

THE ECONOMY OF THE ROMAN SOUTH PENNINES WITH PARTICULAR
REFERENCE TO THE LEAD EXTRACTION INDUSTRY IN ITS NATIONAL
CONTEXT

by

Martin J. Dearne

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Martin J. Dearne

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Summary

This thesis aims to assess the archaeological evidence for the economy of the upland south Pennines in the Romano-British period. It is particularly directed towards examining the role of lead mining in the national context of that industry. The initial chapters examine the Iron Age, historical and natural backgrounds, the probable size of the population and the available transport system of the area. Chapter 6 examines the major sites within and on the periphery of the area, paying particular attention to the economic basis of military vici and the contrast with civil towns.

Chapter 7 examines the highly limited evidence for rural settlement. The evidence for the lead (and perhaps silver) extraction industry, mainly the pigs or inscribed blocks which it produced, is examined in detail from a number of standpoints in Chapter 8. The evidence for the national industry, not just that of Derbyshire, is examined since it provides a vital context for the specific example under study. All the extant pigs are listed in a detailed catalogue (Appendix 1) and some further implications of their study are considered in Appendices 2 and 3. Ancient and modern comparative evidence is also cited for the lead industry and a model for its nature is suggested in Chapter 9.

A number of conclusions, mainly provisional because of the often incomplete evidence, are reached. It is suggested that military vici enjoyed only a limited integration into the more general economy of the area. However, it is clear that the south of the study area was more developed than the north. This is attributed to three factors, the importance of the lead industry, the spa function of Buxton and to strategic concerns.

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Abbreviations

The following abbreviations are used in the text and bibliography. For abbreviations used only in the notes to Appendix 1 see p.456. References to Br. and J.R.S. in the text refer to the 'Roman Britain in ...' sections of those journals.

- A.J.A. American Journal of Archaeology
Ant.J. Antiquaries Journal
A.A. Archaeologia Aeliana
Arch.Camb. Archaeologia Cambrensis
Arch.J. Archaeologists Journal
B.A.R. British Archaeological Report
Br. Britannia
C.I.L. Hubner (1873)
D.A.J. Derbyshire Archaeological Journal
G.M.A.J. Greater Manchester Archaeological Journal
H.S.T. Hunter Society Transactions
I.J.N.A.U.E. International Journal of Nautical
 Archaeology and Underwater Exploration
J.Brit.Arch.Ass. Journal of the British Archaeological
 Association
J.C.A.S. Journal of the Chester Archaeological Society
 (also Journal of the Chester and North West
 Archaeological Society)
 (formerly Chester Arch. and Nat.Hist.Soc.J.
 which is retained in Appendix 1)
J.R.S. Journal of Roman Studies
N.S.J.F.S. North Staffs. Journal of Field Studies

- Phil.Trans.Royal Soc. Philosophical Transactions of the Royal Society
- P.B.N.H.A.F.C. Proceedings of the Bath Natural History and Antiquarian Field Club
- Proc.Soc.Ant. Proceedings of the Society of Antiquaries of London
- P.U.B.S.S. Proceedings of the University of Bristol Speleological Society
- P.U.D.P.S. Proceedings of the University of Durham Philosophical Society
- P.S.A.N.H.S. Proceedings of the Somerset Archaeological and Natural History Society
- Proc.Yorks.Phil.Soc. Proceedings of the Yorkshire Philosophical Society
- Rev.Arch. Revue Archéologique
- R.I.B. Collingwood and Wright (1965)
- T.B.G.A.S. Transactions of the Bristol and Gloucester Archaeological Society
- T.C.W.A.A.S. Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society
- T.S.A.N.H.S. Transactions of the Shropshire Archaeological and Natural History Society
- V.C.H. Derbyshire Haverfield (1905)
- V.C.H. Somerset Haverfield (1906)
- Y.A.J. Yorkshire Archaeological Journal

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Introduction

The intention of this thesis is to examine the evidence, almost exclusively archaeological, for the economy of the upland south Pennines in Roman times. The study area is principally within Derbyshire, North Staffs and West Yorkshire, but also includes small parts of South Yorkshire and Cheshire. Though including lower lying areas in the south and north east it is principally an upland landscape (Fig.1), largely consisting of the white and dark peak areas. Convenient boundaries are provided to the west, east and south by the edges of the Pennines. To the north a rather more arbitrary boundary has been set approximately along the line of the R. Calder.

A number of major Roman sites lay around the periphery of the area, though the upland area itself is sparsely covered with such sites. A number of the peripheral centres are included in Chapter 6 since it is likely that they played some role in the economy of the study area. The study area lies in the so-called 'upland military zone' of Roman Britain, though it can perhaps be regarded as at the extreme southern edge of it. This is reflected in the fact that only two of the major sites, in or on the edge of the area, do not have proven military roles. Indeed, both of these (Buxton and Carsington) have been the subject of speculation in connection with forts.

The evidence for the economy of the area is limited, though some sectors are better represented than others. Excavation, much of it in the last twenty years, has produced considerable amounts of information on a number of the major sites which allows some important aspects of their economic lives to be partly reconstructed. However, it is only in the last few years that more than a handful of rural sites attributable to the Roman period have been located in the south of the study area. The north of the area remains largely barren of such sites. Even in the south little beyond the initial surveying of those known sites has occurred, and considerable problems remain in dating and establishing the function of the majority. Thus, it remains difficult to draw valid conclusions from the rural evidence and at present this sector of the economy is largely the preserve of hypothesis.

