Proto-industrialization and the Economy of the Roman Empire

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Introduction

Conventional historical interpretations of the economy of the Roman Empire stress its agricultural character. Based on the work of Moses Finley and A.H.M Jones, it has become usual for Ancient Historians to view farming and local consumption as the basis of production and exchange. Taxation and conquest – not manufacturing or trade – are seen as the driving factors in urban and state finances, exemplified in the 'Consumer City' model forming part of this view. That is, for Finley and Jones 'the wealth of the Roman world' was derived from different sources to that of more recent polities, comparison with which has been characterised by them as unacceptably 'modernising' (e.g. Finley 1985, Greene 1986, Engels 1990, Harris 1993, Parkins 1997, Bang 1997, Parkins/Smith 1998, Garnsey 1998).

This interpretation envisages production for longer-distance trade as a very minor aspect of the economy – mostly relating to luxury goods alone – and little technological development. It supposes that manufacturing in particular was a small-scale, low-status, activity, which did not show great profits and saw any substantial returns immediately invested in land as the only means of true wealth. In this characterization of the Roman economy, there was not much trace of profit-driven growth or specialization, but rather an 'embedded' economy in which social factors shaped economic relations.

Over the last twenty years this 'minimalist' or 'primitivist' model has been developed and modified by both historians and archaeologists. In particular, Keith Hopkins introduced the concept of sustained economic growth into this general hypothesis and this has been demonstrated in archaeological work (e.g.Hopkins 1980, Hopkins 1995/6). Archaeologists, such as Kevin Greene, David Peacock and Andrew Parker, have demonstrated that material evidence suggests that long-distance sea-borne trade and workshop-level manufacturing were more important to the economy than most historians had imagined (e.g. Greene 1986, Peacock1982, Parker 1992).

Thus, most archaeologists reject the 'minimalist' or 'primitivist' perspective of historians. Yet, they have stressed that their own models focus on agricultural production and – as Greene has argued in a series of papers – reject the possibility of major technological changes or innovations in production techniques through the Roman imperial period (e.g. Greene 1990, Greene 1994, Greene 2000).

The resulting image is that the Roman Empire had what might be termed the 'Peasant Economy'. In such an economy, manufacturing is undertaken by small-scale workshops catering for local needs and situated in or near agricultural settlements or in urban centres financed by other means. No one is engaged year-round in manufacturing, which is a subsidiary activity undertaken in conjunction with farming or dependent upon subsidy. Production of this sort is loosely organised, usually on a household- or estate-basis or as a family business. Although relatives or other members of the household, such as slaves, may participate, there is never a large number of employees principally engaged in non-agricultural production.

In such an economy, the state may also subsidise manufacturing of this sort (for military or official purposes) through tax-revenues ultimately derivative of farming. Nevertheless, long-distance trade may exist in a 'peasant economy' and both market towns and wealthy merchants may be found, but where these occur they will also be adjuncts of agricultural production.

Far from being specific to the Roman Empire, this prompts comparison with the 'classic' Peasant Economies of medieval Western Europe. For example, in twelfth- and thirteenth-century England, trade might bring great wealth to market towns such as York or Bristol, but this trade was based upon agricultural production. The production of manufactured goods, such as pottery and metalwork, was

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a small-scale, part-time, activity strictly ancillary to the feudal agricultural economy unless this was geared toward the preparation of military forces. For example, the best known pottery-production site, at Lyveden, is clearly but one element in an otherwise agricultural settlement and even the post-medieval pottery at Potovens, Yorkshire, comprises nothing more than a single house with three adjacent kilns and waste dumps covering about c.10 x c.20m (Moorhouse 1987, Crossley 1990 ch.12).

That is, conventional interpretations of the Roman economy have ceased to present it in 'minimalist' or 'primitivist' terms, but depict a form of economic organization analogous to that of the medieval period – even if this analogy is seldom directly stated (Duncan-Jones 1990, Mattingly/Salmon 2001, Rathbone 1991, Whittaker 1990). However, this is not the only possible interpretation of the available evidence for the Roman economy and, in particular, for the role of manufacturing.

This paper seeks to show that archaeological and historical evidence may support an alternative interpretation: that the Roman Empire had a 'Proto-industrial Economy'. As such, it develops more widely a theme that I have explored elsewhere in relation to the end of the Roman economy and in relation to Roman Britain Economy' (Dark 1996, Dark/Dark ch.6). The key evidence is provided by investigating the role of large-scale manufacturing in the Roman Empire from the 1st to the 4th centuries AD. This, as we shall see, challenges all the assumptions inherent in most current interpretations of the economy of the Roman Empire.

Here, of course, it will only be possible to explore this topic through a few specific examples and more generalised discussion of the principal themes raised. In this contribution, therefore, my aim is both to demonstrate the potential of such an approach and set out some implications deriving from these examples regarding the character of the Roman economy. Obviously, many individual case studies of particular types of manufacture, specific sites and geographical regions are required to elaborate the resulting hypotheses and to investigate them more fully and, hopefully, other scholars will be prompted by this paper to undertake these.

Before embarking on this task, it should be pointed out that adopting the model proposed here is no more 'anachronistic' than that of the 'Peasant Economy'. Like that model, it is based on widely-used broad classifications of economic organization and identified by shared characteristics, not tied to specific historical situations. If an economy or manufacturing process has all the characteristics of particular classification, then it may be described in that way, if not it cannot. So, for example, 'Peasant Economies' exist in parts of the world today.

Nor does the economic model used in this paper require one to either deny or underestimate the role of smaller-scale crafts production in the Roman economy. It is not my intention to downplay the importance of agriculture as the basis of economic life in the Roman Empire. All state societies necessarily have large populations to feed, house and clothe. Consequently, to date, all states are ultimately dependent upon agriculture and the production and distribution of foodstuffs and other materials (such as wool or leather) required for these purposes. But that was as true of Europe in 1800 as it was of Europe in the Early Roman period. So, the recognition that agriculture and the extraction of raw materials played a fundamental role in the Roman economy is essential, but it is also irrelevant to assessing the role of production and long-distance trade in that economy.

