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RESEARCH ARTICLE

Continuity and change in animal husbandry during the Later Iron Age of Britain

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Abstract

The Later Iron Age in Britain was a transformative period: material culture, settlement patterns, technology, trade networks, and the structures of power changed, ultimately leading to the Roman invasion. This paper examines the significance of investigating animal economies in this period within the broader context of socio-economic developments. It reviews the available evidence regarding animal economies in this period, integrates new osteometric analyses, and discusses diachronic changes using the Roman evidence on a comparative basis. The investigation shows a broad pattern of continuity of practice, with relatively uniform livestock types and management strategies until the very end of the Iron Age. This suggests that the trajectory of local farming practices was largely independent from Mediterranean developments. This study contributes to a deeper understanding of Iron Age societies and their response to external influences, while also informing future research directions in archaeology.

KEYWORDS
biometry, Britain, change, Later Iron Age, society, zooarchaeology

1 | INTRODUCTION

Much academic research in the last few decades has abundantly demonstrated that major socio-cultural change is often accompanied by changes in the human relationship with animals (e.g., Reitz, 2017; Rizzetto & Albarella, 2022; Zeder, 1991). In Britain, both the beginning and the end of the Roman presence on the island have been demonstrated to bring about a substantial reorganization of husbandry strategies (Albarella et al., 2008; Holmes, 2014; Rizzetto et al., 2017). Both these moments are also characterized by radical changes in material culture, settlement patterns, technology, agriculture, trade networks, and the structures of power (Bang, 2008; Bird, 2016; Mattingly, 2007; Millett, 1992; Millett et al., 2016). These pivotal transitions have been a major focus of study, as the change we can see in the archaeological record is both interesting and detectable. It is interesting because it gives us a tantalizing opportunity to explore our own world, since Western society sees the Roman period, for better or worse, as the foundation of its current culture. It is detectable because when compared to most prehistoric or early medieval societies, the Roman presence is highly visible: It is historically well documented and has left abundant and durable material evidence. Studying its transitional moments therefore represents an opportunity to answer important questions about the way human societies develop, reproduce, and eventually disappear.

In contrast, developments within the Iron Age are more difficult to gauge and have received less scholarly attention. The absence of written sources; the ephemerality, uniformity, and relative stability of the material evidence; and dating difficulties (Hamilton et al., 2015) have led to a certain complacency in using vague and loose chronologies (Barrett et al., 2011). The Iron Age has ended up being perceived as a static continuum, and, up until the 1970s, a widespread preconception in the archaeological literature saw the Iron Age populations

of Britain as timeless and primitive (Collis, 2007). Although the archaeological narratives have substantially changed in the last few decades (Champion, 2016), this idea has not entirely disappeared from the archaeological literature. Regarding animal husbandry and its relationship with societal developments, this has largely resulted in avoiding the question about continuity and change altogether. A counter-narrative, which plays down the effects of Romanization by ascribing the start of new practices to the Iron Age (e.g., Millett, 1992), is based on very limited zooarchaeological evidence.

It is important to address this knowledge gap, especially in view of the pervasive entanglement between pre-industrial societies and their livestock, the increase in settlement density (Hill, 1995b, 2007), and the growing evidence for social change during the Late Iron Age (Champion, 1994; Hill, 2007; Sharples, 2010).

The main aim of this paper is to investigate the developments in animal husbandry during the Later Iron Age and their implications for socio-cultural change. To do so, the available evidence for change in human/animal relationships in the Later Iron Age will be reviewed and integrated with the analysis of newly collected zooarchaeological data, with an emphasis on the study of animal size. Unlike Mainland Europe, livestock size changes within this period in Britain have been largely neglected. Yet their investigation allows us to address the important question of whether there was any livestock improvement and/or introduction of larger animals that pre-dates the Roman conquest such as found in other regions such as France, Switzerland and Austria (Frémondeau et al., 2017), or Northern Italy (Trentacoste et al., 2018). This has implications for our understanding of local developments and their relationship to wider networks of cultural transfer.

Since the Iron Age to Roman transition has been so much better investigated, it is here taken as a yardstick to measure and characterize single or compound aspects of Iron Age life and place them on a scale ranging from continuity to radical change.

2 | METHODS

The osteometric analyses presented in this paper use a suite of post-cranial measurements taken on fully fused bones selected from those published by von den Driesch (1976) (Table 1).

The data are analyzed by comparing their graphic visualization in either scatterplots and boxplots of raw measurements and ratios or histograms and boxplots of Logarithm Scaling Index (LSI) values. LSI divides single measurements by a standard value and converts them into a decimal logarithm. In this way, values from different measurements of different skeletal elements are plotted on the same scale, increasing the dataset (Meadow, 1999). The standard values employed here (Table 1) are the mean values of the archaeological populations from the Latest Iron Age sites recorded by MB, to resemble as closely as possible the body proportions of the morphotypes to which the populations under study belonged (Albarella, 2002). Although an individual animal is often used as a standard in LSI analysis, in this case, preference has been given to the mean of a group of measurements. This guarantees that any potential anomalies in size or metric proportions is mitigated by the collective influence generated by the combination of different sexes, ages, and individuals.

TABLE 1 List of measurements from von den Driesch (1976) employed in the osteometric analyses. The standard values for LSI are the mean of selected width measurements taken on the Latest Iron Age assemblages of Dragonby (caprine and cattle) and Skeleton Green (pig).

		Standards for LSI		
Element	Measurement	Caprine	Cattle	Pig
Astragalus	GLI	-	-	-
	Bd	16.5	37.5	-
Humerus	BT	25.1	66.0	29.0
Metacarpal	Bd	22.1	53.3	-
Metatarsal	Bd	21.7	48.5	-
Pelvis	LA	23.3	60.7	-
	LAR	-	-	30.8
Radius	Bp	27.1	71.1	26.8
Tibia	Bd	22.8	54.8	27.6

The selected measurements are commonly used and tend not to be highly influenced by known bias factors such as post-fusion growth.

Since bone proportions vary in different populations and dimensions lying on different axes could therefore change differentially (Albarella, 2002; Davis, 1996; Meadow, 1999), lengths and widths were not aggregated and widths were preferred as proxies for general size since lengths are more rarely recorded. Only one measurement value per specimen was included to avoid inter-dependence, despite the inevitable reduction in sample size. Measurements of caprine (subfamily Caprinae) specimens attributed to goats were excluded, while those from specimens not attributed to either species were included assuming that the large majority of them would belong to sheep given the overwhelming prevalence of the latter in the analyzed sites and in the British Iron Age in general (Albarella, 2019; Bormetti, 2023; Hambleton, 2008).

