CONTENTS

v About the Association
vi From the Chairman
viii Editorial

ARTICLES

1 - 14 DAVID RATLEDGE, The Roman Road from Birdoswald to Bewcastle, Cumbria, RR865, A LiDAR Reappraisal

15 - 28 IAN MILLER, The Road to Wigan, RR70b: Excavation at Land Gate

29 - 44 OLIVER COOK, The Wigan to Walton-le-Dale Roman Road, RR70c, at Cuerden.

45 - 52 ROBERT ENTWISTLE, Roads around Cirencester

53 - 72 DAVID BUDGE & SEAN CROSSLEY, The Cam High Road, RR73, at Bainbridge, Wensleydale, North Yorkshire.

73 - 106 STEPHEN YOUNG, Bannaventa: Geophysical Survey and the Roman Road Network

107 - 108 MIKE HAKEN, The Case for Proto Dere Street: Introductory Notes


175 - 184 JOHN POULTER, An Assessment of the Case for the Existence of an Early Roman Road running directly between Ebchester, by the River Derwent, and Beukley North of Hadrian’s Wall

185 - 206 DAVID PICKER-KILLE, De Caris Brittonum, Vehicles of Roman Britain: Current Evidence & Future Directions

207 - 218 JANET PHILLIPS & PETE WILSON, Margary RR81a and a Bustum Burial at Brooklyn House, Norton-on-Derwent, North Yorkshire

219 - 230 VINCE RUSSETT, CHRIS SHORT & GEOFF PEARSON, Characterisation of a known section of a Roman road, using combined resistivity and terrain modelling surveys

231 - 270 BEV KNOTT, The Roman Market Economy and Local Roads. Regional Land Transportation of Goods in North Somerset

271 - 278 ZOE SCHOFIELD, 629-631 Roman Road, Tower Hamlets, E3 2RN, RR3a

279 - 284 DAVE ARMSTRONG, Management and Allocation of New Margary Road Numbers

285 - 318 MIKE HAKEN, Classifying with Confidence: Rating the veracity of a segment of Roman Road

ROMAN ROADS IN 2020

319 - 376 Roman Roads in 2020

377 - 378 DAVE ARMSTRONG, Newly Allocated Margary Road Numbers

379 - 382 INDEX
The Roman Roads Research Association also wishes to acknowledge the contributions of all the other individuals who have volunteered their time and expertise in the preparation, production and distribution of this volume, without whom it would not have been possible:

<table>
<thead>
<tr>
<th>People and Officers</th>
<th>Contact Roman Roads Research Association</th>
</tr>
</thead>
<tbody>
<tr>
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ABOUT THE ASSOCIATION

What did the Romans do for us? One thing they certainly did was to lay the foundations for our modern road network, with millions of us driving every day along roads first laid out by Roman surveyors two millenia ago (such as Oxford Street in London, and large parts of the A1, A5 and many others). Unfortunately though, much of the Roman road network is not represented by modern roads, and despite a common assumption that Ivan Margary’s comprehensive gazetteer, Roman Roads in Britain (1973) made our understanding of the Roman road network reasonably complete, less than 40% of the network is actually known with any certainty. That false assumption has also frequently led to a lack of attention from the professional archaeological community (with the notable exception of roads in Wales), and for most of the past hundred years the serious study of Roman roads was left to a handful of disparate individuals and small amateur groups, with little or no co-ordination or cooperation between them.

The RRRA was formed in 2015 as a registered charity to bring those disparate individuals together, and to coordinate a nationwide programme of consistent and high quality research, promoting the study of Roman roads and Roman heritage throughout the former Roman province of Britannia. Over the last couple of decades, it has often been a race against time to discover and record what we can of the 60% of the Roman road network about which we are still uncertain, since modern agricultural methods and urban development have been steadily removing surviving features from the landscape. Fortunately, new technologies such as LiDAR and geophysical survey have helped enormously and enabled researchers to identify the remains of hundreds of miles of previously unknown Roman roads, along with associated Roman sites, and we continue to work to fill the many gaps. Research is only half the story though, we also have to ensure that the results of our work are readily available. We aim to:

1. bring together all known information on Roman roads in Britain, summarised in a freely accessible online interactive gazetteer, expected to be complete by 2026.

2. identify key sites where important questions remain, and organise fieldwork necessary to answer those questions. 100 Ha of geophysical survey have been completed, with a further 500 Ha already planned, and several future excavations are currently at the planning stage.

3. encourage the involvement of as many people as possible in our activities. We care passionately about community archaeology, and will always encourage local people to get involved in our work, without any charge (unlike some organisations, we will never do this!).

4. organise events to keep people up to date with research including online talks & seminars.

5. ensure that all our published work is Open Access, including our quarterly newsletter and Itinera (following a very short initial members only embargo).

Membership is open to everyone, and our three hundred or so members come from a wide variety of backgrounds ranging from those with just a general interest in our Roman heritage to professional archaeologists from both the public and commercial sectors, alongside seasoned Roman roads researchers. Joining the RRRA gives you the knowledge that your modest subscription (just £14 a year for a single adult) is helping to support our important work. You might even get a warm and fuzzy glow.
WHILE IT MAY NO LONGER BE FASHIONABLE FOR ACADEMIC JOURNALS TO CARRY A CHAIRMAN’S MESSAGE OR ANNUAL REVIEW, WE FELT THAT FOR OUR FIRST EVER VOLUME A BRIEF OUTLINE OF OUR ACTIVITIES IN 2020 WAS MORE THAN JUSTIFIED, ESPECIALLY IN THE CURRENT CIRCUMSTANCES OF THE COVID-19 PANDEMIC.

The Roman Roads Research Association is a young organisation and was less than five years old at the beginning of 2020. Of course, at that time we had no idea of the challenges that the COVID-19 pandemic would present. For ourselves, the impacts were felt mainly in our fieldwork and public engagement. Our plans to revisit the site of our hugely successful community excavation on Dere Street (RR8a) and a nearby Romano-British settlement in 2019 had to be shelved, and we currently cannot say with certainty if we will revisit the site this year. The pandemic also prevented us moving forward with our Devil’s Causeway project in Northumberland, examining possible Roman military sites along the route of the Roman road, and it seems unlikely that much fieldwork will take place there until 2022. Similarly, plans to launch a major community based geophysical survey also had to be postponed, as did a planned community project near Doncaster which was to process the finds from a fieldwalking survey conducted just before the first lockdown on a newly identified Roman roadside settlement.

