she lost her calf, although a few were reluctant to let down. Thodoros, as a teenager in his father's household in Aroniadika, ploughed with oxen, but following marriage in the early 1950s switched to cows that could also produce calves for sale as yearlings to compensate for his modest landholding. His cows were of local breed, small enough to plough unhindered under olive trees and able to survive on a very sparse diet, unlike his neighbour's two Kean cows that died from under-feeding. Thodoros never milked his indigenous cows and regarded this as the norm. His wife Georgia, however, had as a girl watched an uncle stroking a cow from the neck down to the udder as a prelude to the unfamiliar experience of being milked because, after sale of her calf, she was producing too much milk to dry off safely unaided. Thodoros and Georgia did not emulate the uncle, but they had sufficient dairy produce from their sheep and goats and valued large calves (suckled for three to four months) more than an increased milk supply, perhaps partly because Georgia's one attempt to make cheese with cow's milk had been a failure. Likewise,

Stavroulla from Pitsinianika had not milked cows because she had enough sheep and goats for this purpose, while Titika recalled that cows were not milked in the villages around Karavas, because their milk was reserved for fattening calves to sell.

In Mitata, Stefos recalls that his father ploughed with an ox and a cow, both of local breed, and that the latter each year bore a calf that she suckled for at least five or six months. Nobody, he claims, milked such cows 'not even if the calf died – the cows were not accustomed to it and would not stand for it'. Nonetheless, at least one neighbour, Foteini, did milk her small indigenous cows. Her first she acquired as a young calf, that she petted and fed by hand, but another acquired as an adult from Fratsia let down milk in response to the presence of Foteini or her husband, even with her first calf. These cows had a small udder but were well fed and, after suckling for 1.5-3 months until the calf began to graze, were then milked for two to three months without the presence of the calf, although they dried up sooner if yoked to the plough. Foteini mixed their milk with that from her sheep and goats, to make cheese for the family. Irini grew up with an uncle in Vouno (near Karavas where Titika saw no indigenous cows being milked). The uncle reared calves for sale both as future draught oxen and for meat. His calves suckled for two or three months, until they could graze or eat dry fodder, and were sold at five or six months, after grazing outdoors over summer, or sooner, if winter approached and byre space was limited. If the cows had a lot of milk, he took whatever the suckling calves left, but he mainly milked after weaning and, with the calves initially present in a separate pen within the byre, did not experience major problems with let down. Like Foteini, he mixed milk from cows and sheep to make cheese. He and Foteini were unusual on Kythira in milking indigenous cows, but not exceptional. As Stratis from Potamos recalls, however, those who milked the old Kythiran cows were few and the practice was unknown to most.

**Pieria**

In north Greek Pieria, milking of indigenous cows was more widespread, but not universal, while traditions of animal husbandry also differed between cultural groups such as Thracian refugees from European Turkey, Pontic refugees from north Anatolian Turkey, and 'locals' already resident in the region. Takis from the 'local' township of Kolindros was a young child in the early 1920s when the refugees settled in neighbouring villages. His father had enough land to support draught oxen

(castrated males), while his indigenous cows produced calves that he either retained as replacement oxen or sold to the butcher at one or two years of age, depending on his need for cash. 'Because we had milk from our sheep, we did not put a hand under the cows, but left the calves to consume their milk and grow faster.' Takis also considered that cow's milk made poor cheese and later, as head of a household without sheep and despite having a cow that produced more milk than the family could drink, he bought cheese from a herd of goats. Conversely, his neighbour Andreas grew up in a household that owned only two donkeys and three or four goats, of necessity relying on the latter for dairy produce.

In general, the poorer 'locals' in Kolindros did not own cows, while at least some of the better-off also owned sheep that yielded richer milk preferred for both domestic consumption and sale. Nikolaos' father, however, who owned four oxen but no sheep (perhaps because his sons were too young for herding), milked his five or six indigenous cows kept primarily to rear calves for sale as adult (3-4 year old) cows or oxen. He milked after weaning at 5-6 months, but started sooner if a cow produced more than her calf consumed. All his cows were reluctant to be milked and initially he let the calf suckle two teats, while he milked the other two. Some kicked, spilling the milk, and had to have one leg tied to a post during milking. The family consumed most of the milk fresh or as yoghurt, but his father also made cheese when the supply was particularly abundant. A few years later as a husband and father, however, Nikolaos kept sheep as well as cows and relied on the former for dairy produce, leaving the latter to suckle their calves which thus grew bigger and were sold at a higher price.

Elderly 'locals' in surrounding villages had similar childhood experiences of indigenous cows. In Livadi, Lefteris' father kept as many as 10-15 oxen and cows and no sheep or goats, but did not milk his cows, preferring to raise bigger calves for sale. In Paliambela, Giorgos' father had 100 sheep, which supplied dairy produce for consumption and sale, and a handful of cows, whose milk fattened calves for sale; when he switched to higher-yielding cows, sired by a Swiss Braunvieh bull, he acquired infant calves for fattening from Pontic refugees (below). A neighbour, Manolis' father, had no sheep and fewer indigenous cows that provided draught for the plough, calves for sale, and milk for the family. He let the calves suckle for one or two months and then fed them milk from a bucket, supplemented by alfalfa hay. Manolis recalls that a few of these cows were easy to milk, and let down milk even

after losing a calf, but most were difficult and some again needed to be hobbled to prevent them kicking during milking.