The datasets used in each analysis were paired and statistically tested with a two-tailed *t*-test with Welch's correction. Both data representation and statistical testing were conducted with GraphPad Prism 10.

The *t*-test is a parametric test that should in theory only be used when measurements are normally distributed, but it does represent a "robust" test, which in practice is little affected by normality or variance (Simpson et al. 1960).

Despite variance between datasets being similar, Welch's correction was preferred because of unequal sample size in some of the pairings. The significance of the test was reported following GraphPad style, which reports four digits after the decimal point with a leading zero (0.1234). *P* values less than 0.0001 were shown as "< 0.0001." *P* values less than 0.05 were reported with one asterisk, less than 0.01 with two asterisks, less than 0.001 with three asterisks, and less

than 0.0001 with four asterisks. These thresholds provide an immediate way to gauge the difference between the tests for each paring, offering fine resolution suitable for approximating comments on differences at the ordinal scale.

Two research areas (as delimited in Figure 1), Central-Eastern England and Wessex, have been chosen according to the following criteria:

- Abundant zooarchaeological data.
- Their contiguity and nearness to the European Mainland (where foreign cultural influences are more easily detectable when present).
- Relative formal and cultural uniformity of the material and settlement evidence within each area but differences between the two areas (Cunliffe, 2004, p. 74).

The datasets include data from:

- Four sites in Central and Eastern England recorded by MB (Bormetti, 2023).
- Sites across the two areas obtained from publicly available sources such as ABMAP (https://archaeologydataservice.ac.uk/archives/view/abmap/) and zooarchaeological reports.
- Datasets kindly shared by other zooarchaeologists (see the Acknowledgements).

The location of all the archaeological sites discussed in this paper is presented in Figure 1.

The Later Iron Age datasets have been divided by chronology following subdivisions in Middle Iron Age (400/300 to 150/100 BCE), Late Iron Age (150/100 BCE to 50 BCE), and Latest IA (50 BCE to ~50 CE) that largely follow the scheme proposed by Cunliffe (2004). To emphasize the outgroup function of the Roman data in what is an analysis focused on the Later Iron Age, osteometric data from the Roman period have been selected from the Mid to Late chronologies (roughly between 160 and 400 CE), when the differences with the Iron Age data are starker.

Before delving into the analysis of osteometric data, the next section will present an overview of the main developments in animal management and consumption that have been identified for the Iron Age and the post-conquest period. The review describes general trends that inevitably obscure exceptions and localized patterns whose treatment is beyond the scope of this paper.

3 | REVIEW OF THE ZOOARCHAEOLOGICAL EVIDENCE

One of the clearest elements of discontinuity between the British Iron Age and the Roman period is the array of species exploited. While pre-Roman Britons used a limited set of domestic animals throughout

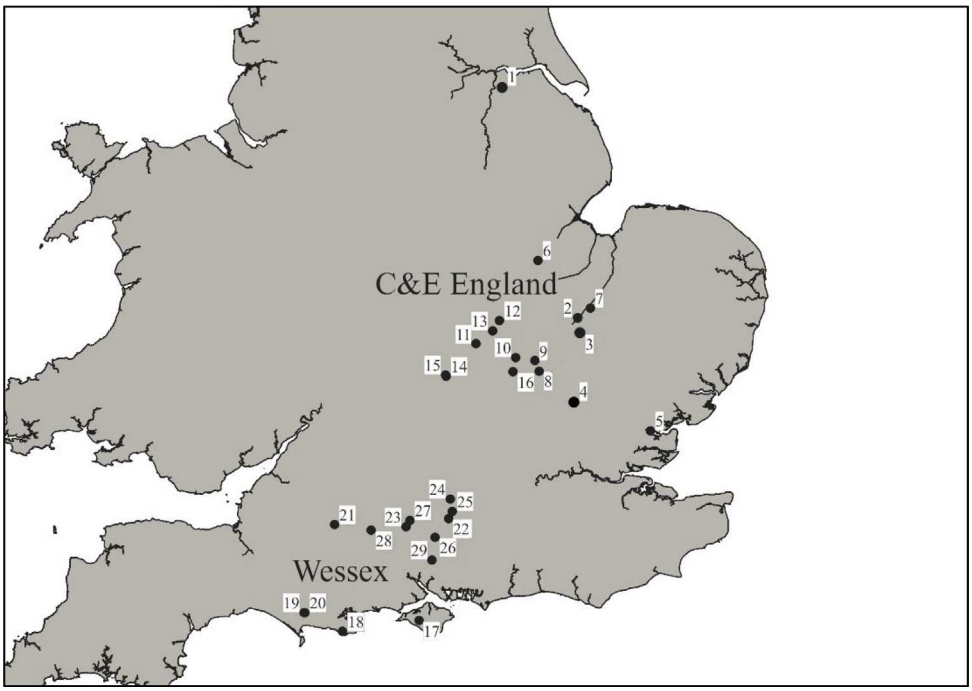

FIGURE 1 Location of the sites used for the osteometric analysis. Central and Eastern England: 1, Dragonby; 2, Haddenham V; 3, Northstowe; 4, Skeleton Green; 5, Heybridge, Elms Farm; 6, Market Deeping; 7, Wardy Hill; 8, Broom Quarry; 9, Moggerhanger; 10, Bedford West By Pass; 11, Brackmills; 12, Wellinborough, Burton Way; 13, Wellinborough, Wilby Way; 14, Brackley, Northampton Road; 15, Brackley, Radstone Road; 16, Marston Park. Wessex: 17, Isle of Wight, Rock Roman Villa; 18, Rope Lake Hole; 19, Dorchester, Flagstones; 20, Dorchester, Alington Avenue; 21, Battlesbury Bowl; 22, Brighton Hill South; 23, Andover, Balksbury; 24, Silchester; 25, Basingstoke, Popley; 26, Micheldever Wood; 27, Knights Enham Hill, Andover; 28, A303 Stonehenge; 29, Winchester, Victoria Road.

the whole period (Albarella, 2019; Hambleton, 2008; Maltby, 1996) and largely avoided wild and marine resources (Dobney & Ervynck, 2007; Rainsford & Roberts, 2013), the Romans introduced or consolidated the presence or exploitation of a wide variety of domestic and managed animals (e.g., cats, Kitchener & O'Connor, 2010; donkeys and mules, Johnstone, 2010; chicken, Sykes, 2012; anatids, pigeons, pheasants and peacocks, Maltby, 2016; garden dormouse, O'Connor, 1986), consumed local and imported marine resources (Locker, 2007; Müldner, 2013), and practiced gamekeeping at high-status sites (Sykes et al., 2011). This, along with the introduction of several plant species in what has been defined as a horticultural revolution (van der Veen, 2016), indicates a definite change in attitude towards nature and its manipulation, as well as a far-reaching network of animal movement.