However, the year’s events were far from being entirely negative. Despite the difficulties, or even perhaps because of them, 2020 did bring positive changes as well. It was right at the start of the first lockdown that we took the decision to launch *Itinera*, and just over a year later you are now reading our first ever volume. Our increased social media presence resulted in a doubling of our membership in the year, a trend that has continued since, with membership now standing at 311 at the time of writing (early March 2021). Whilst most of our community projects were postponed, our small but highly dedicated team conducting geophysical survey on parts of the road corridor between Doncaster and Aldborough did achieve some excellent results (when the regulations permitted). Turning out in all weathers, even in a blizzard, they surveyed the fort at Roecliffe, confirmed the route of RR720b as it approaches *Isurium Brigantium* (Aldborough, N. Yorkshire), and discovered an entirely unexpected ‘new’ road near Tadcaster. These are just a few examples of their many achievements, and the reports for all these surveys will be published on our website later this year.

2020 also saw the launch, quietly, of a pilot project in the East Riding. *Living Beyond the Town – Petuaria* is our contribution to the *Petuaria ReVisited* project (shortlisted for the 2020 Marsh Award for Community Archaeology) and will conduct a magnetometer survey of the Roman road corridor out of Brough (Roman *Petuaria*) heading towards York, as far as South Cave. The project aims to give us a clearer idea of how the Roman period landscape developed...
along this road corridor. The survey is being carried out by a group of fourteen local volunteers, who have all received training and support in using our equipment, and it will cover about 300 Ha. It is one of the largest community geophysics projects ever conducted in this country, and if successful it will be replicated elsewhere in Britain.

Without question, the most significant event for us in 2021 is the launch of this first volume of *Itinera*. From the beginning, the Editorial Committee was very conscious of the increasing problems faced by researchers when attempting to access academic papers, even by those with access to university libraries, since so many academic journals these days are held securely behind a publisher’s pay wall. We wanted to ensure that no researcher would ever struggle to obtain a paper published in *Itinera*, and so we took the decision to produce the journal entirely ourselves and without the aid of a publisher. This was far from being a straightforward process, but we have now proved that with a dedicated group of volunteers, inexpensive publishing software and the advice of people with experience in publishing, typesetting and illustration, it can be done. We can only hope that others follow our lead. Crucially, by going down this route we can not only keep the price of the printed version low but are able to make the entire journal open access online, after an initial members-only embargo of one year.

We continue to promote a strong community-based approach, and 2021 will see the launch of two further community geophysics projects examining sites along the course of Roman roads, one in Nottinghamshire and the other in North Yorkshire. Another potential project is being discussed in Cambridgeshire. We are very well aware of an apparent bias towards projects in Yorkshire; this is an unintentional but inevitable consequence of the Association being founded in Yorkshire. However, we are extremely keen to undertake fieldwork elsewhere in Britain, especially geophysical survey, and welcome any suggestions for areas of future research. In time, we hope that we can meet many more of our members face to face, whether that be by our planned zoom series of chats and lectures, or back out in the field when circumstances allow.

Despite the uncertainties of the coming months, thanks to the enthusiasm and participation of our membership, the long-term outlook for the RRRA is extremely bright. In the meantime, we hope all our readers remain safe and well in these challenging times.

Mike Haken
Chairman
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EDITORIAL
ROBERT ENTWISTLE

The first Editorial of a new annual journal is a significant moment. Launching Itinera marks a step forward for the RRRA, focusing light on an aspect of Roman archaeology that has not previously enjoyed its own published academic outlet. That such a development is possible, demonstrates the current health and breadth of an area of Roman studies that will always be associated with the expert labour of Ivan Margary in the middle years of the twentieth century.

Itinera is, from conception, a journal intended to bridge the gap between academic researchers and that large band of enthusiasts – the backbone of so many local societies and our own RRRA membership – who wish both to stay informed about, and contribute to, developments in the field. Thus Itinera’s content will include quality work by capable independent researchers alongside significant papers from established academics. To ensure maintenance of standards, all papers are peer assessed.

Itinera has been established to offer a point of reference for all those doing work which can develop and broaden understanding of Roman roads and land communications. It is an aspect often touched upon in wider archaeological investigations (see for example Janet Phillips and Pete Wilson’s paper in the current volume) but in the past such isolated findings have not always been treated with due emphasis and made readily available for a better understanding of the road network as a whole. Itinera will allow Roman road studies to make their proper contribution to understanding Roman society, technological practice, communications, and military and economic development. The journal will inform academics about the current state of knowledge while also making it available to local individuals and societies, allowing future work to be targeted for maximum efficacy. Thus this journal is published both in digital form for maximum reach (free to RRRA members), and in paper form for permanent academic reference and record.

Our content, as may be judged from this first volume, is wide-ranging. The first paper, from David Ratledge, shows how an experienced and skilled practitioner is able to exploit modern technology (in this case LiDAR) to expose and clarify routes that were previously imprecisely defined. Other papers demonstrate the findings of specific excavations, examine the artefactual and archaeological evidence for Roman transport, explore issues of planning and surveying, and speculate about the extent of local road networks. A major contribution from Bill Trow represents the culmination of many years work in testing some of Selkirk’s conclusions regarding the existence of a ‘Proto Dere Street’. A roundup of the year (interpreted broadly for this first volume) keeps track of investigative work relating to Roman roads around the country.
The starting point of Roman road studies has long been Ivan Margary’s classic study, ‘Roman Roads in Britain’. A major challenge for the present day is how to build constructively upon this work in the 21st century, allowing recent findings, seldom pulled together, to be readily referenced by the archaeological community. Two important papers in this volume, from Mike Haken and Dave Armstrong, examine ways in which the RRRA supports identification, classification and nomenclature of new discoveries, building upon Margary’s work and ensuring that it remains fit for purpose in the twenty-first century.

A new journal is not launched without the labour of a dedicated band. Our editorial committee has met regularly on-line throughout this year of pandemic to resolve the many issues that have arisen. It has established ground rules; invited, gathered, reviewed, and selected material; communicated with authors; edited text and images; created and used templates; entered materials into publishing software; stitched together the journal itself; and finally sent the completed journal for printing and circulation.