The only major industry attributable to the study area is the extraction of lead (and perhaps silver) ore and its processing. The main archaeological evidence for this is the cast and often inscribed blocks, or pigs, in which form the refined lead was transported. Such pigs (all of which are listed in Appendix 1) are known from a number of lead producing areas in Britain. The whole corpus, and other evidence for lead mining, is considered from a number of viewpoints. This has allowed the drawing of a number of

conclusions which may be applied to the south Pennine industry; conclusions not obvious solely from the study of pigs from the area itself.

Despite the evidence of the lead pigs many aspects of the lead extraction industry remain obscure, though it is clear that it was regionally, nationally and imperially important. Therefore, a number of ancient and more recent parallel cases are also considered as comparative evidence to aid in the modelling of some aspects of the structure and significance of the industry within the context of the wider economy. This economy, it is argued, was dominated by lead mining, and by the spa function of Buxton, and perhaps to a lesser extent by military requirements.

All dates are A.D. unless otherwise stated.

Chapter 1: The Natural Resources and Environment

i) Introduction

As already noted the study area has relatively convenient geographical boundaries to the south, east and west with the Calder valley coinciding with the slightly more arbitrary northern limit. Tracts of lower land are present within these boundaries but the area is principally an upland one characterised by limestone and gritstone environments. The significance of the resultant height and shape of the land, and of the climate, and resultant pedology of the area will have had an important effect on the farming regimen of these environments in the Romano-British as much as in any other period. It is a matter of some importance to assess the nature of these natural resources, though the evidence for the climate and soils is limited and often equivocal. Equally the presence of certain natural resources, in particular of lead ores, had a great significance for non-agricultural activities, while the lack of others such as navigable rivers provided significant limits to such factors as the transport system in the area.

ii) Geology

The solid geology of the study area is almost exclusively of Carboniferous age, forming the southern part of the Pennines. They represent a broad monoclinial uplift

with an eastern tilt flanked to the west by large fault zones. The four main rock types represented within it are Carboniferous Limestone, the Millstone Grits, the Lower and Middle Coal Measures and the Carboniferous Limestone Shales. Broadly speaking the Limestone forms an uplifted dome in the south of the area (the 'White Peak') which is bounded by Limestone Shales in a narrow band to the east (the Derwent Valley) with a triangular area in the south east of the study area (including Lower Dove Dale) and a larger extension to the north of the Limestone (the Hope and parts of the upper Don Valley systems). To the south west areas of the Limestone Shales are also included in the area. The Limestones and Limestone Shales are bordered to the east, north, north west and in places to the south west by the Millstone Grits (forming the East Moors and 'Dark Peak'). In the north of the study area these Millstone Grits continue, with the Lower and Middle Coal Measures overlying them in the north east of the area (Fig.2).

The Peak District Limestones are of Lower Carboniferous date and are generally massive, thickly bedded grey stones with distinctive Reef Limestones in Dovedale and the Eyam district (e.g. Wray 1936, 31f). Dark igneous 'toadstones' originating as lava flows, volcanic ashes or dolerite sills occur within them particularly in the Castleton/Millers Dale, Matlock, and Tissington/Kniveton areas. The Limestones are

generally highly permeable and are often highly jointed and faulted. The softer but less permeable Limestone Shales are also of Lower Carboniferous date but were deposited after the Limestones. Their appearance only at the edges of the Limestone is due to their denudation from the Limestone dome but protection by the hard surrounding Gritstones (e.g. Wray 1936, Fig.12).

The Millstone Grit series of gritstones, sandstones and intervening shales and mudstones form a variable group of rocks. The lowest series (series E; Wray 1936, 33ff) include the Edale shales but the third group (series R) are the most widespread with large exposures of groups such as the Mam Tor Sandstone and Kinderscout Grit, the latter having its maximum extent on the northern border of North Derbyshire. The highest group (series G) including the constant and uniform 'Rough Rock' is also present. The Millstone Grits are an Upper Carboniferous formation, as are the Coal Measures, only the Lower and Middle divisions of which occur in the study area. They form part of the extensive York, Derby and Nottingham coalfield and are fine grained silty shales or mudstones with bands of sandstones and of coal.

Only in the extreme south of the study area are later rocks present with a band of glacial drift obscured Triassic

Keuper and Bunter Sandstones now known as the Sherwood Sandstones and Mercia Mudstones (Chisholm et al 1988, 74ff) lying across the southern end of the study area. The drift geology of the study area is not as significant as the solid geology. Although the study area was covered by ice in some glacial periods the southern boundary of the ice sheet in the last (Devensian or Weichselian) glaciation lay immediately north of the area (e.g. Faull and Moorhouse 1981, 36). The Calder valley was important in the ice melt drainage system and laminated peri-glacial clays are present at the Aire/Calder confluence (Wray 1936, 72). However, glacial drift is principally important to the north of the study area (Faull and Moorhouse 1981, 36). Although wind deposited loess is an important parent material for soils on the White Peak Limestone and perhaps on the Eastern Moor Gritstones (below p.10). Head (periglacial solifluction deposits) occurs in some localised areas (e.g. Chisholm et al 1988, Fig.26).

More significant are the alluvial deposits in the study area's river valleys. These are important for the pedology of the north east of the area particularly in the Calder Valley and also in the Derwent, Wye and Dove/Manifold valleys where sands and gravels form heavier soils than in much of the rest of the region. Peat also forms large deposits in much of the study area and these are considered below (p.11).

iii) Physical Geography

The physical geography of the study area is principally dictated by its solid geology, and in some areas such as the Edale Valley by glacial processes. The White Peak Limestone has been reduced to a gently undulating plateau sloping from south to north where it reaches nearly 1,600 ft. (487m) O.D. at Eldon Hill. It is cut by precipitous dales representing the widening of faults and other weaknesses in the rock by solution, weathering and erosion accelerated in some cases by glacial action. The numerous caves known in the Limestone may be attributed to similar processes. The nature of the Limestone also dictates a lack of surface drainage features since it is highly permeable and rivers are mainly restricted to the periphery of the White Peak where streams emerge at the boundary with the less permeable Shales.