Management strategies and scale of production also changed between the two periods. During the Iron Age, animal husbandry remained substantially stable over time and relatively uniform across space. Cattle and sheep were the staples of animal farming, with the local prevalence of one or the other linked to topographic variation, as ease of foddering and watering in some environments favored cattle husbandry (Grant, 1984a; Hambleton, 2008; Maltby, 1996). Regardless of the local patterns, an increasing prevalence of sheep throughout the period has been demonstrated at least for the intensively studied regions of Central Southern England (Hambleton, 2008) and Central and Eastern England (Albarella, 2007, 2019).

Conversely, the Roman conquest saw a definite shift towards cattle prevalence (Albarella, 2019; King, 1999; Maltby, 2016) that, together with their increase in size (Albarella et al., 2008; Duval & Albarella, 2022; Rizzetto et al., 2017), signals a change in strategy where cattle fulfilled a more significant dual role as draft animal in arable agriculture and source of meat for the increased population of net-consumers.

During the Iron Age, sheep mortality profiles across Britain show consistently steady rates of mortality, usually after a peak representing the culling of individuals before 1 year of age. This is taken to represent a mixed management strategy aimed at producing the whole suite of sheep products (manure, meat, wool, and milk), with a substantial autumn culling of lambs. Given the unimproved character of the Iron Age morphotypes, such an unspecialized management practice suggests that surplus production may have been obtained through the extensive management of large flocks which were regularly reduced to keep them sustainable through the winter without the need for substantial foddering (Albarella, 2007; Maltby, 1981).

Although with much more inter-site variability, cattle mortality profiles also generally present mixed patterns of exploitation during the Iron Age, with a substantial number of animals kept alive after their prime suggesting a generalized use to support arable agriculture and exploit secondary products (Hambleton, 1999, p. 78). By the Roman period, mortality curves present an increased representation of older individuals for both sheep and cattle (Maltby, 2016). This represents an increased focus on traction for cattle, while sheep husbandry largely abandons the culling of lambs and boosts prime age mutton or wool production depending on the site.

The limited reliance on pigs in both periods appears to be a stable character of late prehistoric and historic British husbandry. Considering the potentially high output of meat production from mixed sheep and cattle farming before and after the conquest, this does not imply limited reliance on meat in general. Rather, we can imagine the pigs' role was that of a smaller food reserve on the hoof to complement the more substantial output of the other species. There is also evidence that pigs were fed with settlement waste possibly because of the scarcity of woodland after the widespread late prehistoric clearance (Hamilton et al., 2009; Wilkie et al., 2007).

During the Iron Age, all three main domesticates are often described as "small" in the literature (Grant, 1984a, 1984b; Hambleton, 2008; Maltby, 1981, 1996), but morphometric analyses have been rare and not focused on diachronic change. When utilized, they have shown that livestock was improved during the Roman period, with an early increase in the size of cattle followed by that of sheep and pigs roughly a century later (Albarella et al., 2008).

Dogs and horses are invariably present in Iron Age assemblages, often with higher numbers in Associated Bone Groups[1] compared to general waste (Hambleton, 2008), indicating their symbolic and physical separation from meat-producing animals. Dogs, rather uniformly pertaining to morphotypes suitable for guarding properties and flocks before the conquest (Baxter & Nussbaumer, 2009; Harcourt, 1974), show increased size variability in the Roman period, due to the import of new types for specialized roles like companionship and hunting (Clark, 2000; Maltby, 2016). Limited evidence suggests a model of localized feral horse taming and free-range management in Southern England (Hamilton, 2000; Harcourt, 1979). However, findings from Eastern England (Bormetti, 2023) and the Upper Thames Valley (Mulville et al., 2011) contradict this, with diffused evidence of on-site breeding. Horses in the Iron Age were mostly pony-sized, with an apparent increase in average height by the Late Iron Age (Maltby, 1981, 1996). In the Roman period, equid remains were less frequent except in roadside settlements (Wright et al., 2019), indicating changes in their role and breeding practices. Additionally, increased arthropathic conditions suggest their use as working animals or an ageing population, with size improvement noted later in the Roman period, similar to sheep (Albarella, 2019).

Iron Age butchery practices were primarily conducted at the household level, with limited bone modification. Waste disposal within settlements was common, with few exceptions indicating specialized crafting or meat production (Hambleton, 2008). Bone tools and debris suggest localized production (Albarella, 2019, p. 107). Butchery patterns on sheep and cattle bones were similar across Iron Age sites (Hambleton & Maltby, 2004; Maltby, 1987; Wilson et al., 1978), but qualitative analyses are scarce, hindering regional understanding. In the Roman period, new butchery patterns emerged, with substantial dumps of specific body parts and increased use of heavy implements like cleavers (Maltby, 2007; Rizzetto et al., 2017; Seetah, 2006). Intensive processing for marrow extraction became

[1]Groups of articulated bones from the same individual, deposited in a single archaeological feature usually also containing general waste and often interpreted as structured or symbolic depositions. See Hill (1995a), Wilson (1999), and Morris (2008, 2010).

common. Salt production hints at new curing practices in the Iron Age (Maltby, 2006), while the Roman period saw the appearance of specific processing patterns (Maltby, 2007) indicating that meat was often sold on the bone, a practice also suggested by differential recovery of postcranial and cranial elements in roadside settlements (Wright et al., 2019).

Changes occurring around the Iron Age-Roman transition did not immediately nor homogenously affect society as a whole. Driven by the necessity of logistically supporting the military apparatus, burgeoning urbanization and the sophisticated lifestyles of the upper classes, these changes can initially be found mostly at the so-called Romanized sites such as villas, cities, and military settlements. Rural settlements mostly maintained Iron Age traditions (King, 1984, 1999). Intermediate settlement types, such as roadside settlements, tend to present mixed traits (Wright et al., 2019). This creates two distinct patterns of animal use and consumption, the gap between which tended to disappear as Roman Britain developed its own identity and autonomy in the Late Roman period.

4 | LIVESTOCK SIZE AND SHAPE IN THE BRITISH LATER IRON AGE

4.1 | Cattle

Metric data from cattle bones exhibit a pattern of relative chronological and regional uniformity during the Later Iron Age in Southern Britain. The analysis represented in Figure 2 (top) compares astragalus metric values for length and an index for robustness. Most Later Iron Age values cluster together, while data from the Roman period forms an overlapping, but distinct, group to the right of the main group, indicating taller and slightly more slender animals. Such greater slenderness is more apparent when plotting the robustness index values in a box chart (Figure 2, bottom). This comparison primarily addresses chronological periods. Regarding regional differences, the box chart also shows that the Wessex animals were, on average, more robust than those from Central and Eastern England in both periods.