Mike Haken, the RRRA Chairman, has been unsparing of his time and expertise, actively involved at every stage. Dave Armstrong, indefatigable as the man at the centre, has pulled together the materials into the form of a journal, always positive and perceptive, no labour too challenging. Mike Bishop has given generously of his archaeological knowledge and crucial publishing experience; Chester Forster has brought his experience from other archaeological journals both to head up our band of local correspondents and to manage the indexing of this volume; and John Poulter has been a valued consultant. Paul Bidwell and Pete Wilson, among several others, have acted as readers and referees, their immense knowledge and expertise allowing us to maintain a solid academic basis to this venture.

Nevertheless, it is the authors to whom a journal is ultimately indebted for its success: we thank all our contributors for making Itinera’s first volume possible. We trust that others will be inspired to maintain and develop this journal, taking note of our mid-November deadline for 2022 copy. Similarly we welcome offers of help for our next volume in terms of reading, reviewing, managing images or digital typesetting.

We look forward to receiving ideas for relevant and authoritative papers, whether from inside or outside the UK.

Robert Entwistle
Hon Editor, Itinera
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De Carris Brittonum, Vehicles of Roman Britain: Current Evidence & Future Directions

by David Picker-Kille
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ABSTRACT

The growing amount of scholarship on travel, transport, and mobility in antiquity frequently overlooks the archaeological evidence from Roman Britain, despite its richness, diversity, and relevancy to the subject. From the preserved wood of discarded vehicle parts and the ruts worn into the gateways of the forts serving Hadrian’s Wall, to the textual accounts of travel, trade, and vehicle part inventories recorded by the Vindolanda Writing Tablets, this discussion surveys a selection of Britain’s many archaeological resources that have significant potential to enhance and revise our understanding of the capabilities and uses of transport in the Roman world.

INTRODUCTION

The past few years have seen a sharp growth in archaeological studies concerning mobility and transport in antiquity. From traffic management to vehicle technologies, such research has relied on an impressively diverse corpus of evidence – archaeological, artistic, epigraphic, and literary, to name a few – to recreate a much more nuanced understanding of how society in antiquity viewed and was shaped by the functions, forms, and practicalities of travel and mobility in their time (Dooreward 2010; Laurence & Newsome 2011; Crouwel 2012; Hudson 2013; Poehler 2017). In the case of such studies pertaining to Roman society, however, Britain appears to have been frequently left out of the picture. The author himself cannot even escape such an accusation; his Master’s dissertation studying patterns in the gauges of wheel-ruts left by Roman vehicles across western Europe, claims to exclude Britain on the basis that “…as one moved further away from Rome, it is possible that their traditions, legislation, or standardisation relating to vehicle construction and size would have become decreasingly influential…especially when maritime travel routes effectively created a gap between the overland segments of a journey that a vehicle could have otherwise traversed” (Picker-Kille 2017, 20). Having had the opportunity to visit many of the Roman forts and sites across northern England the following year, however, I am eager to correct that assumption. Rather than serving merely
to complement the research that has thus far been accomplished, this discussion highlights a selection of Roman Britain’s diverse, unique, and rich catalogue of archaeological evidence, which has the potential to become a focal point, as well as a source of renewed interpretation and evaluation, for future studies on the uses, capabilities, and technologies of transport in the Roman world.

IF THE HUB FITS

The famous La Tène “Arras Culture” vehicle burials from Yorkshire have regularly been the subject of comparisons to similar discoveries across western Europe (Stead 1979, 20-29), and have contributed much to our understanding of cultural connectivity and influence in European prehistory. In addition to these important discoveries, Britain’s anaerobic soil conditions have also allowed for the preservation of many artefacts made of organic material, including the discarded remnants from vehicles of a more utilitarian function, such as the nearly complete wheel from Holme Pierrepont from the 2nd century BCE (Musty & MacCormick 1973, 275-276; Piggott 1983, 215-216). Unlike the ceremonial chariots and wagons of the Arras burials, however, the archaeological record of the latter category has seldom been incorporated into the broader discussions on technology and transport in the Roman period. It is possible that the fragmentary nature of such finds has generated doubts about their relevance or utility, but on the contrary, a comparative assessment of the evidence from within Britain has the potential to yield exciting results.

A well-suited case-study is the nearly complete axle found at Vindolanda in 1991 at the top of the Period I ditch (Birley 2020; Birley 1994, 15-25), which has fastened to each end a series of four or five small iron plates (Figures 1a-b). While likely corresponding to the placement of the vehicle’s hubs, the precise mechanical purpose of the metal fittings has remained obscure, especially since they do not encircle the axle, but instead run along its base. In addition, the fragments of a Roman wheel, discovered at the bottom of a barrel-lined pit during archaeological excavations in Carlisle between 1977-1982, seem to display evidence of the exact same feature. Among the pieces of felloe and spokes, its well-preserved wooden hub (Figure 2) was stated to have “much iron corrosion inside... suggesting the remains of iron ‘boxes’ which would have reduced the wear caused by the rotating wheel.” (McCarthy, Padley, & Henig 1982, 85) ¹. A careful comparison between the remarkably similar technologies on both of these finds, however, has yet to be the subject of what would surely be a rewarding investigation. Given, for instance, that evidence from certain Vindolanda writing tablets (185, 309) suggests that vehicles, or at least their parts, may have been more frequently imported than made on-site, what might the technological similarity of the axle and the hub suggest about vehicle production in Roman Britain: is such iron plating associated with only particular types of vehicles? Were there a limited number of wainwrights in the region providing their services to multiple Roman forts and towns, or was there widespread standardisation in manufacturing techniques throughout the region? Future comparative analyses on similar finds have the potential to address questions concerning the traits and variability of vehicle manufacture and technology along and beyond Hadrian’s Wall.
Fig. 1a: Vehicle axle from Vindolanda, 85-92 CE. Currently on display at site’s Wooden Underworld gallery, along with other vehicle parts. The information panel (2018), does state that it “was made for a set of wheels spaced five feet apart” but it is unclear whether they are referring to the modern foot (0.3048 m) or the Roman pes (0.296m). Photo by author, 2018.