The Shale areas in the south of the study area form the main bands of lower land and are easily eroded by the major rivers such as the Derwent which they carry. The main river systems are the Dove and Manifold system which flows south from the south west of the Peak; the Wye valley system which drains the central White Peak and flows east into the Derwent; and the Derwent, rising north of the Peak and flowing south to the east of it to leave the study area and pass through Derby. The erosion resistant rocks of the

gritstone series to the east of the White Peak form the East Moors, plateau areas up to 1,400 ft. (426m) O.D. with near vertical western 'edges' such as Stanage Edge. They also form higher but less continuous upland blocks to the south west.

In the north of the study area the topography is dominated by the moorland upland areas of Gritstone in the west which rise to 2,088 ft. (636m) O.D. at Kinder Scout and the much lower, flatter terrain of the Coal Measures to the east. The Gritstone moors are drained by many small streams flowing from the edges of their plateaux in all directions, and dip gently to the east but fall steeply to the west. Two particularly important passes, the Snake and Woodhead, run east-west across the south of this part of the region. The most important river systems are the Dearne/Don and the Calder, both of which run east through the Coal Measures, drawing their headwaters from the Gritstones to the west. The Calder runs in a steep, narrow valley in the western Gritstones but widens and meanders dropping much alluvial material in its eastern course.

iv) Pedology

Whilst the solid geology and its resulting physical geography are relatively fixed elements in the natural setting of the study area the soils covering them today are

not necessarily those in existence in earlier periods. The development of a soil profile is a complex process combining micro- and macro-climate, solid and drift geology, vegetation and micro- and macro-topography. The differing interactions of these factors may lead to serious changes in soil types over relatively short periods. Moreover, one of the most important effects on any given soil profile in existence today is likely to be the activities of man, often from the Neolithic period onwards. It is not therefore sufficient to establish the present nature of the pedology of the study area and assume that it was similar in the Romano-British period.

Regrettably, as Fisher (1985, 37ff) has emphasised, there is almost no reliable evidence for the nature of past soils in the study area. However, the possibility that the pedological environment of northern England generally was becoming impoverished due to the activities of man (perhaps coupled with the transition to a sub-Atlantic climate (below p.15)) by the late Iron Age has been emphasised by several authorities (e.g. Higham 1986, 119 and 184). For our area this might be reflected in the failure of the Bronze Age expansion of settlement onto Millstone Grit areas to be continued in the Iron Age and Romano-British periods (e.g. Hawke-Smith 1981, 61). This may be particularly so since the assumed absence of loess as a soil parent material on

the Gritstone as opposed to Limestone areas has now been questioned (Fisher 1985, 37ff; though he notes that this in itself may point to a non-pedological cause).

The replacement of soil profiles as such with peat deposits on the Millstone Grit areas in the south west, south east and north west of the study area may also reflect human or climatically induced deterioration in relatively recent times. Peat formation in the Aire/Ribble/Wharfe headwater areas may have been as late as 1619 \pm 60 b.p., placing it in later Roman times (Smith 1986, 12). However, peat formation at Blackstone Edge within the study area appears to be considerably pre-Roman and to have continued subsequent to the construction of the Roman road there (Applebaum 1972, 5). Indeed, Faull and Moorhouse (1981, 47) regard the main period of Pennine blanket peat formation as c.5,500-c.3,000 B.C. Generally the Dark Peak peat deposits should perhaps be regarded as a result of the transition to a sub-Atlantic climate in the Iron Age (Coles 1985, 11f). Yet on the East Moors peat deposition may well not have occurred until the immediate post-Roman period and may have been connected with human induced soil degradation (Coles 1985, 13).

In broad terms the nature of modern soils probably does reflect something of the nature of their ancient counter-

parts. Within the study area a distinction may be made between three broad groups of soils related to solid and drift geology and to drainage. The soils of the White Peak may have been attractive by virtue of their good drainage, lying on Limestone. On the Limestone plateau loess is the dominant parent material and today leaching is the dominant formation process (Fisher 1985, 36). The soils vary from shallow, calcareous brown earths (which Hawke-Smith (1981, 58) suggests have seen little change since the first millenⁿium B.C.) which occur on the central plateau ridge and other crests, to deep loess soils in shallow depressions. These have been acidified and podsolised by prehistoric deforestations, though some have now been reclaimed as rendzinas by modern farming (Hawke-Smith 1981, 58; Fisher 1985; for a more detailed account of these soils see Hawke-Smith 1979, 59ff). However, within this range differences in micro-climate and topography represent many pedological environments and the edge of the plateau may have been of particular pedological as well as micro-climatic importance (below p.194).

The Gritstones flanking the Limestones of the south of the study area and occurring in the north west of the area are likely to have presented a far harsher pedological environment as they do today. Despite Fisher's(1985, 37ff) doubts about the original brown earth form of the Peak

District Gritstone soils, Hawke-Smith (1981, 58) suggests that in the south of the study area shallow sandy soils were created by podsolisation in the second milleniumⁿ B.C. The poorly drained 'head' soils of impermeable shale depressions within the Gritstone are even less likely to have been attractive. The Gritstones of the north west of the study area today carry very significant peat deposits (e.g. Faull and Moorhouse 1981, 38) and even on the higher areas and slopes free of peat they carry stagnohumic gley and stagnopodzol soils (Faull and Moorhouse 1981, 38). The leaching and iron panning responsible for such soils may principally be a function of height and high precipitation and attributable to glacial times, though they appear to have been amenable to arable cultivation in post-Roman times (Faull and Moorhouse 1981, 38).