Most Paliambela residents were Thracian refugees, who arrived overland in ox-carts, some accompanied by the odd cow or buffalo, but few by smaller livestock. Their distinctive culinary tradition made greater use of milk from cows and buffalos. Mitsos was aged three on arrival. His father, then a new household head, only had his two oxen, but in Paliambela was given a female buffalo by his father-in-law and bought an indigenous cow, both of which provided calves for sale and milk for domestic consumption. The cow calved every second year and, while suckling, gave a litre or two of milk per day that the family mixed with that from the buffalo to drink or make into butter. In their 'homeland' the Thracians considered cow (and buffalo) milk superior to that from sheep for butter, but regarded cow milk as inferior or even wholly unsuitable for cheese. In their early years in Paliambela, however, most did not have sheep and consequently made cheese from buffalo milk (if available) or otherwise cow milk, although that made by Mitsos' mother-in-law apparently spoiled in hot weather.

Koula's father, who arrived in Paliambela as a teenager, gradually built up a flock of sheep before marriage in the early 1930s, when he trained two young draught oxen and his wife brought a young heifer, daughter of a cow that had walked from Thrace. The young cow calved every year and, for an unimproved animal, milked well. Over the following years they accumulated six female buffalos and ten cows, which again produced calves for sale and milk, which they mainly used – unmixed – to make two types of butter for sale and to provide fresh milk and cheese for domestic consumption; her father did not use the milk from his sheep for cheese, because he could sell it to a local dairy. While some Thracian neighbours weaned later and took less milk to rear bigger calves with tenderer meat, Koula's parents milked their cows after weaning the calves earlier at 2-3 months. Their indigenous cows were much less demanding of fodder (although, unlike many in southern Greece, they received grain supplements), much less productive, and much harder to milk than the improved breed that Koula and her husband kept in later years. Her parents routinely used the calf to initiate let down in the former, but Koula's statement that, 'if you did not let out the calf to butt the cow, you did not see any milk', involves some dramatic licence. Switching from the general to the particular, she also describes one particular indigenous cow that could under no circumstances – even with a full udder – be

coaxed or tricked into letting down milk without her calf. By implication, it was difficult rather than impossible to milk their other relatively pampered indigenous cows without the calf being present; in practice, Koula's parents must have faced this difficulty rarely, if ever, since they retained their calves long after weaning and never lost one at or shortly after birth. It is instructive to compare her experiences with those of Mitsos. He started married life with only two indigenous cows that worked, calved and provided some milk and he never achieved more than one or two additional cows for calves and milk. He took a little milk to drink fresh while the calves suckled. He too weaned the calves at around two to three months old and then kept them apart from their mothers in the same byre, allowing him to take all the milk and also make butter. His cows varied greatly in how easily they let down – one kicked so much that she was never milked, but she was an excellent draught animal and produced calves, so he retained her. The rest he milked, however, without untying their calves, although patience was needed – especially with those calving for the first time. He insisted that, if a cow lost a calf, she could be coaxed to let down by washing her udder and then stroking her. Mitsos and others with very few cows had the time and incentive to coax let down and invested the necessary effort in encouraging reluctant cows. Those with ten or more cows, however, like Koula's parents, had neither the time nor the need to coax reluctant individuals and often describe indigenous cows as impossible to milk in the absence of the calf.

By common consent, the simplest way to induce let down in unimproved cows was to allow the calf to head-butt its mother's udder, but many informants noted that, as the calf grew bigger and stronger, its attentions became increasingly irksome and tiring. Koula's parents weaned calves early both to take more of the milk for their own use and to improve the cow's well-being and productivity. Likewise, Mitsos once had three cows give birth in ten days and he removed the calves immediately for bottle- and then bucket-feeding. He gained much more of the first two to three months of lactation, but also found that the cows were less tired and produced perhaps 3 litres of milk per day more than they did normally. The calves grew more slowly, but he did not repeat the experiment primarily because early hand-feeding was very time-consuming.