Fig. 1b: iron plates (underlined in red) on base of left side of axle. Photo by author, 2018.
Equally promising, and arguably of greater importance, are the comparative studies that may be made with archaeological discoveries from the continent. From Italy and France, and as far east as Romania and Bulgaria – essentially the entire extent of Roman Europe – discoveries of the remains of several Roman-era (and earlier) vehicles, as well as the identification of countless friezes, frescoes, and mosaics depicting similar forms of travel and transport (Piggott 1983; Crouwel 2010; Dooreward 2010; Ignatov 2018), have led to a greater understanding of the forms and uses of vehicles in the ancient world. Unfortunately, the rich evidence from the UK is frequently left out of these discussions, especially those organic finds that would complement the “skeletal” remains of those vehicles whose metal structures are all that have survived. Along Italy’s Bay of Naples, where several Roman settlements were tragically buried by the 79 CE eruption of Mt. Vesuvius, three different sites have revealed nearly-complete and undisturbed metal remains of vehicles, shown in Figures 3 through 5. These finds are exceptional owing to 1) their extraordinary state of preservation, 2) their provenance clearly emphasising their utilitarian function, in contrast to the ceremonial nature of those of the Arras culture and other burial sites across the mainland, and 3) the fact that each vehicle appears to be distinct in form and design from the other two (Miniero 1987; De Caro 1994, 206-208; Sodo 2003, 206-209). Having been the focus of a 1983 study by Paola Miniero, the better preserved of two four-wheeled wagons from the Villa Arianna is arguably not only the best reconstructed, but also the most technologically complex compared to the single-axle vehicles from the House of the Menander and the Villa Regina. Although it allowed for only partial pivoting of its front axle, a certain amount of sway was allowed between the draught pole and the body of the carriage, which would have allowed its draught animal(s) to navigate around street
Fig. 3: Reconstructed cart from the House of the Menander at Pompeii (Sodo 2003, 208).

Fig. 4 (left): Sketch reconstruction of vehicle from the Villa Regina, Boscoreale (De Caro 1994, 207).
Fig. 5a: (Top) Four-Wheeled Wagon found at the Villa Arianna in Stabiae, 79 CE. Notice the iron rods running through the tires, which would have been affixed to the wooden axle where it passed through the hub. Photo by author, 2020.

Fig. 5b: (Above) Schematic showing the approximately 20° sway allowed by the draught pole and 12° by the front axle on the Villa Arianna wagon (Poehler 2017, 108).
obstructions while the vehicle maintained a straight trajectory (Figure 5b: Poehler 2017, 108). It is therefore well-suited to be the subject of comparison with the evidence from Britain. Like the one from Vindolanda, the axles on the Villa Arianna wagon appear to have been equipped with devices to prevent the wood from being worn by rotation against the hubs, but instead of several small iron plates, the ends of each axle are fitted with a single rod of iron (Miniero 1987, 192). Such a seemingly minor difference between otherwise similar components may highlight the regional socio-economic differences in the use of these vehicles. The “plating” method indeed would have been the more economical choice, requiring less iron to achieve – in theory – the same effect. The Villa Arianna wagon was found in one of the most exquisite villas known in the region, which hints of someone who could have afforded to pay the extra denarius for a model offering better mileage (it is worth remembering that the Vindolanda axle and Carlisle hub were in fact discarded!). It is additionally possible that differences in such features may be suggestive of different types of vehicle with which they were associated. The iron-plating method, for instance, in contrast to the more wholly protected axles of the four-wheeled Villa Arianna wagon, may be indicative of a more cheaply built two-wheeled cart sufficient for military functions. The distinction of vehicle typologies is a potential means of addressing broader socio-economic discussions: what types of vehicles were either available or most convenient for soldiers stationed in Vindolanda and along Hadrian’s Wall, and how do those choices and limitations affect the capacity, efficiency, and cost of transport throughout the region? Such questions will continue to be explored after introducing additional evidence from textual sources.

WHEEL-RUTS

Although the twentieth century saw some growth in the study of the gauges of ancient vehicles in continental Europe, only more recently has research begun to recognise the wider analytical utility of wheel-ruts. Eric Poehler’s 2017 book, The Traffic Systems of Pompeii, for instance, considers the wear, abrasion, and locations of ruts, kerb stones, and other road features to recreate the regulation, management, and evolution of the direction of traffic in the Roman city. In other words, ruts provide more than a few rudimentary measurements about the dimensions of ancient vehicles; more importantly, they can highlight and define the use of those vehicles within the environment where they left their mark. In Britain, however, despite the strong interest in the study, tracing, and mapping of the country’s Roman road networks (to which the RRRA’s existence is testament), the visible surfaces of these routes are today unfortunately scarce, and the few previous studies that have identified ruts (Table 1) rarely provide enough, if any, contextual information to assess the accuracy of either their measurement or Roman-era attribution. During the Walbrook Stream excavations, for instance, despite recording the ruts’ depth and location, the gauge appears to have been overlooked (Ranieri & Telfer 2017, 53-84).

Along Hadrian’s Wall, the forts of Housesteads and Chesters each reveal a pair of deep grooves in what coincidentally happen to be the southern portal of each site’s eastern gate, and likely correspond to the passage of vehicles (Figures 6 & 7). This conclusion is further strengthened by the fact that the centre-to-centre distance between each pair is no more than a centimetre shy – 1.47 metres at Chesters, and 1.475 at Housesteads – of five Roman
feet (1.48 m), which also appears to have been the standard axle-width for most vehicles throughout Roman Gaul (Picker-Kille 2017, 28-29). In fact, although the gauge of the axle from Vindolanda (the distance between the centre points of each set of iron plates where the hubs would have been) has unfortunately not been reported, its full length is known to be 1.734 metres (Birley 2020), which, even though slightly warped and missing a fragment on one of its ends, may very well have supported a gauge of five Roman feet.