The third group of soils are more varied, including alluvial deposits on Limestone Shales and the Coal Measures as well as the Coal Measures in general. The Coal Measures of the north east of the study area produce rather acidic brown earths which are usually well drained, though less well drained stagnogleys occur on the shale bands between the gritstones and sandstones (Faull and Moorhouse 1981, 38). Such soils have much in common with those of the adjacent Gritstones in the north west but may have been more attractive because of their lower altitude and consequent

lower precipitation, particularly if manured and limed. Alluvial soils occur in a number of places in the study area in the Calder, Don, Dearne, Derwent and other major river valley systems. As Hawke-Smith (1981, 58) points out such sandy or gravelly soils have been little studied. However, they are in many ways potentially fertile if often heavy and not well drained. Their importance to agriculture in earlier periods seems at the moment to be limited (below p.195), however this may be due to difficulties in surveying them and their potential importance as pasture should not be ignored.

v) Vegetation

The question of the Romano-British vegetation of the area has already been touched on with regard to the presence of peat deposits (above p.11). The study area is assumed to have been widely forested prior to human action and the date of deforestation is an important matter. In mid-Weardale north of the study area clearance appears to have been underway by c.110 b.c. and was perhaps largely complete by the Roman period, though in some areas clearance perhaps continued during Romano-British times (Higham 1986, 118f). Widespread and permanent clearance of the mixed oak forest of the East Moors followed more localised, short lived clearance phases and occurred in the late Iron Age (Coles 1985, 13).

However, as on the Craven Limestone (Smith 1986, 12), clearance of the White Peak is likely to date considerably earlier than that of Gritstone areas. A grassland and coppice environment is indicated here in the Bronze Age and may even reflect a late Neolithic clearance (Hawke-Smith 1981, 58; Coles 1985, 13ff). Thus, it appears that significant clearance of woodlands within much of the study area was primarily a phenomenon of Iron Age or earlier date. Although deforestation may have been a continuing process in some areas, the Romano-British environment was essentially a pre-cleared one. This does not preclude the existence of tracts of primary or regenerated woodlands, perhaps particularly on Gritstone areas such as the East Moors of less agricultural value. However, much of the study area must have been under grass or heath if not cultivated. Again a broad three fold division is likely between open grassland in the White Peak, lusher and richer pasture in river valleys, and heath, moor and areas of peat formation on the Gritstone.

vi) Climate

Along with pedology the climate, both macro and micro, of the study area forms the most important parameter for farming activity. The Romano-British period (and indeed the present day) falls within the climatic phase termed the sub-Atlantic, a generally wetter and cooler phase than the

preceding sub-Boreal. It appears to have begun in the Iron Age c.500-450 B.C. (e.g. Smith 1986, Fig.6; Greene 1986, 82). However, it is clear that within this phase there have been smaller changes in climate which may have had significant effects on agriculture. A warm phase centred c.1200 gave average temperatures some 1°C above those of 1750, allowing the growing season for crops to be extended by several weeks and land to be ploughed profitably at greater altitudes than in subsequent centuries (Greene 1986, 82). The 'Little Ice Age' that followed this warm period seems to have ended some 100 years ago, being followed by a further warming.

Although continuing glacial retreat from the beginning of the sub-Atlantic phase until the beginning of the 'Little Ice Age' seems to suggest that the Roman period might be climatically comparable to the thirteenth century and perhaps to today (Greene 1986, 82), opinions on the point have varied. Applebaum (1972, 5f) felt that the British climate gradually became wetter up to c.500, perhaps being wetter than today. However, more recent views have emphasised the comparability of Roman and modern climates (Higham 1986, 182), perhaps with a temperature peak similar to that of c.1200 in the early Roman period (Greene 1986, 84). Yet within the pre-'Little Ice Age' sub-Atlantic phase variations, at least in precipitation, are likely to

be represented by phases of tree growth in otherwise peat deposition areas (Coles 1985, 12). The establishment of broad climatic trends may have obscured important smaller fluctuations of temperature and rainfall (Greene 1986, 84).

The prevailing climate at present is relatively wet with prevailing westerly winds causing relief rainfall especially on the western side of the study area. The precipitation figures for the area reflect this with the western highlands receiving 1,000-1,200 mm annually with local highs related to topography up to 1,600mm, and a steady decrease to c.700 mm on the eastern edge of the area (Jarvis et al 1984, Fig.6). The accumulated median temperature in day-degrees C for January to June (now the favoured temperature measurement for grass/cereal growth; Jarvis et al 1984, 27ff) varies similarly from 1,150 day-degrees C in the west to 1,250 day-degrees C in the east, with higher figures c.1,350 day-degrees C for the lower land in the north east of the study area (Jarvis et al 1984, Fig.5).