It is intriguing to see what results are forthcoming when one explores the possibility that largest scale of Roman-period manufacturing could be classified as 'Proto-industrial'. Obviously, in order to undertake such an exploration first one must define what 'Proto-industrialization' actually means and decide how one might identify this in the Roman economy.

Proto-industrialization and the Roman Economy

'Proto-industrialization' is a well-established analytical category widely used in the fields of economics and economic history. It is not a historically-specific term, as already noted, but a classificatory category used for studying economic systems. Proto-industrialization is the situation in which long-standing crafts-working practices are coordinated to undertake mass-production aimed at long-distance trade. Proto-industrial economies are, therefore, 'industrializing' – in that they mass-produce for distant markets – but have not experienced an 'Industrial Revolution'. They lack centralised factories and use no new technology, relying on the collective efforts of many small-scale workshops and 'traditional' manufacturing practices to produce standardised goods (for examples from an extensive scholarly literature on Proto-industrialization: Berg 1994, Ogilvie 1993, Clarkson 1985, Poni 1985, Perlin 1983).

It must be stressed that in order to classify an economy as Proto-industrial it is not necessary to identify this form of organization in every part of that economy. If any aspect of the economy is organized along these lines that is enough for it to be considered Proto-industrial. Even in what might be considered the 'classic' Proto-industrial economy of seventeenth- and early eighteenth-century England, only a small part of manufacturing was undertaken in this manner. The remainder was small-scale crafts-production for the home, village, estate or locality.

This contrasts with the 'Industrial Economy'. In such an economy, manufacturing is organised both 'sequentially' (in successive stages, with a strict division of labour) and centrally and it is frequently urban-based. Centralised production also permits the use of 'power-driven' machines, such as water- or steam-driven saw-mills or stamping presses, and may promote innovation. The use

of machines driven by means other than human or animal exertion is often seen as a key part of such production but not all manufacturing processes require this. It is possible to have Industrial production without machines but not without centralised manufacturing (for the Industrial Revolution of the eighteenth century: Hudson 1992, Berg 1991, Mathias/Davis 1989).

Industrial production need not involve large factories. As a recent study noted, even in the period 1815-1896 small firms dominated the English cotton industry. The belief that large factories were typical of nineteenth-century Industrialism may derive from descriptions of large but atypical cotton-mills and literary hyperbole (Farnie 1979). In the cotton industry at the height of the Industrial Period firms usually employed only 100-200 people (Lloyd-Jones/Le Roux 1980).

As Lucy Newton has recently shown, until late in the nineteenth century fully Industrial manufacture – even the metalworkers of nineteenth-century Sheffield – did not need vast labour forces. In 1881, the majority of such firms employed under 10 people (under 5 in light industry) and in the mid-nineteenth century the average number of employees in even the largest firms was between 23-38 men, women and children. In 1850 there were only perhaps six firms in Sheffield that could number their workers by the hundred, although by this point it accounted for 90% of British steel production and 50% of European production. By this token, any sort of factory-production and any centralised labour-force sequentially producing goods for export can be considered Industrial or at least 'near-Industrial' (Newton 1993).

Likewise, although we can furnish a general definition of Proto-industrialization, scholars have found it far harder to agree on what precisely constitutes a 'Proto-industrial Economy'. For example, Franklin Mendels (who is often credited with inventing the term) defined it as based on regions in which rural handicraft production for 'international' markets accompanied commercial agriculture. Mendels considered Proto-industrial production usually seasonal and mediated through urban centres, where products were marketed and sometimes finished. In Proto-industrial economies, the unit of production is the household and the family (Mendels 1972, Jones 1968). This definition has been developed and challenged by other historians but convincing examples of Proto-industrialization have been identified very widely in Late Medieval and Early Modern contexts, both in Europe and elsewhere. This work has necessitated revisions to the scope of the term, in particular, it has stressed the importance of efficient communications and a monetary economy in furthering such developments and places greater significance on regional rather than international markets.

As a consequence, a more generally acceptable definition of Proto-industrialization would perhaps today be that such an economy has:

1. A money-based market exchange system, with efficient enough communications by land and water to give access to regional, or geographically larger, markets.

2. Regions containing clusters of rural craft-based production aimed at serving such regional, or geographically larger, markets.

3. Products mediated through urban centres to these regional or wider markets.

4. The use of 'traditional' technologies, those already employed in crafts-working in the region before 'Proto-industrialization', not innovative new ones.

5. Evidence of coordination to produce standardised products.

The extent to which an economy of this sort shows the use of newly invented technology, centralised places of manufacture ('factories'), the highly organised division of tasks into sequential stages and the use of machinery driven by means other than human or animal labour, is the degree to which it is becoming fully 'Industrial'. Here, it is my intention to explore the Proto-industrial model in relation to the role of production in the Roman economy, but we shall see it is worth keeping this latter point in mind.

Before looking at Roman-period evidence relating to this subject, it is also worth noting that there has already been some dissent regarding the presently accepted view of the Roman economy. In particular, Bill Manning (writing of metalwork production in the Early Empire) has observed in passing that 'at the larger scale, a factory system was not uncommon' and pointed out that such establishments show a 'degree of specialisation more consistent with a factory system than a small scale workshop'(Manning 1987 595-6). David Peacock has categorised the largest Early Roman pottery producers as 'manufactories' working on what he calls an 'industrial' scale (Peacock 1982). By the term 'industrial' he has in mind something akin to what would be classified here as Proto-industrial production, not a full Industrial Revolution within the Roman period.

Such observations, by leading specialists in the study of the Roman metalworking and ceramics, plainly allow for the possibility of far larger-scale and more economically-important manufacturing than do those analysts whose work has been briefly summarised so far. Yet, the existence and implications of this largest scale of production and exchange within the Roman economy has not been pursued further.

To explore this here, I shall divide the discussion chronologically into two sections: the Early Roman period, comprising here the 1st and 2nd centuries AD, and the Late Roman period, understood here as the 3rd and 4th centuries. To discuss the possibility of Proto-industrialization in the Early Roman economy, it is useful first to begin with the most extensively studied aspect of manufacturing in the Early Roman world: pottery-making. Early Roman pottery production in Gaul is an especially evocative example of the relevance of the Proto-industrial model to the Roman Empire, in addition to being by far the best-

known example of Roman-period mass-production.