Admittedly, ruts found at other locations at each site suggested different gauges: the northern portal of Chesters’ East Gate revealed significantly fainter ruts that, although difficult to measure, suggest a gauge no greater than 1.3 metres, and a pair running through the eastern portal of Housesteads’ South Gate (Figure 8) was measured at 1.04 metres (1.11 m according to Rushworth 2009, p. 209). At Chesters, however, the sharp contrast in visibility of the two gauges may very well speak to the frequency or preference of one over the other, and at Housesteads, several factors suggest that the stones on which the ruts appear are either not in their original location, or not even of Roman origin: their loose arrangement, their positioning at the top of steps over which vehicles were not likely to proceed, the sharp contrast in the amount of wear defining each groove, and the reoccupation of the South Gate in the 17-18th centuries, all indicate that their current placement was the result of activity after the closure of the eastern portal in the early 3rd century (Rushworth 2009, 200, 209-210). As mentioned previously, however, a careful study of wheel-ruts and their context may reveal more than just the gauge of the vehicles that generated them. One question, for instance, that is frequently debated within studies of Roman roads and traffic is whether or not guides or tracks were sometimes intentionally incorporated into roadways (Chevallier 1976, 89; Picker-Kille 2017, 33-34; Poehler 2017, 12), although those in favour of such a possibility – including the author – are left with the larger burden of proof since any intentional pairs of ruts would subsequently be exposed to and “masked” by the same wear and erosion as those generated entirely by the iterative passage of vehicles. Fortunately, a striking exception to this tendency appears to exist at Chesters’ East Gate, where the ruts in the southern portal, rather than being cut or worn in the entryway’s lip, appear to be instead defined by gaps between its constituent stones, a feature that could only have been the result of an intentional placement or intervention.

<table>
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<td>≈ 4 ft. 6 in. (1.3716 m)</td>
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<tr>
<td>Delamere Forest, Cheshire</td>
<td>4 ft. 8 in. (1.397 m)</td>
<td>Watkin 1886 (p. 37)</td>
</tr>
<tr>
<td>Gelligaer Roman Fort, Wales</td>
<td>≈ 5 ft. (1.524 m)</td>
<td>Ward 1903 (p. 40)</td>
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<td>Stanwix, Cumbria</td>
<td>1.2-2.0 m</td>
<td>Smith 1978 (p. 23)</td>
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<tr>
<td></td>
<td>1.75-2.3 m</td>
<td>Smith 1978 (p. 34)</td>
</tr>
<tr>
<td>Walbrook Stream, London</td>
<td>N/A</td>
<td>Ranieri &amp; Telfer 2017</td>
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Table 1: Known recordings of rut-measurements from the UK.
Fig. 6 (top): Southern portal of the East Gate at Chesters, looking west into the fort.

Fig 7 (middle): Surface of entryway in the southern portal of Housesteads’ East Gate, facing west into the fort. Rushworth (2009, p. 211), alternatively estimated the gauge to be about 1.39 m. Rather than an error in either of the measurements, this is more likely the result of different measurement methodologies to account for the lack of a defined “centre” of the northernmost rut.

Fig. 8 (bottom): Rutted stones in Housesteads’ South Gate (looking north into the fort), likely moved from a different position from the Roman period. All photos by author, 2018.
Housesteads, too, might have some evidence of traffic accommodation. Passing through the East Gate, the *Via Praetoria* continued westbound until intersecting with the *Via Principalis*, on which were documented a pair of parallel trenches approaching the North Gate (Figure 9). Rushworth suggests that these channels, 1.5 metres apart centre-to-centre (nearly exactly five Roman feet), were initially considered ruts, but were determined ultimately to be drainage, particularly because each channel continues along either side of the North Gate’s central pillar or *spina* (2009, 46-47). It is entirely possible, if not likely, however, that these two hypotheses need not be mutually exclusive: although likely designed as drainage, this particular spacing may have been purposefully chosen so as to also serve as a guide for vehicular traffic. In fact, spacing the drainage channels differently than the predominant axle-gauge may have caused further problems of vehicles tilting or overturning if or when the wheel(s) on one side accidently slipped into the channel (apparently a frequent enough occurrence that a common Roman phrase to bemoan an unexpected or sudden misfortune was *plaustrum perculi*, “I’ve overturned my oxcart!”, attested to in Plautus’ play Epidicus, 6.2.22). That the same *Via Principalis* also passes the entrances for both the fort’s headquarters and granaries (Crow 2012, map in back cover), may very well have been a reason to guide traffic in the right direction. These two buildings would have had the strongest relationships with transport services – the former receiving bulk shipments of grain, and the latter potentially needing to communicate quickly and efficiently with other garrisons along the Wall. Furthermore, the dual functionality of such road features is not entirely without precedent; a Gallo-Roman road running along a cliff above Nolay, France exhibits deep, contiguous wheel ruts worn directly into the bedrock (Figure 10b), at least one of which was likely the vestige of a trench cut during the quarrying and construction of

Fig. 9: Plan of *Via Principalis* with ruts and/or drainage at Housesteads (Rushworth 2009, 47).
the road surface (Picker-Kille 2016, 19-24). If investigations of the other sites along Hadrian’s Wall reveal similar features indicative of intentional traffic and vehicle management, such discoveries would imply an active Roman awareness of issues of traffic regulation and safety beyond what is currently known to have existed within large urban centres in Italy (Crawford and Nicolet 1996; Poehler 2017).

Evidence of rutting may also allow us to raise new questions about traffic along Hadrian’s Wall. Being one of the projecting forts whose layout extends beyond the limes, the East Gate at Chesters, although the fort’s largest, opens north of the Wall (Hodgson 2016, 19-22), and may have something to tell us about the socio-economic relationships between the garrisons and the native population, a notion that will be further explored later. At Housesteads on the other hand, the East Gate in which the ruts are found received the Military Way, which is traditionally believed not to have sustained vehicular traffic on account of its often-steep gradient, often surpassing 30% (Margary 1973, 448-449 [RR86b], Bruce & Breeze 2006, p. 89); more recent assessments, however, have shown that such sharp inclines only occur in short bursts lasting no more than a few metres, with an average slope closer to about 17-21% (Armstrong, forthcoming 2021; Bidwell 1999, pp. 137-139). Returning briefly to the Gallo-Roman road in Burgundy, it is worth noting that the approach to the cliff summit (Figure 10a) along which the deep ruts are found (Figure 10b), although presenting an average slope of about 15.8%, similarly exhibits small segments exceeding 30%. The fact that drivers in Gaul were able to overcome this topographical challenge, as proven by the deep ruts at the top of the cliff, therefore suggests the same of those traveling along the Military Way in Britain. Such an implication would make necessary a reevaluation of the

Figure 10a (left): Gallo-Roman road (red line) ascending the cliff above Nolay, France, at about a 15% gradient (Map Source: IGN Géoportail). Figure 10b (above) shows the deep ruts that appear upon reaching the cliff’s summit (photo by author, 2020).
nature and strength of the socio-economic connections between the many forts and vici along Hadrian’s Wall.