Within this picture there are many micro-climatic variations which probably had significant effects on ancient agriculture, as they do on modern cultivation. In particular variations of topography have an important climatic effect. Valley areas for instance, are liable to frosts resulting

from temperature inversions and valley slope sites avoiding the wind chill of plateau environments (e.g. Makepeace 1985, 95ff). Generally the area is regarded as climatically marginal for cereals, their growth being viable only up to c.350m O.D. (e.g. Hawke-Smith 1981, 58).

vii) Other Resources

Apart from the biotic environment the study area has at least one important natural resource, its mineral deposits. The mineral resources of Derbyshire (e.g. Kirkham 1968, 55ff; Ford and Rieuwertz 1983, 9ff) are contained within veins in the White Peak Limestone and associated basaltic rocks ('toadstones'). The veins take four forms, known as Rakes, Scrins, Flats and Pipes. Rakes and Scrins are vertical ore bodies differing essentially in size. The former are up to 20ft. (6.1m) across and often a mile or more in length, whereas Scrins are only up to 1 ft. (0.3m) wide and about a quarter of a mile long; their depths are unknown but the former have been proved to c.500 ft. (152m) deep. Flats occur parallel to the Limestone bedding planes and so usually horizontally. They may be irregularly shaped and, like Scrins, often branch out of Rakes. Pipes consist of irregular ore filled cavities/caves alongside Rakes. However, except for Flats and Pipes revealed in Limestone cliffs, only Rakes and Scrins are likely to have been known in Roman times, the other types of ore bodies not

having surface outcrops.

The veins consist of crystallised hydrothermal deposits in expanded bedding plains, joints and fissures, often dammed up by toadstones. They consist of lead ore (Galena; PbS), forming up to 10% of the vein though often in lesser percentages; Sphalerite ('Blende' or 'Black Jack;' Zinc Sulphide); Cerussite (Lead Carbonate); Smithsonite ('Calamine;' Zinc Carbonate); and gangue (waste) minerals (Fluorspar, Barytes and Calcite). The latter often form up to 90% of the deposit and today are commercially far more important than the ore minerals. The mineral veins occur over a wide area of the Limestone from Castleton in the north to Brassington in the south and from Buxton in the west to Ashover and Crich in the east. The main vein areas however are west of Matlock and Wirksworth; south and east of Bakewell; and in the Castleton/Tideswell/Stoney Middleton areas (Fig.2; Ford and Rieuwerts 1983, 9). The Galena, yielding 86% metallic lead (Ford and Rieuwerts 1983, 11), was the principal ore mineral extracted prior to the twentieth century, with the zinc minerals extracted to a far lesser extent. Galena also yields small and variable quantities of silver (below p.266). Of more minor economically important mineral resources we may note the almost unique Blue John Fluorspar deposits of the Castleton area, though they may not have been known to the Romans (below p.351).

Stone may have been an important resource in many ways. The hard Gritstones outcropping in much of the area are eminently suited, as their common name, the Millstone Grits, suggests, for producing quernstones. Stone's importance in dry stone walling and in building is also a resource obviating the need for large quantities of timber. Indeed, some of the finer stone from the study area was probably good enough to be quarried and transported some distance in the Roman period (below p.352). Potting clay also occurs in the area, notably around Hazelwood and Holbrook, and was the basis of a small Roman industry (below p.349f). Finally we may note the presence of the hot springs at Buxton which locally were probably a crucial natural resource.

Chapter 2: The Native Iron Age Background

i) Introduction

Very little can be said about the native background of the study area. At least part of it was Brigantian territory, though whether it all was is a matter of debate. The Brigantes are probably the least documented major tribe of Iron Age Britain. Literary sources record almost nothing of use while the archaeological evidence for the tribe, and indeed for the Iron Age in general in the study area, is severely limited. The only major Iron Age site attributable to the Brigantes is Stanwick and recent work has seriously questioned Wheeler's (1954) interpretation of this site.

ii) Tribal Identification

Tacitus (Agricola 17) refers to the Brigantes as 'the most populous (tribe) in the whole province' and Ptolemy (Geography II, 3, 10) says that they 'stretched from sea to sea'. The latter attributes nine centres to them of which the most southerly is probably Slack (Camulodunum) (Rivet and Smith 1981, 295) though Hartley & Fitts (1988, 4) suggest that Rigodunum might be Castleshaw not Ingleborough. Thus, the northern part of the study area may safely be attributed to the Brigantes. However, opinion is divided on whether the rest of the south Pennines should be attributed to them or to the Cornovii or Corieltavi (on the name see

Br. (1983) 14,349ff). Frere (1987, 41), Whitwell (1982, 59), Hart (1981, 81) & Hartley & Fitts (1988, 5) with reservations, attribute the area to the Brigantes, but Rivet (1964, 142) and Makepeace (1985, 48) argue that it was Corieltavian or Cornovian territory.

The evidence on the point is limited. The distribution of Corieltavian coins except for hoards well into Brigantia (Allen 1963, 13ff) does not include the south Pennines, and Hart (1981, 81) concluded that there was no other material to suggest contact with more advanced Iron Age groups. Natural boundaries to the east are provided by the Trent Valley and, perhaps more likely, the Magnesian Limestone ridge. The principal argument against a Brigantian attribution is that the distribution of hill forts and other defensive works seems to allow of the interpretation of a defensive system cutting across the Peak District and down the Rother/Derwent interfluvium, perhaps suggesting Cornovian domination of the area (Makepeace 1985, 48ff). There are problems with this interpretation in that most of the hill forts had in fact been long out of use by the late pre-Roman Iron Age (below p.95) and one important element of the defensive system, the Grey Ditch at Bradwell, is undated and has even, if unconvincingly, been suggested to be post-Roman (O'Neil 1945; but see Dearne 1986, 91f). Webster (1975a, 22) tentatively placed the eastern boundary of the

Cornovii at Wall.