La Graufesenque and Terra Sigillata Production in Early Roman Gaul

It is probably true to say that most archaeologists studying the Roman Empire are familiar with the red-gloss fine-ware pottery known as *terra sigillata* or, in especially the UK, 'samian ware'. It is also well-known that vessels of this sort were manufactured in moulds and often stamped with names, the exact significance of which remains unclear (for general discussions: Greene 1986 157-62, Bémont/Jacob 1986, Guéry 1990).

Terra sigillata was produced in a series of centres in southern, central and eastern Gaul in the 1st-3rd centuries AD and this Gaulish production, like that of Eastern Sigillata in Anatolia, developed from the Arretine pottery of Italy. For example, in Gaul, this relationship is seen at La Muette near Lyon, where Atei and Rasinii established workshops in the early 1st century AD using 'Arretine' moulds. However, there were soon specifically 'Gaulish' innovations in this ceramic tradition, as at the South Gaulish site of La Graufesenque, where innovations in the highly-skilled techniques of forming and decorating these vessels created a distinctive regional tradition of production. This was rapidly developed in other centres, as at Lezoux, Lyons and Montans (Bémont/Jacob 1986, Desbat/Genin/Lasfargues 1997).

The Gaulish *terra sigillata* 'industry' is illuminated both by the study of its production sites and finished products. At La Graufesenque, there was an extensive pottery-making complex, which – while not at all well-known from excavation – clearly included kilns and workshops with adjacent settlement and burial evidence, extending over more than 500m.

A series of more than 200 graffiti 'dockets' scratched onto sherds from the site (*bordereaux d'enfournement*) give what appear to be details of firings. These suggest loads of 25 000-30 000 vessels fired together, belonging to up to 10 different manufacturers and suggest that individual potters employed several kilns for their wares. Thus, large collective firings of separate potters or potteries are well-attested and suitable kilns, and quantities of fused wasters from several different potters, have been found. For example, the 'fosse de Cirratus' contains thousands of vessels bearing more than one name-stamp (for examples of the very extensive scholarly literature on La Graufesenque: Hermet 1934, Bémont/Vernhet/Beck 1987, Vernhet 1991, Polak 1989, Polak 1998, Nieto 1987).

The vessels and moulds that were used in their production indicate a multi-stage process of manufacture. This involved a standardized sequence of actions, in order to produce a single vessel. Given the scale of production attested by finished products and 'dockets' it is likely, but not directly demonstrable, that these were divided between specialists in each stage: a sequential method of manufacturing.

The names on the 'dockets' from La Graufesenque also seem to suggest a largely free (rather than slave) workforce. The only indication of slavery at the site is the mention of a team of slaves on one graffito. That is, this would seem to be a specialist community of highly-skilled free potters, manufacturing on a very large scale by contemporary standards (Webster 2001).

It was also an especially literate rural community, not simply a group of local farmers collaborating to 'run-off' pots as a cash-crop during low-points in the agricultural year. The degree of literacy found among the workforce is implied by the names found stamped onto *terra sigillata* vessels and the 'dockets', even if their exact meaning has resiliently defied elucidation. Even the moulds used for producing this pottery have, in some cases, inscribed names, which may be different to that of the stamp on the vessel they produced.

The products from La Graufesenque were extremely widely traded in the Roman Empire. They are found in Gaul, Britain, Italy, North Africa and the Danube provinces. Wreck sites on the south coast of France and Spain (such as Culip IV) attest the use of shipping to transport the products of this production centre (Marichal 1988). But as Peter Webster has pointed out, land-transport must also have been used, as the Tarn at La Graufesenque is unlikely to have been navigable up to the potteries (Webster 2001).

By the mid-first century Gaulish and Eastern sigillata had replaced 'Arretine' (or 'Italian-type') ware in broad regions of the Empire. This may suggest the existence of an inter-regional competitive market, from which a more distant producer could be excluded by the rise of a more readily-available (and cheaper?) product. It also shows the ability to move ceramics across whole regions of the Empire to capture these markets.

There is no doubt, from either maritime or terrestrial archaeological finds, that products from La Graufesenque were marketed through towns. In Britain, direct evidence shows it shipped to London and sold in shops there and at other towns, for example, Verulamium. So, the criteria of Proto-industrial production can be easily met by La Graufesenque *terra sigillata* production:

Criterion 1: A money-based market exchange system, with efficient enough communications by land and water to give access to regional, or geographically larger, markets.

This is provided by the infrastructure of the Roman West, a money-based exchange system with paved roads and shipping networks illustrated, for example, by wrecks (including wrecks with La Graufesenque *terra sigillata*) and epigraphic sources. The relative efficiency of Roman-period and eighteenth century Proto-industrial communication systems is demonstrated by Duncan-Jones' figures for their cost ratios. He calculates these as identical for sea transport and for inland waterways in the Roman period at 4.7 compared to 4.9 for early eighteenth-century England.

On land these figures are 22.6:28.0, so again closely comparable (Jones/Mattingly, Duncan-Jones 1974, Gibbins 1999).

Criterion 2: Regions containing clusters of rural craft-based production aimed at serving such regional, or geographically larger, markets

The focus at La Graufesenque and its export to markets across the west of the Roman Empire confirms this. Southern Gaul as a whole could be considered a broad region of production.

Criterion 3: Products mediated through urban centres to these regional or wider markets

These must have been shipped from Gallo-Roman ports to those in other parts of the Empire, emphasising the urban element in marketing *terra sigillata* from La Graufesenque. Even if this involved several intermediary stages and mixed cargoes these are likely to have been mediated through towns.

Criterion 4: The use of 'traditional' technologies, those already employed in crafts-working in the region before 'Proto-industrialization', not innovative new ones

This is not a 'fit' with the model because innovation did occur. In respect, *terra sigillata* production was not only 'Proto-industrial' but closer to the fully Industrial model.

Criterion 5: Evidence of coordination to produce standardised products

This is seen in shared kilns and, perhaps, the sharing of decorative designs – if this is not simply competitive emulation. The existence of identifiable widespread *terra sigillata* forms may also show this.