**TEXTUAL SOURCES**

Roman Britain’s textual and literary record is arguably one of the richest sources for new knowledge about vehicles in antiquity. Many studies of Roman transport, however, appear to lean predominantly towards either archaeological or literary evidence for their source material, with the scholars of one sometimes expressing scepticism towards the utility of further incorporation of the other (Dooreward 2010, 260; Hudson 2013). On the contrary, a selection of texts from the *Vindolanda* Writing Tablets, Britain’s most well-known corpus of records illuminating life on the Roman frontier, shows that a readiness to approach a more eclectic catalogue of evidence would do much to enhance our understanding of not only the forms and functions of transport itself, but more importantly of the implications and practicalities of its use in the Roman world.

**Terminology**

Shown in Table 2, fewer than 20 unique records in the *Vindolanda* corpus contain explicit references to vehicles or their constituent parts, or their use, of which only a handful are sufficiently preserved to be conducive to analysis. But even with those few instances several observations can be made. The frequent occurrence, for instance, of *carrulum*, the diminutive form of *carrum* (*carrus*) \(^1\), is exceptional, as it is unattested in the Latin lexicon except for a single instance from a second century legal ruling preserved in Justinian’s Digests (Koptev ed., 17.2.52.15). Similarly, Bowman and Thomas provide an alternative reading of *raeda* on lines 3-4 of Tablet 617 as *raedula*, an otherwise entirely unattested

<table>
<thead>
<tr>
<th>Type of Reference</th>
<th>Word (alternate spellings or meaning)</th>
<th>Tablet No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Types</td>
<td><em>carrum</em> (<em>carrus, karrum</em>)</td>
<td>155, 160, 343, 394, 488, 583, 584, 585, 641, 642, 649, 721</td>
</tr>
<tr>
<td></td>
<td><em>carrulum</em></td>
<td>315, 316, 643</td>
</tr>
<tr>
<td></td>
<td><em>raeda</em></td>
<td>185, 617</td>
</tr>
<tr>
<td>Vehicle Parts</td>
<td><em>ax(s)is carrarius</em> (axle)</td>
<td>185, 309</td>
</tr>
<tr>
<td></td>
<td><em>capsus</em> (vehicle body)</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td><em>modiolum</em> (<em>hub</em>)</td>
<td>309</td>
</tr>
<tr>
<td></td>
<td><em>radium</em> (<em>spoke</em>)</td>
<td>309</td>
</tr>
<tr>
<td></td>
<td><em>vitus</em> (felloe)</td>
<td>600</td>
</tr>
</tbody>
</table>

Table 2: References to vehicles in the tablets. Words with an asterisk (*) are generally accepted to be masculine but occur as neuter throughout most of the Vindolanda corpus.
diminutive of *raeda* (617, Note 3-4). The “diminuisation” of these terms, especially given their unparalleled frequency here, raises questions concerning the characteristics of the vehicles to which they refer. Are these to be understood as smaller carts or wagons, or is the terminological distinction more abstract in nature, with reference to their condition or use? Nothing about the currently known texts in which these terms are found appears to favour one possibility over the other, but the fact that *carrum* and *carrulum* never co-occur within the same tablet suggests that a differentiation may very well exist. It may also simply reflect authorial preference of one form over the other. Hopefully, additional occurrences of these words on yet-to-be discovered tablets will shed more light.

Even for the more regular forms *carrum* and *raeda*, the *Vindolanda* record proves to be a useful source to revise our understanding of the forms and functions of these vehicles. Tablets 185 and 309 contain inventories of various supplies, including cart axles. The former specifies both their quantity and purpose: *duos ad raedam* (“two for a wagon”). That *raeda* might be interpreted as a four-wheeled wagon or carriage (potentially like the one from the Villa Arianna) is admittedly substantiated elsewhere in Latin literature (see esp. Cicero: *Mil.* 28-29, *Att.* 5.17.1), but it is satisfying to see consistency between the famous authors in Rome and the everyday accounting of a frontier garrison in Britain. By contrast, outside of the *Vindolanda* tablets, the term *carrus* and its derivatives are much less frequent in the Latin corpus, and thus more difficult to interpret. Although in later antiquity or outside Western Europe, the interpretation of *carrus* may have been more flexible – the 301 CE attempted price regulations of the Edict of Diocletian, for instance, make explicit reference to both a four and two-wheeled *carrum* (Erim & Reynolds 1973, 101-102) – some patterns may be observed in its usage prior to the third century. Firstly, a majority of such occurrences are found in Caesar’s *Civil Wars* and *Gallic Wars*, of which all but one instance (*Civ.* I.54.3) appear to refer to the vehicles of the Gallic or Germanic armies, an association that is largely maintained outside of Caesar. Secondly, an even greater majority of these sources – including Caesar – place the use of the *carrus* in some official capacity, namely either a military or governmental context (Mitchell 1976). This association is in fact further emphasised by Diocletian’s Edict, where the costs for “De Carris” are listed separately (section 15.38), and are consistently lower, than those of other standard vehicles – *raeda*, *saragara*, *carruca*, and *carruca dormitoria* – listed in “De Vehiculis” (section 15.31; Erim & Reynolds 1973, 101-102). Scholars have historically provided differing translations of the word: some as a two-wheeled cart, others a four-wheeled wagon, and even the occasional mis-identification as a chariot, where it was likely confused with the similarly spelled *currus*.