Figure 3 presents Log Scaling Index analyses for cattle bone widths, used as a proxy for general livestock size. The histograms show similar ranges, distributions, and means for all the Later Iron Age subgroups, indicating that cattle size remained stable in this period. This pattern is supported by the non-significant differences in mean yielded by the statistical tests and made more evident by comparing the Iron Age with Roman data. The only notable Later Iron Age differences are those between the C&E England and Wessex groups, which indicate that the Wessex animals, although more robust as seen in Figure 2, were smaller throughout the chronological sequence. The size difference between the two regions is partly determined by the occurrence of some particularly large animals in Bedfordshire (Figure 3 bottom). In Roman times, there was a clear size increase but the size ratio in the two regions — with smaller and more robust animals in Wessex — remains unchanged.

4.2 | Caprines

Metric data from caprine bones reveals significant uniformity both chronologically and regionally during the Later Iron Age in Southern Britain. The analysis represented in Figure 4 (top) examines astragalus length and robustness, mirroring the approach taken with cattle bones. Regardless of geographic provenance, most values tightly cluster together, indicating consistent morphological characteristics across Later Iron Age Britain. Roman caprine values tend to plot more to the right of the *x*-axis suggesting taller animals. The comparison of robustness index values through box charts (Figure 4, bottom) confirms the uniformity of the Later Iron Age animals. In Roman Central and Eastern England, some more slender animals are observed but this interpretation must be taken cautiously because of the small sample size.

Figure 5 presents Log Scaling Index analyses for caprine bone widths, used as a proxy for general livestock size. Cumulatively, histograms and statistical tests show similar ranges, distributions, and means for all the Later Iron Age subgroups, indicating that, like for cattle, caprine size remained stable. Once again mirroring the cattle evidence, Wessex animals were slightly smaller throughout the period, but with less pronounced local variation than cattle (Figure 5, bottom). The size increase in Roman times is even more substantial than for cattle, but once again, the relative proportions between the two regions are maintained.

4.3 | Pigs

Despite pigs being present at every site, the contribution of pig husbandry during the Iron Age was relatively small and only marginally increased during the Roman period. Furthermore, pigs were generally slaughtered at a younger age than cattle and caprines, so that fewer fused bones are found. Therefore, pig bone metric data tend to be much less abundant and had to be aggregated in a different manner, limiting the analysis of regional variation (Figure 6).

Nonetheless, the data shows patterns and trajectories similar to those of the other main domesticates. Pig size was generally uniform across Southern Britain. In terms of diachrony, size did not appear to change significantly during the Later Iron Age, while a distinct size increase was noticeable during the Roman period.

5 | DISCUSSION

The osteometric evidence presented in this study demonstrates unambiguously that there was no livestock size improvement during the British Iron Age. The differences in mean and distribution between the different Iron Age phases are negligible for all three taxa. Conversely, comparison with Mid to Late Roman datasets invariably yields a strongly significant difference, even when examining specific taxa, such as sheep and pigs, which did not undergo immediate improvement through the introduction of large continental stock