Consequently, there can be little doubt that South Gaulish *terra sigillata* production at La Graufesenque has all the criteria for classification as a Proto-industrial level of production. However, in several important respects it also exceeds these criteria. Notably, there is evidence both of technical innovation and the introduction of new technologies from elsewhere, and of large permanent settlements devoted to pottery production. There is also much evidence for sequential production involving people who are clearly differentiated from the remainder of the local workforce by specialised skills and/or literacy. These are not features that would be expected from Proto-industrial sites and go far beyond the minimum definition of this 'mode of production'. This raises the question of exactly how far in excess of a Proto-industrial mode of production La Graufesenque actually was.

One might compare the 1st and 2nd century *terra sigillata* pottery at La Graufesenque with what is known of the early eighteenth-century Staffordshire potteries on the verge of the Industrial Revolution. In 1710-19 there were only 67 potters at the main centre of the 'industry' and most firms employed only about 10 employees. These were manufacturing alongside their homes in a dispersed manner, with kilns and other production facilities typically located at the rear of properties. They were moving ceramics packed in straw by packhorse some 50km to markets on roads of lesser quality than those common on the main arterial routes in Early Roman Gaul. Canal transport of these pots only began in 1766, when the Trent and Mersey canal opened, and purpose-built manufactories only appeared in 1756, when the Ash Pottery at Lane End opened. These were associated with larger kilns, typically firing up to 1500 pieces at once, while technical innovations such as the use of lathes and moulds have been seen as heralding moves toward a full Industrial phase of production. But even in 1760, workforces numbered in tens not hundreds. As late as 1790 the famous Josiah Wedgewood only had 270 employees in two branches of the foremost pottery of his time (Dawson 1997, Peacock 1982 44-45).

That is, the Staffordshire potteries before c.1750 were operating in a less industrialized manner than was Early Roman La Graufesenque. Moreover, their production capacity was apparently much lower, with far smaller firings. The La Graufesenque potteries seem to have been capable of firing twice as many vessels at once. La Graufesenque also has more evidence of the division of labour into specialised tasks than at the Staffordshire potteries of the first half of the eighteenth century. That is, La Graufesenque was closer in its scale and organization of production to Industrial production than was the Staffordshire pottery 'industry' on the verge of its emergence as the focus of the Industrial Revolution's first main producer of ceramics.

By the normal criteria of economic and economic historical classification, production at La Graufesenque was not simply Proto-industrial: it was nearly a fully Industrial operation. This is an interpretation that has, of course, far reaching conclusions beyond the study of large-scale production in the Early Roman Empire. This was certainly not luxury-goods production: *terra sigillata* of this sort was standard tableware for a wide range of social and cultural groups.

It is unclear how typical of *terra sigillata* production La Graufesenque really was. Other sites have produced similar lists, as at Arezzo, Orta, Montans and Rheinzabern. This may suggest an analogous communal method of firing and this may be implied by welded pots by different potters from Les-Martes-de Veyre. Likewise, the sequential production process, if true of La Graufesenque, should hold true of other sites, as this is implied by the vessels and moulds themselves. Especially in Italy, there may also be strong archaeological reasons to suggest that at least some *terra sigillata* production elsewhere was organised on a similarly large scale, although not necessarily structured in the same way as La Graufesenque (Kenrick 1993, Fülle 1997).

The distinctiveness of the decorative styles specific to particular name-stamps in eastern and central Gaul in contrast to the shared decoration of South Gaulish *terra sigillata* may suggest that these were in some way differently organized, as David Peacock has argued. Likewise,

his observation that the cemeteries of Lezoux and Rheinzabern and buildings at Lezoux and Faulquemont-Chémery show relatively little indication of status differences may suggest that these were communities of free workers, who were nevertheless not getting rich on the products of their considerable labour (Peacock 1982 122-6, Stanfield/ Simpson 1990).

However, there are hints that at least some of the other centres of *terra sigillata* manufacture were very large – over 200 kilns were found at the Central Gaulish centre of Lezoux – although others, such as Rheinzabern in eastern Gaul seem to have been based on clusters of small workshops. The latter might more closely fit the conventional model of Proto-industrial production, perhaps implying that the *terra sigillata* 'industry' included establishments operating across the whole range from classically Proto-industrial to near-Industrial, with only a few large foci at the larger end of this spectrum. It is possible that 'branch-managers' controlled smaller workshops for larger concerns, as such operations are known from Roman law, or that a chronological development is visible here: the Eastern and Central Gaulish centres post-dating the South Gaulish 'industry'. If so, we might be witnessing the fragmentation of markets due to growing competition within the Early Roman Empire However, La Graufesenque is not the only example of production at the upper limits of the Proto-industrial range in the western provinces of the Early Roman Empire (Greene 1986 160, Bet/Gangloff/ Vertet 1987 esp. VII-VIII, Aubert 1994, Kehoe 1992).

Centralised Production in the Early Roman Empire

In a recent study of military *fabricae* in Germania Inferior, Bernard Van Daele noted that almost all of the Early Roman fortresses that he examined had workshops and many of these were sizeable (up to about 100 x 100 m) purpose-built blocks. He has also pointed out that the 'Vindolanda tablets' tell us both that on one day more than 340 men were working in the *fabricae* and that it was expected that c.80 men would usually be assigned to a *fabrica*. Although probably somewhat diversified, with several activities taking place within the same complex, this implies that large-scale production was commonplace in the Early Roman army (Van Daele 1999).

Not all these manufacturing complexes were simply part of larger sites with other functions, nor were all diversified workshops producing a range of different goods. The production site at Holt in Llwyd, Wales, was originally established to supply the legionary fortress at Chester with building materials. Nevertheless, Holt was about 15km distant from the fortress itself and remained operational as a specialised pottery and brick producer from the late first to late third or fourth centuries (Grimes 1930, Thompson 1965, Peacock 1982 137-9).

The site at Holt was zoned into specific activity areas: a substantial 6 room stone house with hypocausts, a separate bath block, a walled barrack block (capable of accommodating c.160 men) and a series of production facilities to the southwest of these. The size of the production facilities, in particular a main block of eight conjoined kilns, suggests very large- scale manufacture and this is borne out by the quantity of the site's demonstrable products.