For this reason, when 'local' Giorgos and Thracian Thanasis fattened others' unwanted calves to use up surplus milk from their cows that the dairy would not take, they acquired calves 30-40 days old that could drink from a bucket. These calves

came from villagers of Pontic refugee origin, for whom milk, butter, cheese and yoghurt were of great culinary significance and many of whom – for cultural and practical reasons – did not keep sheep and so wished to milk their one or two cows intensively. The first generation of Pontic refugees, having fled by sea and largely empty-handed, of necessity raised unimproved cattle of 'local' or possibly Thracian origin. At Nea Trapezounta, Anastasios and Zoi, two neighbours in their nineties, used to separate such calves at birth, feeding them with their finger ('like a teat') and then from a bucket until weaning or slaughter at 40-50 days old, when their meat was edible, but they recall Zoi's grandfather discarding carcasses as inedible at birth. They milked their indigenous cows almost immediately after calving (once the first colostrum had given way to 'clean' milk). To encourage let down, they stroked or sang to some cows. Others kicked unless they could lick their calf tied in front of them, but usually were accustomed to milking by the time the calf was slaughtered or could be satisified by stuffing its hide with straw 'like a scarecrow' (a ploy also used if a calf died prematurely). Any cow that did not respond to coaxing went to the butcher, but both milking of cows and control of calves were easier if the latter were removed at birth. Milking was also easier if cows were warm and well fed.

**Milking unimproved cows in Greece**

Greek farmers of the early and mid-twentieth century kept indigenous cows for draught, to produce replacement breeding and working animals and calves for sale to urban butchers, and in some cases to provide milk for human consumption. These regionally variable cattle had been selected for tolerance of poor diet and hard work rather than capacity to produce or willingness to let down milk. Elderly informants, especially in southern Greece, routinely declare that unimproved cows were not milked because of their limited productivity and/or reluctance to let down milk except for their own calves. Closer enquiry, however, reveals that such cows, although producing much less milk and letting down more reluctantly for human milkers than well-fed cows of improved dairy breed, were quite widely milked – even in southern Greece. Milking and suckling of the calf were often combined, but variously because large calves were at least as high a priority as milk for human consumption, and/or because the potential yield from milking these cows outstripped demand, and/or because scarcity of labour inhibited heavy investment in encouraging let down without the calf. Conversely, the greater the importance attached to acquiring cow's

milk for human consumption, the younger the age at which calves were weaned or slaughtered. Moreover, although many informants were well aware of calves being able to access the last fraction of milk that cows retained for this purpose, none cited this as a reason for delaying weaning or slaughter. On the contrary, some informants held that early weaning, by freeing cows from increasing harassment by growing calves, could significantly boost the availability of milk for human consumption. Finally, calves sometimes died or were slaughtered or removed at or very soon after birth and, in most such cases, herders could – if they invested sufficient effort – coax let down of milk.

**Conclusions: rustic breeds, mortality profiles and milking**

The experiences of pre-mechanised farmers with unimproved livestock offer invaluable insights to zooarchaeologists, but this study highlights two respects in which potential insights must be treated with circumspection. First, the Aubrac and Salers of central France and the regional rustic breeds of Greece alike underwent prolonged selection for particular (sometimes changing) production priorities, as well as for resilience, and their recent use reflects cultural demands and constraints as well as biological potential. Ethnozooarchaeologists must, therefore, deconstruct the ecological and historical context from which their information is drawn and should treat rustic breeds as prehistoric proxies with caution. Secondly, in central France and both north and south Greece, informants may offer sweeping generalisations ('nobody here milked cows') that are representative of central tendencies, but conceal vital variability in practices and outcomes that we ignore at our peril.

As for the disputed relationship between mortality patterns and milking, nineteenth century evidence from central France and more recent oral historical data from northern Greece indicate that slaughter of infant calves is entirely compatible with management for milk of rustic unimproved cows. More problematic is the equifinality of mortality data. In Greece, the milking of such cows accompanied slaughter of their offspring at various ages: up to 40-50 days old by Pontic refugees who prioritised milk over meat; from two or three months upwards on Kythira where meat was more important than milk but pasture was scarce; in the second year by farmers in Pieria who supplied urban butchers and had more abundant pasture and fodder; or in late adulthood when reared as replacement breeding cows and draught oxen. In other words, milking of unimproved cows is compatible with 'milk', 'meat'

and ‘traction’ mortality (sensu Higham 1968; Legge 1981a) and ‘post-lactation kill-off’ (Balasse et al. 2000) – in effect with any mortality pattern that spares some adult cows. Mortality patterns thus cannot demonstrate the presence or absence of milking, for which organic residues in ceramics provide a more direct proxy. On the other hand, unlike ceramic residues, they may shed light on the potential intensity of dairying (Halstead 2014), and the testimony of recent cattle herders from central France and Greece unambiguously supports infant culling (or weaning) as leaving most potential for human use of milk. Furthermore, heavy culling of infant calves (or lambs or kids), which for reasons of seasonal ecology is unlikely to reflect lack of pasture, represents a dramatic sacrifice of potential carcass weight in subsequent months, favouring the existence of a competing priority, such as production of calf skins, tender veal, or milk. Post-lactation slaughter entails less sacrifice of potential carcass weight and, unless coupled with isotopic evidence for early weaning, is equally compatible with rearing large calves (constrained perhaps by scarcity of winter fodder), balancing meat and milk production (for example, if two teats were suckled and two milked), or even intensive dairying (if calves were mainly bucket fed). If mortality data alone are available, therefore, Tony was right – culling of infants provides the strongest hint in favour of intensive dairying.

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