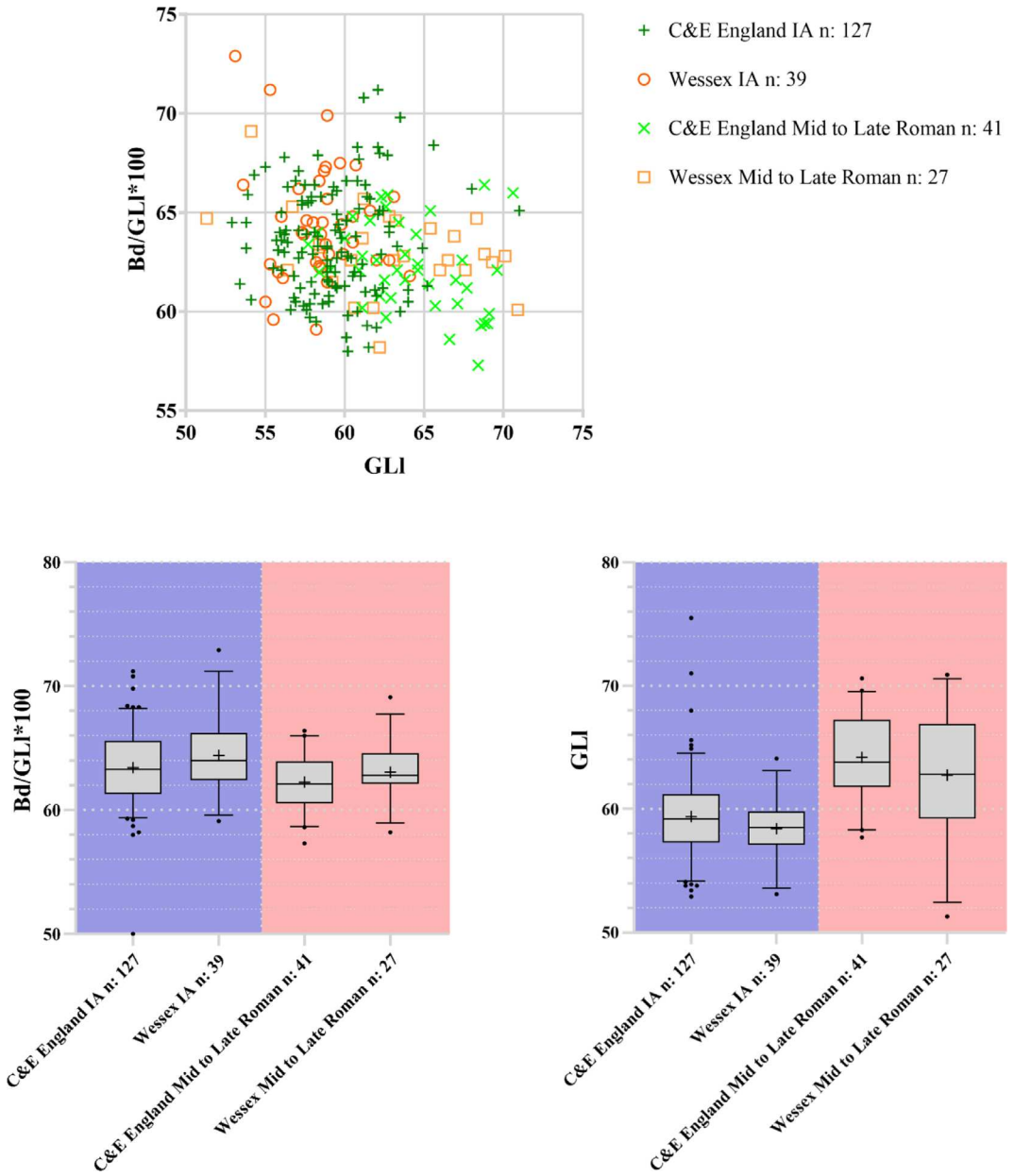

FIGURE 2 Robustness and size of cattle astragali in Later Iron Age and Middle to Late Roman period in the two areas of Central and Eastern England and Wessex. Top: scatterplot of length (*x*-axis, GLl), and robustness index (*y*-axis, ratio of the Bd and GLl measurements multiplied by a hundred to obtain the same order of magnitude as the raw measurements). Bottom: boxplots of the robustness index and the length of the astragalus by period and area. [Colour figure can be viewed at wileyonlinelibrary.com]

(Albarella et al., 2008). Considering that the duration of the Later Iron Age exceeds that between the conquest and the full implementation of livestock improvement in Roman times, we would expect to see comparable changes in the data if livestock improvement was practiced at a similar pace.

While a tenuous increase in the size of cattle through the Iron Age has been previously proposed for at least some areas (Duval & Albarella, 2022), the comparison of data from different counties in the boxplots in Figure 3 makes evident that this does not represent a general trend. While in some areas mean log ratio values increase (Beds.), in others they decrease (Cambs. and Hants.), and most remain unchanged. This is apparent also for caprines, and, in any case, the minimal differences in size between phases for each county likely fall within the margin of error due to the process of aggregating and comparing various datasets.

What the evidence confirms is the presence of regional populations of different sizes and possibly morphology, as hinted by subtle differences in the shape of the astragali. Considering the probable increase in human and animal mobility during this period (Minniti et al., 2014), the presence of outlying larger animals detected in some areas (e.g., see Figure 3) could then be explained by animal trade within Britain (cf. Duval & Albarella, 2022), although the possibility —

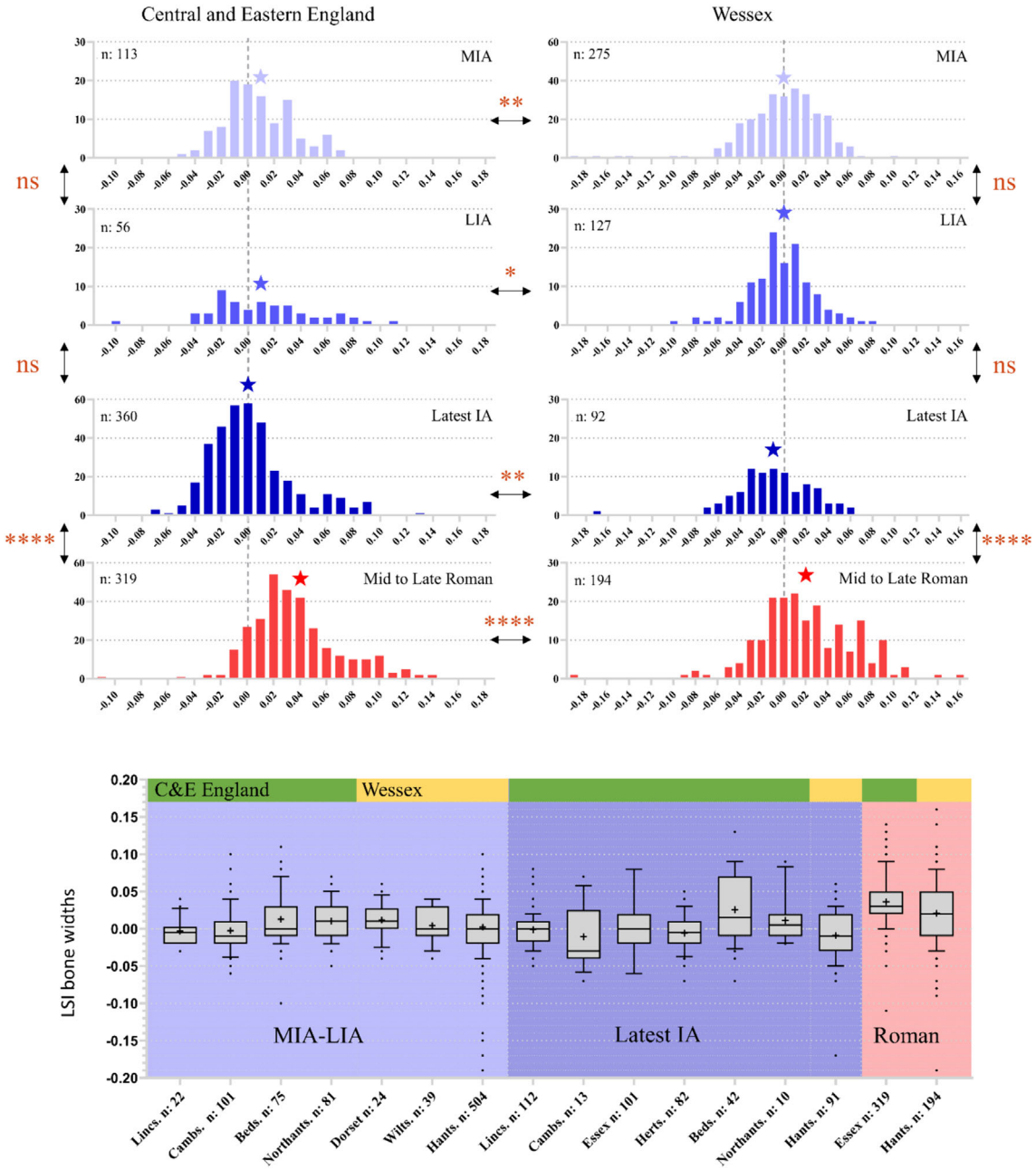

FIGURE 3 Cattle post-cranial bone widths as a proxy for livestock size. Log Scale Index histograms by area and period (top); stars indicate the means. The significance of the Welch's *t*-test statistics between the groupings is represented by arrows between the histograms. Log Scale Index boxplot displays data by period and county (bottom); whisker ranges represent the 5–95 percentiles, points represent values outside the range, bars represent the median, and crosses mark the mean. [Colour figure can be viewed at wileyonlinelibrary.com]

previously proposed — of cross-channel exchange remains a valid alternative.