The linear layout of the workshops at the site, their different features and finds, and perhaps their relationship to the kiln plant, suggests a sequential mode of production. Sequential brick and tile production has been independently demonstrated in Roman Britain in the study of production sites in the South Midlands, so this is unsurprising (Darvill/McWhirr 1984).

The barracks, even if only ever partly full, would imply a workforce well over 100. The existence of the well-built house separated by a wall from the barrack block implies some degree of social differentiation, with one individual or group (family?) in a superior position. It seems reasonable to suppose that this derived from managerial responsibility in the establishment, probably originally at least through military command.

This was not a short-lived operation, but lasted centuries as a major manufacturing centre. Nor is there any trace, albeit from old and imperfectly published excavations, of any other function than production being performed here. Current evidence necessitates the interpretation that Holt was a centralised specialised focus for large-scale sequentially-organised production. If so, Holt is, then, literally an Early Roman factory.

It is difficult to ascertain at present how common such wholly production-based complexes might have been. Nevertheless, if military *fabricae* making pottery, brick and tile could be of Proto-industrial proportions, as Van Daale argues, and specialised as at Holt, then one might look at other brick-, tile-and pottery-manufacturing sites as possible Proto-industrial 'manufactories' if not actual factories in the Early Roman Empire (Le Ny 1988).

For example, it might be possible to envisage Holdeurn, in Holland, in this way although the evidence is less definitive. There, two complexes were found about 100m apart. One contained well-dated series of 8 kilns, and ancillary structures, the other a rectilinear courtyard with accommodation and workshops. These were in use throughout the Early Roman period and could represent a similar establishment to that known in more detail at Holt. But this is uncertain and the site needs detailed re-evaluation before any new interpretation can more confidently be placed on the excavated evidence (Peacock 1982 140-42).

Another site that might have had a similar function to Holt, although it had a different morphology, is Wilderspool on the River Mersey. This was first occupied from the first century through to the fourth. In the first and second centuries, the site was a specialised manufacturing centre producing both pottery and metal goods. Like Holt, this was originally a military site, but perhaps one devoted to pro-

duction rather than the stationing of fighting troops (Hinchcliffe/Williams/Williams 1992).

Holt, and perhaps these other sites, may hint at the existence of centralized large-scale production in the Early Roman Empire. It is interesting that, whereas La Graufesenque and the other *terra sigillata* producers of Gaul were plainly civilian, these sites all originated in a military context. But it is important to remember that terms such as 'Proto-industrial' or 'Industrial' are classifications of modes of production equally applicable whether this production is civilian or military.

Extending the model in the Early Roman period

The relevance of the Proto-industrial model to Early Roman production extends beyond the manufacture of pottery and tile alone. This too can be illustrated by evidence from Roman Britain. Iron-production and iron-working in the East Midlands and Weald of England show a cognate scale of production, with many small iron-working sites clustering into restricted regions and supplying very wide regional and supra-regional markets, through urban centres. Production was on a very large scale, with slag heaps at Beauport Park in the Weald covering over 3 acres representing 50-60 000 tons of iron produced over 160-70 years. Both there and in the Forest of Dean industrial operations in the post-medieval period actually mined the Roman-period slag heaps (Dark/Dark 1998 129-30, Cleere/Crossley 1986).

In these cases there is no hint of centralised manufacturing sites, but rather a picture closer to the conventional Proto-industrial model of clustered and coordinated (but physically separate) rural crafts-specialisation. For example, in the East Midlands over 150 Romano-British iron-working sites are known and, although these varied in scale and form, they included the site at Laxton, where iron-working debris spread over 400 square metres and completely filled a 100 m-wide valley. This rural production took place so close to the Romano-British small-towns of Irchester and Water-Newton that it is difficult to deny it some role in their economies.

These examples suggest that by the 2nd century there was Proto-industrial manufacturing in Roman Britain in the Weald in the south east, in the East Midlands and in the Forest of Dean in the South West Midlands, as well as in the North West Midlands at Holt and perhaps Wilderspool. These may well attest a range of economic organization covering most of the possible 'Proto-industrial' range.

Evidence from both Britain and Gaul, therefore, suggests the existence of a highly-developed Proto-industrial economy in the Early Roman Empire. More widespread small-scale crafts-production and near-ubiquitous agriculture are of course complementary to this, just as they were in early eighteenth-century western Europe. In the Early Roman period the involvement of the army as a stimulus to Proto-industrial production, is clearly visible, but the evidence comes from both civilian and military contexts. Two broad 'levels' of Proto-industrialization can be identified, one involving centralised sequential specialised production (as at La Graufesenque or in a different form at Holt), the other, commoner, version close to 'classic' Proto-industrialization.

This pattern can also be traced in the Late Roman period. By the end of the fourth century, textual evidence for *fabricae* becomes fuller and archaeological data offer more information about technology and the distribution of wealth derived from mass-production.

The Late Roman period

The most striking evidence for mass-production in the Late Roman period is provided by the *Notitia Dignitatum* and other written sources. These attest a network of official *fabricae*, throughout the Empire, producing clothing and equipment for the army and civil service. These were mostly situated in urban contexts and appear to have been concentrated in Gaul and the eastern Mediterranean. No Late Roman *fabrica* in the list has ever certainly been excavated, but hints imply a very considerable workforce under strict supervision (Southern/Dixon 1996 89-90, 98 and 116, James 1988. Data used in the following discussion of *fabricae* is based on these works, unless otherwise referenced).

The exact size of the *fabricae* listed in the *Notitia Dignitatum* is unclear, but Ramsey McMullen and A.H.M. Jones estimated that each *fabrica* had between 200-500 hundred employees. The majority of *fabricae* mentioned in the *Notitia Dignitatum* were located in Gaul or the Danubian provinces, but it seems that even elsewhere a large proportion of the entire workforce of towns might be employed in this way.

At Cyzicus, Tarsus and Caesarea in Anatolia much of the working population was arguably employed in *fabricae*. For example, at Cyzicus, only two *fabricae* apparently accounted for much of the workforce, at a time when that town's population may have numbered well over ten thousand (Mitchell 1993 244).