Using the *Vindolanda* corpus, however, we may be able to begin to propose a more accurate interpretation. Certainly, the military associations are reinforced, and as the fort was garrisoned by the Tungri and Batavi (Birley 2011, 41-48) that may also further attest to the non-Roman origin of *carrus*. Returning to Tablets 185 and 309, it is also noteworthy that the term used for “axles” in both instances, rather than simply *axes* (plural), is instead a compound form *axes carrarios*. If, then, this compound form is intended to refer to a type of axle intended for a *carrus*, then the fact that 1) the writer of Tablet 185 felt it necessary to state that two such axles were needed for a different type of vehicle as mentioned above, and 2) in Tablet 309, of the 38 axles being delivered, only one (rather than two) is specified to have been turned on a lathe – *axes carrarios n(umero) xxxix inibi axis tornatus n(umero) i* – hints at the possibility that the *carra* used at Vindolanda may have had only a single axle (2
Figures 11a-c: Two-wheeled carts on the Column of Trajan: Scenes 61 (11a, top), 107 (10b, middle), and 129 (11c, bottom). From Arachne Monument Viewer.
wheels). In addition, these bulk shipments strongly suggest that the garrisons outsourced the manufacture of vehicle parts, and thus also that their dimensions, including the gauge of the axles, would have been standardized. As a final note, it is worth observing that the Column of Trajan in Rome, which pictorially recounts the Roman conquests of Dacia between 101-106 CE, depicts several instances of two-wheeled carts being used by the Roman army (Figures 11a-c), and given their general contemporaneity, as well as the decidedly military context of both, the author is tentatively optimistic that the carrus frequently mentioned by the inhabitants of Vindolanda may in fact be the same type of vehicle seen carrying the supplies of Trajan’s legions.

Transport Capacity

A stronger appreciation of the various forms and functions of vehicles of the Roman world would above all serve to contribute much to our understanding of the social, economic, and political climates that underpinned the need for these vehicles. In that respect, it is useful to present as a final case study an oddly specific account of a grain shipment from Tablet 649, written between 92-97 CE, that highlights how transport is fundamentally tied to much broader subjects such as trade, law, urbanism, and movement, in the ancient world:

The first portions of the paragraph are sufficiently well preserved to know that 381 modii (a Roman unit of dry measure equal to about 8.62 L (Duncan-Jones, 2013)) of some form of cereal are being delivered by the native British population – potentially by a particular Racarromaucus – with 53 modii being loaded into each individual cart. Thereafter, the interpretation is less certain, other than that another shipment of 63 modii is somehow involved. Bowman & Thomas, noting that 53 modii × 6 containers plus one additional 63-modii container equals exactly 381 modii, suggest that there might have been 7 carts used for the delivery, of which one was slightly overburdened by ten units (Tablet 649, Notes i.2-i.8). Anthony Birley alternatively suggests that the cereal might have been reloaded from vehicles holding 53 modii to those capable of holding 63 (2011, 90-91). Although the former interpretation does seem more likely, what is clear in either scenario is that the size and measurements of the shipment were a concern to the letter writer, and his attention to detail here is enthusiastically welcomed. With this information, it is possible to approximate the volumetric capacity of goods that the cart would have been able to hold, as well as estimate a range of weight with which such carts may have been typically burdened. As for

2) recepitis de carris Brittonum
3) …iii arac…romaeco bracis
4) m t…cis (modios) trecentos octo-
5) -ginta unum onerarunt au-
6) -tem in singla carra (modios) liii
7) l…er quem ueh…s[
8) t[...] re abet (modios) lxiii

“You will receive out of the Britons’ carts …from Rac..romaeco three hundred and eighty-one modii of … grain. Furthermore, they have loaded 53 modii into each individual cart. The container which they are conveying… holds 63 modii.”

(Notes: red text indicates uncertain readings or translations, an ellipsis represents illegible portions, brackets indicate lacunae in the text, and parentheses are expansions of a Latin abbreviation)
the former metric, 53-63 modii takes up a space of about 0.457-0.543 cubic metres, but given that the grain loaded onto each cart would have likely been dispersed across several containers such as barrels, which would have had empty space in between them, and would have also been stacked above the height of the walls of the cart (in fact the barrel-loaded carts on the Column of Trajan (Figures 11a-c) have no sided whatsoever), the capacity of these vehicles would have certainly been well over half a cubic metre. With that baseline established, however, it is worth noting the similarity to the two-wheeled cart found in the House of the Menander at Pompeii (Figure 3). The author is hesitant to assign it the specific designation of carrus, but with the dimensions of its body measured at 1.35 m × 0.987 m × 0.40 m, or about 0.533 cubic metres (Sodo 2003, 207), it becomes at the very least plausible to suggest that the components of some vehicles may have been manufactured within a range of standardised measurements. Again, the fact that Tablets 185, 309, and 600 recount the import of individual components rather than of whole vehicles, might further strengthen this claim.

More intriguing, however, would be the calculation of the weight of each shipment, in light of known Roman legislation concerning overburdened vehicles. The term used for the cereal being transported in Tablet 649 is bracis, a term that is found semi-frequently throughout the Vindolanda corpus, but whose exact meaning remains elusive. Pearce (2002, 934) suggests that it might refer to spelt, whereas Bowman & Thomas tentatively identify it as some form of malt (Tablet 646, Note “Back.2”). Unfortunately, without a certain interpretation of bracis, one cannot reconstruct an exact weight; we can however, select a “placeholder” to produce a very general estimate for the capacity of the vehicles. Fortunately, the author happened to possess a package of uncooked spelt from France, which, especially considering its European origin, is perhaps well-suited for this experiment. One litre of the grain was measured at 774 grams, thus making the weight of one modius of the spelt about 6.671 kg (0.774 kg × 8.6185 L/modius). 53 of these, then, would be about 353.548 kg, or 1095.254 Roman pounds, or librae (1 libra = approx. 322.8 g, Duncan-Jones 2013). Far from being a light shipment, this weight appears to vastly exceed the limits placed on the carrus according to a Roman act of legislation from 385 CE cited by the legal codex of Theodosius II, concerning the Roman courier system known as the cursus publicus: “A burden of one thousand librae must be assigned to a raedae, and not more than six hundred [librae] for a carro…” (raedae mille librarum onus imponi debet, carro sescentarum nec amplius… Koptev ed., 8.5.47). That the carrus is allowed a forty percent lower weight limit than the raeda again suggests that the latter was larger (i.e., four vs. two wheels). Even if bracis was taken to mean something other than spelt, however, it would still need to weigh less than sixty percent than that of our current estimate for it to have adhered to this legislation; whatever the Britons were transporting, therefore, it likely greatly exceeded 600 librae per carrus. Again, given the significant temporal and geographical separation characterising the Theodosian Code, there is also the strong possibility that the exact meaning – and thus implied capacity – of carrus changed over two and a half centuries, but the stark contrast between the vehicle burdens implied in each text might nonetheless suggest the reason why such a law was felt to be required.
Directions of Future Research