The lack of livestock improvements, together with a stable array of exploited species, and largely unchanged husbandry and butchery practices help us characterize the Later Iron Age mainly as a period of continuity in terms of animal farming and exploitation. This relative conservativeness could appear surprising in the face of the adoption of other continental and Mediterranean practices (e.g., coinage, but see Champion, 2016) and the ongoing social restructuring indicated by the appearance of new site types, mortuary practices, production modes, and relationships with objects and exchange (Hill, 2007; Pitts, 2010; Webley, 2015). We have, however, to keep in mind that other fundamental aspects of social life, such as roundhouse architecture, showed continuity well into the Roman period. Furthermore, continuity of practice does not imply a complete absence of change and that the opportunity to adopt foreign practices might not match the socio-economic needs and cultural preferences of the local population.

If we consider the stability of the core traits of the farming economy together with the trend for settlement expansion and

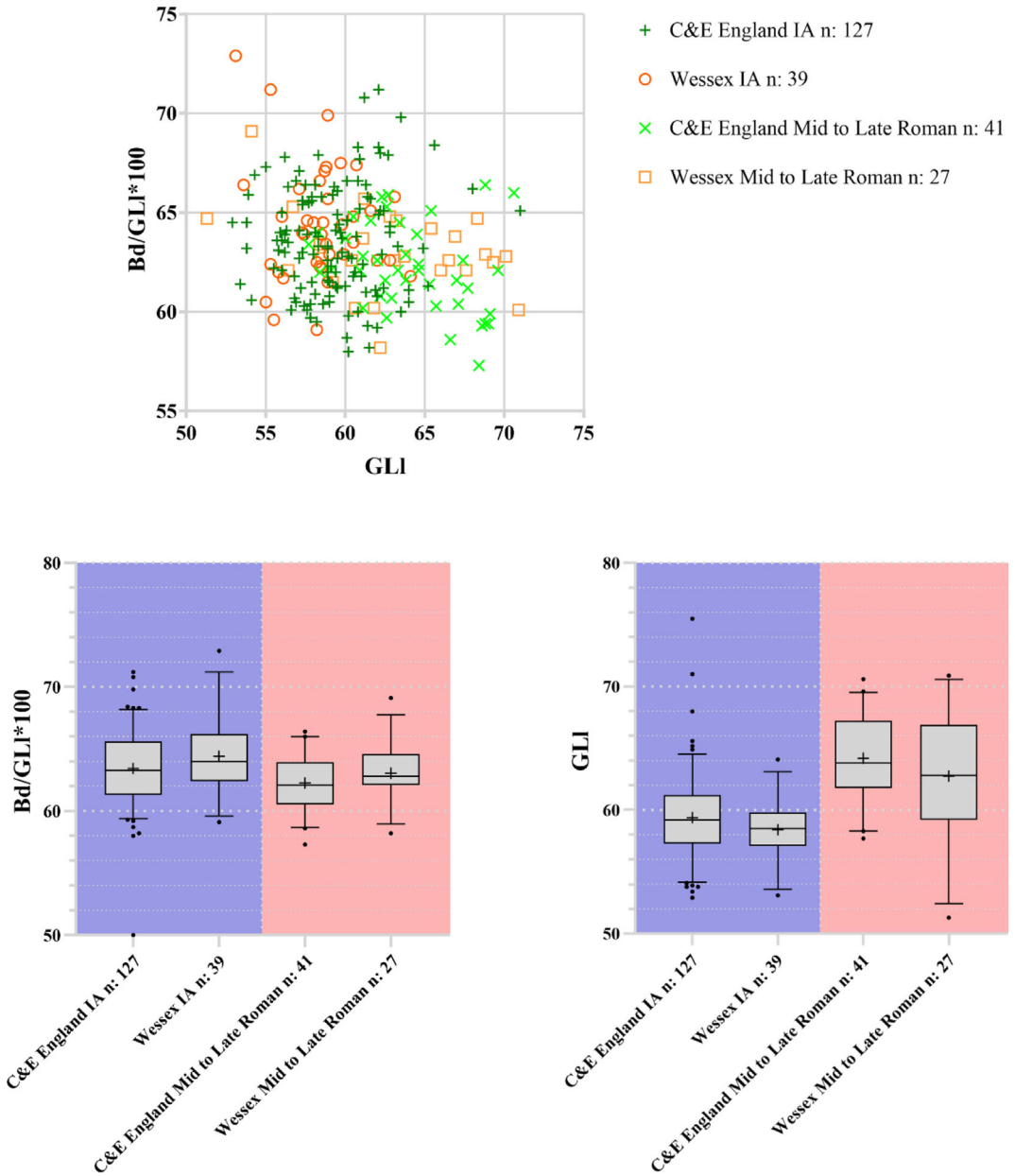

FIGURE 4 Robustness of caprine astragali in Later Iron Age and Middle to Late Roman in the two areas of Central and Eastern England and Wessex. Top: scatterplot of length (*x*-axis, GLl) and robustness index (*y*-axis, ratio of the Bd and GLl measurements multiplied by a hundred to obtain the same order of magnitude as the raw measurements). Bottom: boxplots of the robustness index and the length of the astragalus by period and area. [Colour figure can be viewed at wileyonlinelibrary.com]

colonization of previously marginal land on poorer and heavier soils (Haselgrove & Moore, 2007; Jones, 1981; Parks, 2012), we can conclude that the system was already successful as it created the surplus necessary to sustain an increasing population and the foundation of new settlements. It was probably preferable to replicate the existing system on less productive land than to find unoccupied productive land or invest in more intensive approaches.

One element of change we see in this period is the chronological trend towards an increased emphasis on sheep. This was most probably a symptom of the expansion since these animals would have represented a convenient way to sustain population growth even in areas unsuitable for cereal agriculture. This is the case for three main reasons:

- Sheep are sturdy animals that can thrive even in harsh environments; their adaptability and success in Britain are amply demonstrated by their prevalence through much of its history even in wet or rough terrains.
- They are also hugely versatile both in terms of husbandry techniques and product yield. The frequent pattern of culling of the lambs represents a way to maximize meat output while maintaining winter foddering to a minimum.