In at least some *fabricae*, employees were concentrated enough to be regulated like military units and even wore uniforms. This may suggest the sort of plants seen earlier at Holt or found within Early Roman forts, rather than scattered piece-work by home-based craftspeople. This sense of order and coordination is also implied by product-standardisation identified in the working practices of the *fabricae*. In an important study of these establishments, Simon James has argued that the simplification of armour in this period was to assist sequentially-organised mass-production at such sites (James 1988 271-2).

It is immediately evident that if there were scores of centralised production sites involving hundreds of workers in sequential manufacture, this alone demonstrates a very considerable Proto-industrial element in the Late Roman economy. But there is other evidence that Proto-industrialization may have been much wider in Late

Roman economy than even this source implies.

The *basilicae* at the centres of Western Roman towns were sometimes converted into manufacturing centres in the fourth century. Examples of *basilicae* re-used as metalworking complexes, with linear arrangements of hearths in the main hall, have been found in both Britain and Gaul, as at Amiens, Caerwent, Silchester and York. While Amiens was among the *fabricae* mentioned in *Notitia Dignitatum*, the only British *fabrica* included in that text was a textile producer, not a metalworking complex. If these instances of re-use suggest sequentially-organised metalwork production, it is clear that they add to, rather than duplicate, the information provided by textual sources. Moreover, this has only become visible at each of these sites following recent excavation: much more such evidence might yet be found at other towns. In any case, it suggests that – potentially large-scale – productive activities were taking place at the centre of major Late Roman towns in Britain and Gaul (Dark 1996 16).

If we can count these archaeological examples as analogous to the *fabricae* of *Notitia Dignatum*, which is uncertain, then we must envisage the possibility that such centralised production-places were far more common in the fourth-century Roman Empire than even that text would lead us to suppose. Even without these sites, textual evidence alone leads one to believe that factory-like production was much more common in Europe c.400 than in 1750. That is, the late fourth-century Roman Empire may have been more 'industrialised' than was England on the verge of the Industrial Revolution.

Although these examples may represent the 'upper level' of Late Roman Proto-industrialization, there is also evidence of Late Roman production in a manner closer to the classic Proto-industrial model. For example, textile production organised in this manner is suggested by Late Roman *papyri* found at Oxyrynchus. A receipt refers to an advance on a fixed salary to the workshop manager, while we also hear of the foreman of a weaving workshop employing scores of workers and which held a government contract. The same corpus of *papyri* attests both crafts specialization and organization through guilds and the official regulation of prices (Aubert 2001).

This sounds very much as if a decentralised Proto-industrial economy operated in conjunction with, but separate from, the more factory-like official system of *fabricae*. That is, we seem to see at least two levels of Proto-industrial production in the Late Roman economy also. The lowest level is close to the classic Proto-industrial model of coordinated traditional crafts-working in the countryside, although it could have a more urban character in some cases. But there is a more developed second level of near-Industrial production, involving centralised sequential manufacturing concentrated in urban locations. This division could, but need not, reflect a continuing civilian: military division in the organisation of mass-production.

In the Late Roman period there are slight suggestions that we might also see greater evidence of the application of water-driven machinery to manufacturing. Even in the early Roman period water-driven mass-production may not have been entirely absent from the Roman economy. The famous series of watermills employed for milling at Barbegal in the 2nd-4th centuries illustrate this well. But there are hints that Late Roman watermills could have run machinery used for other purposes. At Ickham in Kent, watermills were connected to a trip-hammer for metalworking and Ausonius described a water-driven saw-mill in Gaul. Recent work has emphasised that we may well underestimate the extent and sophistication of water-driven technology in the Late Roman Empire and it may well be that such establishments were much more common than current archaeological evidence implies (Leveau 1996, Wikander 1984 111, Wikander 1985, Spain 1985, Spain 1984).

We must also be cautious not to underestimate the level of hydraulic technology available. For example, the triple mills at Chemtou used a turbine drive otherwise unparalleled before 1577 (Wilson 1995). The use of any water-driven machinery in mass-production would again take us toward the upper end of the 'Proto-industrial' scale of manufacturing.

A final illustration of the scale of mass-production in the Late Roman period comes from Romano-British small-towns. A series of such towns, ironically many of them in the West Midlands where the eighteenth-century Industrial Revolution began, show strong indications of having economies based on the large-scale production of manufactured goods, iron or salt. That is, these were 'manufacturing towns', not agricultural communities undertaking local crafts-working. A particularly instructive case, which has been discussed elsewhere, is the town of Water Newton (*Durobrivae*) in the East Midlands. There, the extramural area given over to pottery-production exceeds the residential part of the town, well-known through aerial photography, field-walking and excavation. A large mansion, conceivably built from the profits of mass-production, terraced into the hillside above the town, overlooks the pottery-making area and is connected to it and the town by its own stretch of road. The town and its area shows considerable wealth (not least the Water Newton hoard of Christian silverware) and pottery produced in the area was widely used across a broad region of Roman Britain. These small-towns seem to show substantial civilian communities economically dependent upon mass-production and generating considerable wealth from this (Perrin 2000, Dark/Dark 1998 127-9 and 114 and 132).

Consequently, we can be confident that Proto-industrial production was widespread in the Late Roman Empire. As in the Early Roman period, a substantial part of this was stimulated by and controlled by the imperial authorities, especially the army. This included centralised 'factories' mass-producing goods for official use. However, as in the earlier period too, much Proto-industrial production was also in civilian hands and the wealth generated by this

could, as earlier at La Graufesenque, support small-towns. Gaul appears to have remained the most extensively 'industrialized' area, although this could represent the uneven character of our sources rather than the true distribution of mass-production in the Roman Empire.

Conclusion

This evidence for Proto-industrial production in the Roman Empire is so extensive that it hardly need be reiterated that this renders the 'Peasant Economy' model for the Roman Empire untenable. We must abandon a 'primitivist' or 'minimalist' view once and for all and give greater attention to the role of mass-production and its relationship to other forms of production. Last, but not least, the realisation that the Roman imperial economy included Proto-industrial mass-production re-opens the question of why the Roman Empire did not experience a full Industrial Revolution.