If the capacity, size, or efficiency of the carra in Tablet 649 is representative of other vehicles used along Hadrian’s Wall, or across the Roman world for that matter, then this information might be used to improve our understanding of how the limitations and efficiencies of land transport fundamentally shaped issues of production, supply, demand, sale, and storage of resources in the ancient economy. Evidence such as we find in the Vindolanda corpus invites a contribution from several sub-disciplines within the classics, ancient history, and archaeology to interpret more effectively the socio-economic challenges of daily life in the ancient world. How far, for instance, did the misuse or overburdening of vehicles, especially those used for official and military purposes, motivate the passing of legislation such as that seen in the Theodosian Code? We might speculate as to whether legislation of this sort was simply ignored, or impacted upon merchants, couriers, and farmers trying to maximise productivity and reduce costs in the import, export, or sale of their goods and services. At a regional or inter-regional level within the Empire, how might the capacities of land transport have influenced the processes of economic and cultural exchange?

Evidence of this sort also sheds light on other socio-cultural issues tied to exchange and movement. The delivery of the goods by the Britons in Tablet 649 is one of only two explicit references to the native population from the tablets. The other, Tablet 164, is a decidedly condescending assessment of the sub-par combat skills of the Britunculi, or “little Brits”. These contrasting references emphasise the complexity of social, economic, and political relationships between the locals and Roman garrisons in northern England. At Chesters, the large and rutted main East Gate opened north of Hadrian’s Wall, and even at Housesteads, a well-rutted path beyond the North Gate may possibly date to the Roman period (Rushworth 2009, 199-200). Although vehicle use is principally an indicator of economic activity – as is documented by Tablet 649 – trade and exchange often indicate other forms of interaction. Some have interpreted Tablet 164 not as a dismissive assessment of enemy forces, but rather as an expression of frustration in attempting to train local recruits (Tablet 164, Introduction; Birley 2011, 94-97). Further investigations might expand our understanding of relationships between Roman soldiers and the indigenous population in areas under military control.

CONCLUSION

The evidence and questions considered above, regarding movement and transport within Roman Britain, are by no means exhaustive. One topic currently lacking sufficient data is the subject of the selection of materials for the manufacture of vehicles. The wheel from Carlisle was made predominantly of field maple (acer campestre) – although a fragment of the felloe appears to have been made, or repaired, with ash (fraxinus excelsior) – the former species not found north of southern Cumbria (McCarthy, Padley, & Henig 1982, 85-86). All that is known
of the *Vindolanda* axle, unfortunately, is that it used some species of oak (Birley 2009, 51). Recent dendrochronological research has, however, shown that some mid-first century buildings in the city of Rome were constructed using oak felled in the Jura Mountains of Gaul (Bernabei et al. 2019), therefore further investigation into the timber sources could provide insights into the criteria for selection of materials of vehicles in antiquity. Were wainwrights in Roman Britain using cheap local materials, or higher quality timber from other provinces, given that their vehicles surely played a role in their import? The existence of small fragments of yet-to-be-identified wood preserved on some of the vehicles around Pompeii, such as the one from the Villa Arianna (Miniero 1987), similarly offers the potential for regional, cultural, and social comparisons across the Roman world. We also have the possibility of comparison between periods. The previously mentioned 2\textsuperscript{nd} century BCE spoked wheel from Holme Pierrepont stands in sharp technological contrast to the nearly intact solid disc wheel found on the late Bronze Age settlement of Must Farm in 2016 (*Dig Diary* 19..., 2016). The use of spoked wheels in Britain therefore clearly predates Roman contact, and such finds encourage studies on the introduction, development, and transformation of such technologies in Britain and beyond.

The diversity of the ever-expanding record of Britain’s past, from discarded wooden vehicle parts to the rich textual corpus of the *Vindolanda* and Bloomberg writing tablets, is sure to continue to enrich our understanding of the role of transport in the daily life, society, and economy of Roman Britain. This corpus is moreover well-suited to serve as a comprehensive resource for broader or comparative investigations on the use of vehicles throughout antiquity. Looking forward, the inception of *Itinera* provides a new outlet for those seeking to apply this knowledge to future studies of transport, exchange, and movement in the Roman world.

**ACKNOWLEDGEMENTS**

I would like to thank Dr. Andrew Birley of the *Vindolanda* Trust for providing me with the measurements and provenance for the axle, especially when the pandemic has made library access particularly difficult. In addition, I wish to thank Dr. Francesco Muscolino and Mr. Luigi Giordano for allowing me access to the vehicle in the Reggia di Quisisana in Castellamare di Stabia, prior to its public opening as the Museo Archeologico di Stabia Libero D’Orsi. Last but not least, I would like to express my thanks to Mr. Dave Armstrong of RRRA for not only pointing me in the right direction for research on the Military Way, but also for his generosity in sharing excerpts from his forthcoming publication on the subject.

**END NOTES**

1. Note on referencing: The main source for the texts, translations, and commentary for the tablets used in this discussion are volumes I-IV of the *Tabulae Vindolandenses* by A.K. Bowman, J.D. Thomas, and R.S.O. Tomlin, made publicly accessible through the Roman Inscriptions of Britain (RIB) website: [https://romaninscriptionsofbritain.org](https://romaninscriptionsofbritain.org). References to the original Latin text or their translations are done by their assigned tablet number, and citations of any commentary are
additionally noted (thus, the commentary for line five of Tablet 649 (https://romaninscriptionsofbritain.org/inscriptions/TabVindol649) would be noted as “649, Note 5”. Any translations or commentary from a different source are appropriately noted.

2. Admittedly, recent research indicates that some of the carts and wagons from funerary contexts in Greece and Bulgaria may show signs of use prior to their internment; (Crouwel 2010 & Ignatov 2018, p. 258)

3. A “diminutive” is a noun that by the addition of some suffix denotes an inferior, in size or quality, form of the word from which it is derived. In Latin this suffix frequently has the root -ul- (Caligula, Britunculu). English examples include piglet, duckling, and kitchenette.

4. Unless otherwise stated, all classical texts were retrieved from the Packard Humanities Institute Classical Latin Texts website. https://latin.packhum.org

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