A major problem is that our evidence is mainly retrospective from the Roman period and, as Webster (1975a, 20) notes, it is not at all unlikely that some tribes or sub-tribes of the Iron Age were amalgamated by the Romans and thus are unknown to us. Equally, whether later Roman administrative units in fact reflect the geographical boundaries of the Iron Age tribes is often difficult to say. A case in point is the Severan Civitatis Corielsolilorom known only from a tile graffito (Whitwell 1982, 55). Whether the whole of the study area was in fact part of the same tribal territory is anyway perhaps rather academic since there is no discernible variation in the material culture of the area. The Brigantian 'state' was probably a highly fragmented loose association of population groupings (below), and the term 'Brigantia' probably had little or no geographical significance in pre-Roman times (Rivet and Smith 1981, 278ff). The whole of the study area will therefore be referred to as Brigantian with the caveat that Brigantian may mean little in terms of tribal organisation.

iii) The Nature of Brigantian Tribal Organisation

As already alluded to it seems unlikely that the Brigantes were an organised tribe with a centralised power structure like better known southern tribes (e.g. Hartley

& Fitts 1988, 1). Whilst Cartimandua clearly held some sway over Brigantia and felt that she had sufficient power to contract an alliance with Rome (below p.34) the revolt of 48 and the troubles of 51-69 suggest that there were significant elements of the Brigantes who were not under her control. There are also other pieces of evidence that suggest that the 'tribe' was in fact an association of smaller groupings. Firstly we know a number of names, retrospectively from Roman sources, that seem likely to apply to sub-divisions of the tribe. These are the Tectoverdi (R.I.B. 1695; Rivet and Smith 1981, 470-2); the Setantii (Ptolemy Geography II, 3, 2: Rivet and Smith 1981, 456-7); possibly the ?Lopecares (Rivet and Smith 1981, 322f); the Gabrantovices (if they were not part of the Parisi) Ptolemy Geography II, 3, 4; Rivet and Smith 1981, 364); and the Carvetii who later became an independent civitas (Rivet and Smith 1981, 301).

Secondly we have the evidence of the conquest. Cerialis is said (Tacitus Agricola 17) to have fought a series of bloody battles with the Brigantes, which might be taken to imply that he had to defeat a number of separate groups. Further it is clear from the probable placing of Agricola's second campaign (below p.40) and the Domitianic reference in Juvenal (Satires xiv, 196) that further battles were fought in other parts of Brigantia, again perhaps suggesting

that there were in fact a number of separate entities to defeat. Thirdly we must consider the role of Cartimandua. She is the only possible ruler of all of Brigantia known to us and there are perhaps hints that this was an unusual occurrence. Though Allen's (1963) demonstration that coins from Almondbury were in fact Corieltavian not Brigantian removed any evidence for suggestions that Cartimandua was a Belgic princess (Frere 1987, 54) it is perhaps pertinent to ask how far her power was due to her association with Venutius and then with Rome.

Tacitus calls Venutius 'pre-eminent in military skill' (Annals xii, 40) and from the events leading up to Cerialis' conquest it is clear that he could command a considerable following in Brigantia. Indeed, there can be little doubt that he was an important member of the aristocracy of Brigantia. It is therefore not unlikely that his marriage and early loyalty (clearly implied by Tacitus (Frere 1987, 54)) to Cartimandua was an important part of her power base. Though impossible to prove one wonders with Hartley & Fitts (1988, 2) if this was not a marriage of two royal houses that, perhaps for the first time, brought a degree of central rule to Brigantia.

Subsequently it is clear that Cartimandua relied heavily on Roman support. A number of military interventions culminated in the rescue of Cartimandua. But perhaps as

important is Tacitus' (Histories iii, 45) implication that she gained wealth from helping Rome. This brings us to a fourth piece of evidence, the lack of an administrative centre. There are relatively few Iron Age sites of any great size in Brigantia. Yet, if Cartimandua is to be seen as the last of a number of rulers of a centralised tribe we ought to be able to point to their administrative centre. Though a number of candidates have been suggested for this none are entirely satisfactory. Many favoured Castle Hill, Almondbury, but the site itself does not appear to have been occupied after the fourth century B.C. (Faull and Moorhouse 1981, 116) and the Republican and Corieltavian coins found in the area may not come from the site (Hanson and Campbell 1986, 74). Besides we should require more than hoards that could easily have been hidden in the wake of Roman invasion as proof.

Aldborough, the future capital of the civitas, provides no evidence of earlier occupation and York, though there are pre-Flavian coins and pottery, exhibits no structural remains (Hanson and Campbell 1986, 76). A more recent suggestion is Barwick-in-Elmet (e.g. Ramm 1980, 28ff) but again the only evidence is a Republican and a Claudian coin (Hanson and Campbell 1986, 74). Indeed, there is only one site that has produced sufficient evidence for significant activity immediately before the conquest, let alone

in the earlier late Iron Age, and that is Stanwick (though Hartley & Fitts (1988, 18) would prefer to see Stanwick as Venutian and place Cartimandua in the Vale of York). Wheeler's (1954) interpretation of Stanwick as the site of Venutius' last stand against Rome, whilst still accepted by some (e.g. Frere 1987, 84f), has been seriously questioned (Turnbull 1984; Hanson and Campbell 1986, 77; Haselgrove 1984, 21). Whilst further work is clearly required on the site it is now clear that it may date in its inception to, at least, the 40s and perhaps earlier (Turnbull 1984, 41 & 47). That is before any hint of trouble between Venutius and Cartimandua. Moreover its end is dated to c.75, long after the defeat of Venutius. Turnbull (1984, 43ff) also questions whether it represents a multi-phased enclosure or just a sub-divided single entity.