Bibliography

Aubert 1994 : J. Aubert, *Business managers in ancient Rome : a social and economic study of institores 200BC-200AD,* Columbia Studies in the Classical Tradition 21, New York and Leiden, 1994

Aubert 2001 : J.-J. Aubert, The fourth factor : managing non-agricultural production in the Roman world. *In* : D.J. Mattingly and J. Salmon (eds.), *Economies beyond agriculture in the Classical world*. London and New York, 2001, 90-112.

Bang 1997 : P. Bang, *Antiquity between primitivism and modernism*. Arbejdspapirer Centre for Cultural Research Aarhus University, 1997, 53-97

Bémont /Jacob 1986 : C Bémont and J.-P. Jacob (eds.), *La terre sigillée gallo-romaine. Lieux de production du Haut Empire : implantations, produits, relations*. Documents d'Archéologie Française 6 Editions de la Maison des Sciences de l'Homme, Paris, 1986.

Bémont /Vernhet/Beck 1987 : C. Bémont, A. Vernhet and F. Beck, *La Graufesenque : village de potiers gallo-romains*. Ministère de la Culture et la communication, Paris, 1987.

Berg 1991 : M. Berg (ed.), *Markets and Manufacture in Early Industrial Europe*. London and New York 1991.

Berg 1994 : M. Berg, *The Age of Manufactures 1700-1820* (2nd ed.). London and New York, 1994.

Bet/Gangloff/Vertet 1987 : P. Bet, R. Gangloff and H. Vertet, *Les Productions céramiques antiques de Lezoux. Recherches sur les ateliers de potiers de la Gaule centrale*, volume IV, Lezoux esp. VII-VIII, 1987.

Clarkson 1985 : A. Clarkson, *Proto-industrialziation : the first phase of industrialization ?* London, 1985.

Cleere/Crossley 1986 : H. Cleere and D.W. Crossley, *The Iron Industry of the Weald*, Leicester, 1986.

Crossley 1990 : D. Crossley, *Post-medieval archaeology in Britain*, London, Leicester and New York, 1990.

Dark 1996 : K.R. Dark, Proto-industrialization and the end of the Roman economy. *In* : K.R. Dark (ed.), *External Contacts and the Economy of Late Roman and Post-Roman Britain*. Woodbridge 1996, 1- 21.

Dark/Dark 1998 : K. Dark and P. Dark, *The Landscape of Roman Britain* (rev. ed.), Stroud, 1998.

Darvill/McWhirr 1984 : T. Darvill and A.D. McWhirr, Brick and tile production in Roman Britain : models of economic organization. *World Archaeology* 15, 1984, 239-61.

Dawson 1997 : A. Dawson, The Growth of the Staffordshire Ceramic Industry. *In :* I. Freestone and D. Gaimster (eds), *Pottery in the making : world ceramic traditions*. London, 1997, 200-5.

Desbat/Genin/Lasfargues 1997 : A. Desbat, M. Genin and J. Lasfargues (eds.), *Productions des ateliers antiques de Lyon, 1ère partie : Les ateliers précoces*. CNRS Editions, Paris, 1997.

Duncan-Jones 1990 : R.P. Duncan-Jones, *Structure and Scale in the Roman Economy*. Cambridge, 1990.

Duncan-Jones 1974 : R.P. Duncan-Jones, *The Economy of the Roman Empire*. Cambridge 1974, 366-69.

Engels 1990 : D. Engels, *Roman Corinth : an alternative model for the Classical city*. Chicago, 1990.

Farnie 1979 : D.A. Farnie, *The English Cotton Industry and the World Market, 1815-1896*. Oxford, 1979, 209.

Finley 1985 : M. Finley, *The Ancient Economy* (2nd ed.), London and Berkley, 1985.

Fülle 1997 : G. Fülle, The internal organization of the Arretine *terra sigillata* industry : problems of evidence and interpretation. *Journal of Roman Studies* 87, 1997, 111-155.

Garnsey 1998 : P. Garnsey, *Cities, peasants and food in Classical Antiquity. Essays in social and economic histor*y, Cambridge, 1998.

Gibbins 1999 : D. Gibbins, *Roman Maritime Trade*. London, 1999.

Greene 1986 : K. Greene, *The Archaeology of the Roman Economy*. London, 1986.

Greene 1990 : K. Greene, Perspectives on Roman technology. *Oxford Journal of Archaeology* 9.2, 1990, 209-19.

Greene 1994 : K. Greene, Technology and innovation in context : the Roman background to medieval and later developments. *Journal of Roman Archaeology* 7, 1994, 22-33.

Greene 2000 : K. Greene. Technological innovation and economic progress in the ancient world. *In* : M.I. Finley reconsidered. *English Historical Review* 53, 2000, 29-59.

Grimes 1930 : W.F. Grimes, *Holt, Denbighshire. The works-depot of the Twentieth Legion at Castle Lyons. Y Cymmrodor* XLI, Society of Cymmrodorion, 1930.

Guéry 1990 : R Guéry, La terre sigillée en Gaule. *Journal of Roman Archaeology* 3, 1990, 361-75.

Harris 1993 : W.V. Harris (ed.), *The Inscribed Economy. Production and Distribution in the Roman Empire in the light Instrumentum Domesticum*. Journal of Roman Archaeology Supplement 6, Ann Arbor, 1993.

Hermet 1934 : F. Hermet, *La Graufesenque (Condatomago)*. Librairie Ernest Leroux Paris, 1934.

Hinchcliffe/Williams/Williams 1992 : J. Hinchcliffe, J. Williams with F. Williams, *Roman Warrington. Excavations at Wilderspool 1966-9 and 1976*. Brigantia Monographs n°2, Manchester, 1992.

Hopkins 1980 : K. Hopkins, Taxes and Trade in the Roman Empire. *Journal of Roman Studies* 70, 1980, 101-25.

Hopkins 1995/6 : K. Hopkins, Rome, taxes, rents and trade. *Kodai* 6/7, 1995/6, 41-75.

Hudson 1992 : P. Hudson, *The Industrial Revolution*. London, 1992.

James 1988 : S. James, The fabricae : state arms factories of the Later Roman Empire. *In* : J.C.N. Coulston (ed.*), Military Equipment and the identity of Roman soldiers*. Oxford, 1988, 257-332.