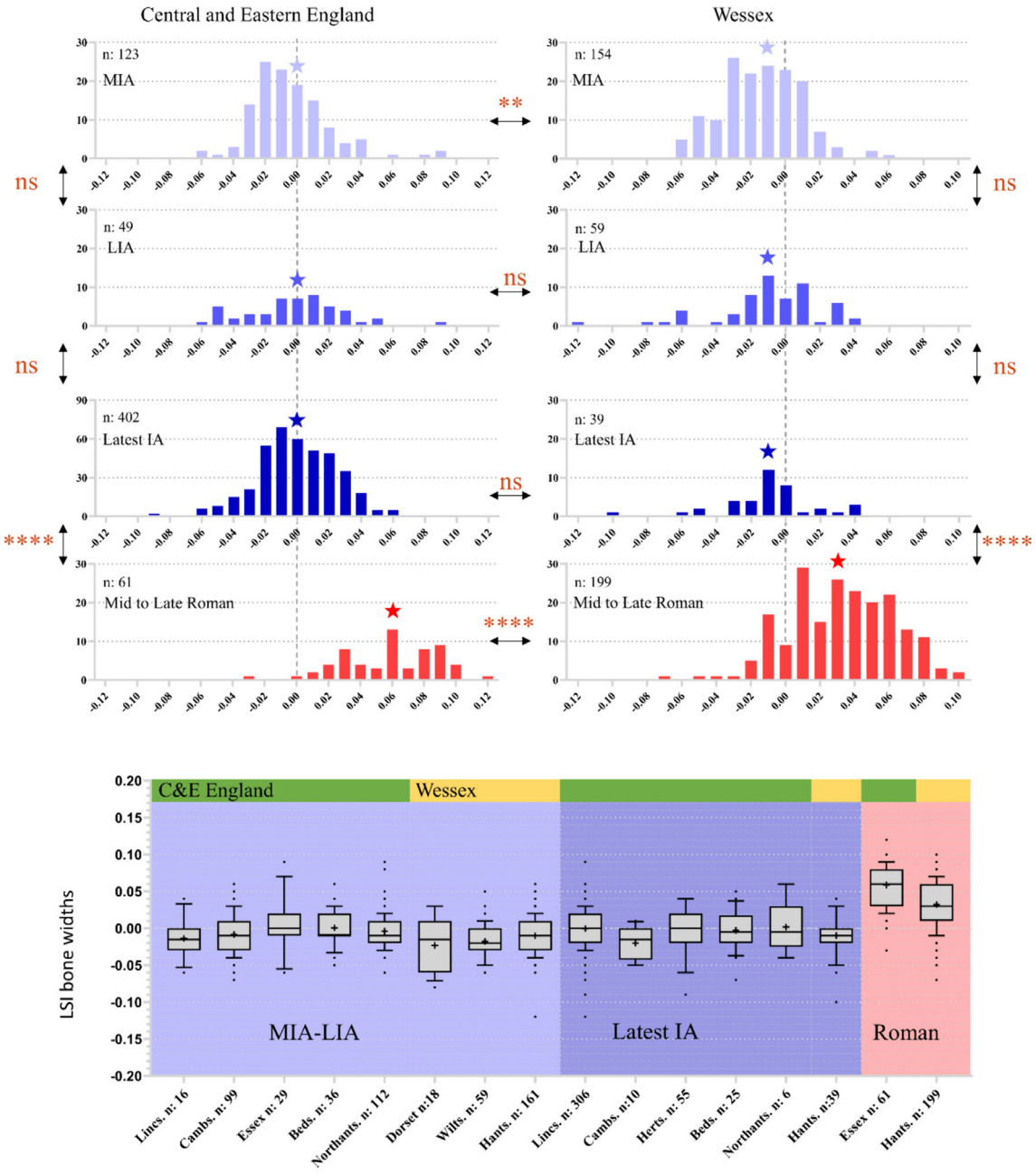

FIGURE 5 Caprine post-cranial bone widths as a proxy for livestock size. Log Scale Index histograms by area and period (top); stars indicate the means. The significance of the Welch's t-test statistics between the groupings is represented by arrows between the histograms. Log Scale Index boxplot displays data by period and county (bottom); whisker ranges represent the 5–95 percentiles, points represent values outside the range, bars represent the median, and crosses mark the mean. [Colour figure can be viewed at wileyonlinelibrary.com]

- They require little effort to raise in extensive husbandry regimes and have lower food and water requirements and faster reproductive rates than cattle. Their smaller size makes them better suited for redistribution and consumption within and between communities, without resorting to curing and storing large amounts of meat.

An illustration of this handiness is represented by the husbandry system on and around the Oxfordshire Ridgeway in the Early/Middle Iron Age. While cattle, the dominant species there, was managed in a relatively complex and mobile way, moving the reproductive animals from the upland to the lowland sites during calving and nursing season to supply them with abundant water, sheep in each site had a very local isotopic signature, similar to pigs (Schulting et al. 2019).

In this system of pastoral colonization, size improvement and the introduction of foreign stocks could have been seen as inconvenient, as it would have disrupted redistribution practices as well as the benefit-to-cost ratio per individual and potentially the adaptability to certain pastures.

Cattle remained an important resource, especially for the small-scale arable agriculture of this period (van der Veen &