Nor can Wheeler's evidence for the struggle itself now be accepted without reservation. The south entrance may only be a collapsed rampart, for there is a genuine entrance some 150m away; the slighted phase two ramparts may in fact be naturally collapsed; and the sheathed sword and cloven skull have been suggested to be fallen gate trophies (Turnbull 1984, 43). Perhaps most important though is the amount of high quality Roman pottery and of roofing tile from the relatively small area so far explored. Together with the metalwork hoard this implies that the site was one

of some refinement and one whose owner had contact with Roman culture. Since this is the only such site known in Brigantia it seems very possible that it was in fact Cartimandua's administrative centre, though it should be noted that this does not entirely contradict Wheeler's interpretation. It merely implies that the site was Cartimandua's, and perhaps therefore up to at least 51 also Venutius', base. It does not deny that Venutius may have taken sole possession of it after Cartimandua's rescue by the Romans, and indeed could have made his last stand there. The possibility that the site was in fact contracted not expanded (i.e. that Wheeler's phases two and three should in fact be chronologically reversed; Turnbull 1984, 43) may in fact be an argument for, not against, preparations for military activity.

If Stanwick is indeed Cartimandua's capital, or rather oppidum (Turnbull 1984, 47f), it tends to suggest that she was not just the last of a line of overall rulers of Brigantia but the first and last. There are indications of small ditched enclosures within the site (Turnbull 1984, 45) which might be earlier features but they could equally be contemporary internal structures. Even if the Brigantian Iron Age was late and perhaps largely aceramic (below p.173f), we should expect datable Iron Age material from further south at such a tribal capital if Cartimandua had pre-

decessors.

The evidence therefore seems to be against any centralised control of Brigantia. The alternative is clearly some form of broad alliance or grouping of smaller units, perhaps at least in part through kinship ties. We have no real evidence for exactly what form this may have taken but Haselgrove (1984, 20ff) has outlined one possible scenario. He suggests that the most important groupings were clans consisting of a number of family units, with the clans making up a number of tribes. The leader of each tribe, essentially a mediator and war leader, would rely on the wealth and prestige of his clan for his dominance within the tribe. Each tribe would be based on a lowland area and separated from their neighbours by highland areas. Thus, we might envisage a single tribe in the Hope Valley and another in the Wye Valley. Haselgrove's (1984, 9ff) analysis of the Iron Age economy would suggest that the rise of Cartimandua was a result of an increasing arable element in the farming regimen and would agree with the suggestion above that she was the first overlord of the Brigantes.

iv) The Material Culture and Economy of the Study Area

There is very little trace of Brigantian material culture or economic activity within the study area. No hill

fort in the area is likely to have still been in use in the late Iron Age (below p.95). However, Brigantian hill forts generally are few, small and generally abandoned by the late Iron Age (Hartley and Fitts 1988, 6f). Very few rural sites may be attributed to the period either (below p.172ff). However, a few pallisaded enclosures could represent it (Makepeace 1985, 64; Faull and Moorhouse 1981, 133). Certainly it seems likely that there had been a transition from hill forts to more open settlements, if indeed there were settlements, in or by the late Iron Age (Makepeace 1985, 63). Only very limited numbers of finds of Iron Age material have been made, notably in the caves in the south of the study area. A little early Iron Age pottery is known from sites in the north of the area (Faull and Moorhouse 1981, 131), while the southern part is slightly better represented. Isolated finds of ?Hallstatt C and D, possibly Middle La Tene and Late La Tene wares, often from cave sites, have come from the latter (Makepeace 1985, 56f).

Iron Age metalwork is almost totally absent from the study area, as in much of Brigantia (Hartley and Fitts 1988, 6). Most of the limited number of quality metalwork finds from West Yorkshire (Faull and Moorhouse 1981, 131f) lie outside the present study area. Slightly more items are known from the south, mainly from caves, of which the coral inlaid brooch from Harborough Cave (Storrs-Fox and Smith 1908) and

the chariot wheel hub (Brown 1864, Plate 8) from Thor's Cave may be particularly mentioned. The bias of beehive quern distribution towards Romano-British sites in the south of the study area has led to suggestions that the Iron Age occurred late in the area (Makepeace 1985, 58). Whether that was the case or not it seems at present that the immediately pre-Roman period was one of abandonment or stagnation. This picture is beginning to change a little in the rest of Brigantia (Hartley and Fitts 1988, 8) and remains to be tested by further excavation within the present study area (see further below p.172ff), yet on present evidence any population must have been very scattered, perhaps aceramic and essentially of undeveloped character. Few influences of the more developed Belgic and Belgic-derivative cultures further south and east are detectable in Brigantia (Hartley and Fitts 1988, 6 and 13). As suggested above this scenario may have begun to change immediately before the conquest with increasing arable farming and one or two brooches from our area may represent activity at this period (e.g. Thirst House Cave: Branigan and Dearne forthcoming No.2.1; Staden:Makepeace 1987, Fig.6 No.1).

The economy of any pre-Roman population is difficult to gauge. There is no evidence for activities other than farming. Pastoralism is likely to have been dominant, perhaps with a transhumance element from outside the area,

though the significance and date of an arable expansion remains uncertain (below p.200§). There is no evidence for the use of coinage, though the hoards in the Almondbury area (north of the study area) may suggest a limited penetration of Corieltavian coinage into Brigantia generally. Some form of socially embedded exchange mechanism such as aristocratic gift giving is perhaps to be envisaged though there is little evidence (cf. Hartley and Fitts 1988, 11). The problems of establishing the size and nature of the Iron Age rural economy are examined further in Chapter 7.