Jones/Mattingley 1990 : B. Jones and D. Mattingly. *An Atlas of Roman Britain*, Oxford, 1990, 200-1.

Kehoe 1992 : D.P. Kehoe, *Management and investment in estates in Roman Egypt during the Early Empire*. Papryologische und Abhandlungen 40, Bonn, 1992.

Kenrick 1993 : P. Kenrick, Italian *terra sigillata* : a sophisticated Roman industry. *Oxford Journal of Archaeology* 12.2, 1993, 235-42.

Le Ny 1988 : F. Le Ny, *Les Fours de tuilliers gallo-romains*. Documents d'Archéologie Française 6, Editions de la Maison des Sciences de l'Homme, Paris, 1988.

Leveau 1996 : P. Leveau, The Barbegal water mill and its environment : archaeology and the economic and social history of Antiquity. *Journal of Roman Archaeology* 9, 1996, 137-53.

Lloyd-Jones/ Le Roux 1980 : R. Lloyd-Jones and A.A. Le Roux, The size of firms in the cotton industry : Manchester, 1814-1841. *Economic History Review* (2nd series) XXXIII.1, 1980, 72-82.

Manning 1987 : W.H.Manning, Industrial Growth. In : John Wacher (ed.) : The Roman World (2 vols.). The Roman World, London and New York, vol. 2, 1987, 586-610.

Marichal 1988 : R. Marichal. *Les graffites de la Graufesenque. Gallia* Supplément 47, Paris, 1988.

Mathias/Davis : P. Mathias and J.A.Davis (eds.), *The First Industrial Revolutions*. Oxford, 1989.

Mattingley/Salmon : D.J. Mattingly and J. Salmon (eds.), *Economies beyond agriculture in the Classical world*. London and New York, 2001.

Mitchell 1993 : S. Mitchell, *Anatolia* (2 vols.), volume 1, Oxford, 1993.

Moorhouse 1987 : S. Moorhouse, The composition and development of medieval potting tenements in the British isles. *In :* J. Chapelot, H. Gailinié and J. Pilet-Lemière (eds.), *La Céramique (Ve-XIXe s.), Fabrication-Commercialisation-Utilisation*. Société d'Archéologie Médiévale, Caen, 1987, 179-94.

Newton 1993 : L. Newton, *The Finance of Manufacturing Industry in the Sheffield Area c.1850-c.18*85, unpublished PhD. University of Leicester, UK, 1993.

Nieto 1987 : J. Nieto, El pecio CULIP IV : observaciones sobre le organization de los telleres de TERRA SIGILLATA de la Graufesenque. *Archéonautica* 6, 1987, 81-120.

Ogilvie 1993 : S.C. Ogilvie, Proto-industrialization in Europe. *Continuity and Change* 8 1993, 159-79.

Parker 1992 : A.J. Parker, *Ancient shipwrecks of the Mediterranean and Roman provinces*. Oxford, 1992.

Parkins 1997 : H. Parkins (ed.), *Beyond the consumer city*. London, 1997.

Parkins/Smith 1998 : H. Parkins and D. Smith (eds.), *Trade, traders and the Ancient City,* London, 1998.

Peacock 1982 : D.P.S. Peacock, *Pottery in the Roman World : an ethnoarchaeological approach*, London, 1982.

Perlin 1983 : F. Perlin, Proto-industrialization in pre-Colonial south Asia. *Past and Present* 98, 1983, 30-95.

Perrin 2000 : J.R.Perrin (ed.), *Roman Pottery from Excavations at and near the Roman Small Town of Durobrivae, Water Newton, Cambridgeshire, 1956-58. Journal of Roman Pottery Studies* 8, Oxford, 2000.

Polak 1989 : M. Polak, Some observations on the production of terra sigillata at La Graufesenque. *Archäolisches Korrespondenzblatt* 19, 1989, 145-54.

Polak 1998 : M. Polak, Old wine in new bottles : Reflections on the organization of terra sigillata production at La Graufesenque 115-121. *In* : D. Bird (ed.), *Form and Fabric. Studies in Rome's material past in honour of B.R.Hartley*, Oxford, 1998.

Poni 1985 : C. Poni, Proto-industrialization : rural and urban. *Review* 9, 1985, 305-14.

Rathbone 1991 : D. Rathbone, *Economic Rationalism and Rural Society in Third Century AD Egypt*, Cambridge, 1991.

Southern/Dixon 1996 : P. Southern and K.R.Dixon, *The Late Roman Army*, London, 1996.

Spain 1984 : R.J. Spain, The second century Romano-British watermill at Ickham, Kent. *The History of Technology* 9, 1984, 143-80.

Spain 1985 : R.J. Spain, Romano-British watermills. *Archaeologia Cantiana* 100 (1984), 1985, 101-28.

Stanfield/Simpson 1990 : J.A. Stanfield and G. Simpson, *Les potiers de la Gaule Centrale*, Gonafaron, 1990.

Thompson 1965 : F.H. Thompson, *Roman Cheshire*, Chester, 1965.

Van Daele 1999 : B. Van Daele, The military fabricae in Germania Inferior from Augustus to A.D.260/70. *Journal of Roman Military Equipment Stuides* 10, 1999, 125-36.

Vernhet 1991 : A. Vernhet, *La Graufesenque : céramiques gallo-romaines*, Millau, Editions du Beffroi, 1991.

Webster 2001 : P. Webster, Earth, Fire and Water : The making and marketing of Roman Samian Ware. *In* : N.J.Higham (ed.), *Archaeology of the Roman Empire*, Oxford, 2001, 289-302.

Whittaker 1990 : C.R.Whittaker, The consumer city revisited : the *vicus* and the city. *Journal of Roman Archaeology* 3, 1990, 110-18.

Wikander 1984 : Ö. Wikander, *Exploitation of water-power or technological stagnation ? A reappraisal of the productive forces of the Roman Empire Scriptoria Minora* 111, Lund, 1984.

Wikander 1985 : Ö. Wikander, Archaeological evidence for early water-mills- an interim report. *History of Technology* 10, 1985, 151-79.

Wilson 1995 : A. Wilson, Water-power in North Africa and the development of the horizontal water-wheel. *Journal of Roman Archaeology* 8, 1995, 499-510.