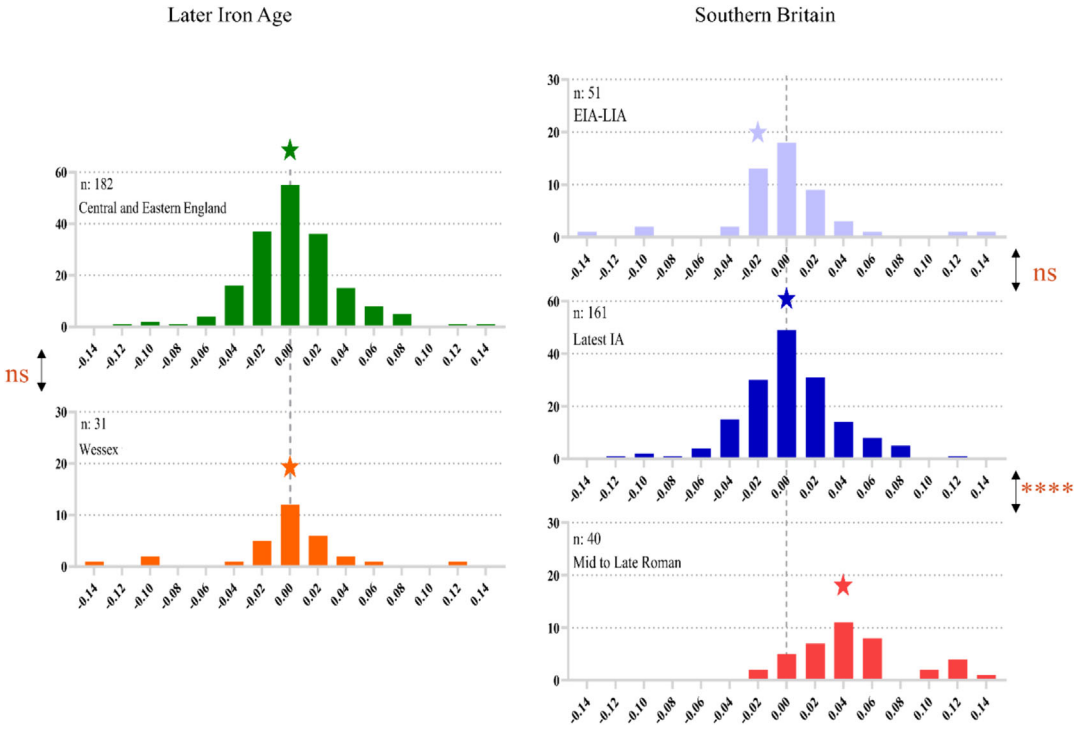

FIGURE 6 Pig post-cranial bone widths as a proxy for livestock size. Log Scale Index histograms by area and period; stars indicate the means. The significance of the Welch's *t*-test statistics between the groupings is represented by arrows between the histograms. [Colour figure can be viewed at wileyonlinelibrary.com]

O'Connor, 1998), but they gradually became relatively less abundant, potentially increasing their value and wealth inequality in general. Cattle are the most represented animal in the La Tene art of England, while sheep are rarely represented (Ellis, 2020), suggesting that on the symbolic level, cattle were seen as more important. Ellis also notes that depictions of cattle are most common on high-status objects used for display during the Late Iron Age, which might suggest some correlation between cattle handling and status. The importance of cattle, their symbolic role and their small size are core elements of the model proposed by Roymans (1999) for Northwestern Europe and confirmed for the Netherlands by van Dijk and Groot (2013). According to this model — in addition to small animals being preferable due to their resilience and lower food demands when compared to fewer, larger ones — quantity was prioritized over quality as Iron Age cattle were used as a medium for exchange and a standard unit of value. This association between cattle and wealth has also been suggested for Iron Age Britain by Haselgrove (1999).

In this context, a size increase, in addition to being unnecessary for meat supply and the current form of arable agriculture, could have been seen as disruptive of an already shifting socio-economic balance.

Another aspect of change is the increasing focus on meat production at some sites (Maltby, 2017; Wright et al., 2019), especially evident at large aggregated settlements (Pitts, 2010). An example of this is represented by the assemblage from Skeleton Green (Partridge & Green, 1981; the faunal assemblage has recently been re-analyzed by Bormetti, 2023), a Latest Iron Age site of the Braughing area in Hertfordshire. At this site:

- The frequency of pig remains is unusually high for the period (roughly half of the identified specimens).
- The sheep mortality profiles show a focus on prime meat production and possibly milk.
- The cattle mortality profile based on dental data shows a preference for slaughtering mature animals, but the absence of subadult mandibles is at odds with epiphyseal fusion data indicating the presence of joints from subadult individuals.
- Although most skeletal elements from all three taxa were recovered, suggesting slaughtering of animals on site, cattle and sheep postcranial remains are more abundant than cranial elements, while meat-bearing bones of all three taxa are particularly well represented in comparison to other Iron Age sites.
- The presence of Gallic or Roman traders has been suggested by the excavators due to the discovery of pottery with graffiti (Partridge & Green, 1981, p. 351). This could have contributed driving the demand for pork and exposed the inhabitants to new meat production ideas.

Other contemporary large settlements like Elms Farm, Heybridge (Atkinson & Preston, 2015), and Dragonby (May, 1996) show an emphasis on meat production in their animal management strategies but do not show a similar pattern of processing and disposal, with their skeletal element distribution indicating the slaughtering and processing of carcasses on-site; they also show much lower frequencies of pigs (Bormetti, 2023). Late Iron Age Silchester instead yielded abundant pig remains, increasing at each phase (respectively 22, 29,

and 31% of the total number of identified specimens). Still, mortality profiles show a wide range of ages for sheep and the prevalence of mature animals in cattle, in line with the majority of Iron Age sites, and skeletal part distribution does not show an overrepresentation of limb bones.

The emphasis on meat production and some form of redistribution are traits shared by other high-population density sites, such as the oppida of nearby Belgic Gaul (for example the settlements in the Aisne valley, Paris, 2017, 2018) or the towns of Roman Britain. However, unlike these sites, large, aggregated settlements in Britain lacked the standardized practices for urban supply, as well as the highly specialized butchery practices and culling strategies. This underscores their independence from continental European developments and shows that the larger settlements were still experimenting with meat supply. The increase in pig meat output represented a surplus created by the local Iron Age husbandry practices and did not lead to size improvement. This is demonstrated by the small size of the pigs at Skeleton Green, the site that relied on them the most. Overall, what we know of meat supply in Late Iron Age large settlements indicate that they were still practicing meat production for social forms of supply like feasting, rather than catering to a market economy as it would happen in the Roman period.

That a generalized need for large livestock was tied to the specific needs of the Roman economic system has also been demonstrated by the steady decline in size of selected species across the Northwestern provinces that followed the collapse of the Empire (see the discussion in Rizzetto & Albarella, 2022, and references therein). Furthermore, cultural contact can entail a variety of reactions, from replacement to syncretism to resistance. Studies on animal husbandry in the area of the Rhine border have shown that while different practices and larger or different livestock types were adopted by some communities outside the direct control of the Roman Empire, a variety of practices, modes of exchange, and animal types persisted even within the border (van Dijk & Groot, 2013; Groot, 2017; Groot & Deschler-Erb, 2015; Lauwerier, 2015). This mixed pattern of cultural transfer was definitely the case for Early Roman Britain. By contrast, the absence of livestock size improvement and other distinctively foreign practices before the conquest tells us that Late Iron Age Britons showed no interest in substantially changing their animal economies. This level of conservativeness despite increasing contacts with the Roman world highlights the powerful agency of Iron Age Britons in shaping their relationship with their livestock and the physical and social landscape in which they lived.

Delving deeper into the Iron Age through the lens of zooarchaeology has already proven to be a fruitful approach to understanding nuances of continuity and change. However, more work on management strategies and animal processing is needed. There is also a need for further integration with other archaeological sub-disciplines concerned with the reconstruction of farming practices and more widespread use of analytical techniques. If agriculture was Iron Age politics (Hill, 2011), utilizing the investigation into farming practices to uncover its socio-economical inner workings could still be a productive approach. Hopefully, these will help sweep away the relics of preconceptions based on outdated ideas of primitiveness, progress, and cultural superiority.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data collected by MB and used in this paper (from the sites of Dragonby, Skeleton Green, Haddenham V and Northstowe) are available from the corresponding author upon reasonable request.

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