Chapter 3: The Historical Context

i) Introduction

The ^{literary} evidence for the military and civil history of the study area is extremely limited. With the exception of Tacitus' (Agricola) account of the events leading up to the conquest of Brigantia (in which at least part of the study area lay; above p.21f) literary references to the area, or rather to Brigantian territory in general, are sparse (Breeze and Dobson 1985, 3). There are also few epigraphic texts of use, and the most important of these (R.I.B. 1322) is the subject of some controversy (Wilkes 1985; Frere 1986). The archaeological evidence, relating principally to the occupation dates of military installations, is rather fuller but leaves considerable areas of doubt and can rarely be called upon to give more than broad dates.

Whilst it is clear that what we know of the history of the study area must be seen in the context of the history of the rest of the province it seems unlikely that, with the exception of possible revolts, particularly in the mid-second century, it played a major part in the political and military history of the province after its conquest. Its civil history is almost totally unknown, and indeed how much of the study area was part of Brigantia, either the Iron Age tribal territory or the Roman civitas, remains uncertain.

ii) The Conquest of the Area

Brigantia, which we must take as including the whole of our study area though the term has no real geographical meaning (Hartley 1966, 7), first appears in the story of Roman Britain in 48 (Tacitus Annales xii, 32). Its queen, Cartimandua, is not mentioned until 51 (Tacitus Annales xii, 36) but seems likely to have been in power as early as 43 (Hanson and Campbell 1986, 73; Frere 1987, 54). She had entered into an alliance with Rome no later than 47 when the Roman line of advance ran along the R. Trent (Hanson and Campbell 1986, 54). Although Cartimandua may not have been technically a client queen (Hanson and Campbell 1986, 73) it is clear that in effect Brigantia was acting as a buffer state between Rome and the north of Britain. Despite a minor revolt in 48 precipitated by Ostorius Scapula's move towards the Cheshire gap it is clear that at this time the pro-Roman party led by Cartimandua was in the ascendancy in, if not in full control of, the broad tribal confederacy that was Brigantia. The revolt was crushed with Roman aid.

In 51 the defeated British leader Caratacus fled to Brigantia but was handed over to the Romans by Cartimandua (Tacitus Annales xii, 36; Historia iii, 45). This may have been the point at which Venutius, Cartimandua's consort, joined the anti-Roman party amongst the Brigantes. However, Hanson and Campbell (1986, 77-9) have argued that Tacitus

Annales xii, 40 and Historia iii, 45 in fact record a single split between the two in 69 and not a protracted struggle from 51 onwards. Whatever the precise details it is clear that, in addition to their advances into the territory of the Parisi to the east (whose exact relationship to the Brigantes cannot be certain (Hartley 1966, 9f)), the Roman army established bases in the Trent Valley in the pre-Flavian period and in the Rother Valley, perhaps just on the edge of Brigantia, in the 50s. The fort at Templeborough is dated to the governorship of Didius Gallus (54-7) (May 1922, 6; Simpson 1973, 84) while the fort at Chesterfield is Claudian or Neronian (Br. 7 (1976), 322; Br. 9 (1978), 430ff). Whether the little explored site at Pentrich has a pre-Flavian origin is not known but the fact that the known Flavian fort lies within a much larger fort shaped enclosure (St. Joseph 1953, 87) might indicate earlier activity. These sites form a defensive cordon, presumably against Brigantia, of which the southern representative is the Strutt's Park, Derby fort dated to the early 50s (Dool 1985a, 25). The dating of this cordon probably supports the dating of the Cartimandua/Venutius split to 51.

This defensive screen around the south Pennines may have continued to the west and have included sites such as Rocester (where two pre-Flavian forts are now known; Cleary

and Ferris 1988), Trent Vale and temporary camps at Astbury and Hogg (Jones, G.D.B. 1968, 2ff). Indeed, Wroe (1982) has suggested that a road and fort remain to be discovered between Chesterton (the successor to Trent Vale) and Manchester. This cordon might have stretched as far as Chester (Hanson and Campbell 1986, 82) but much work is yet required before its certain existence, let alone chronology, can be established. (See on the whole question of the advance in the E. midlands before 72 Carrington 1986). East of this auxiliary cordon there is evidence of a number of vexillation fortresses along the Trent Valley in pre-Flavian times. Again much work is required to define their exact relationships but Hanson and Campbell (1986, 80ff) suggest that those at Osmanthorpe, Broxtowe and Newton-on-Trent represent a line set up to watch over Brigantia with Rossington Bridge as an advanced post, perhaps connected to aiding Cartimandua against Venutius.

The conventional view of Tacitus' account of the events up to 69 (e.g. Frere 1987, 82) is to see continuing dynastic strife between Venutius and Cartimandua, who took as her new consort Venutius' former squire Velloctatus, with the Romans intervening when necessary and Venutius biding his time until the Roman forces were otherwise preoccupied. Whether this is the correct interpretation or not, and the evidence for a military presence in the Rother Valley in the early

50s may suggest that it is, it is agreed that the crucial events happened in 69 when the Roman empire was in the throes of dynastic conflict. The governor at the time, Vettius Bolanus, was forced to intervene, though he could do no more than rescue Cartimandua (Tacitus Historia iii, 45), leaving hostile elements in charge of the former buffer state.

From this point on the conquest of Brigantia must have become an inevitable necessity if the province of Britain were to be held. The exact details of the conquest are difficult to ascertain from the limited accounts in Tacitus and the inexact dating evidence from the relevant forts. Bolanus may already have been active at least in the north east in the territory of the Parisi (Frere 1987, 83), though exactly what is implied by the eulogistic remarks of Statius (Silvae V, ii) it is impossible to say. However, that Bolanus could only rescue Cartimandua implies that any significant campaigning in the Pennines must be attributed to later governors.

The appointment of Petillius Cerialis as the next governor marks a decision to pursue a forward policy in the province. He was clearly an able and proven soldier (e.g. Birley 1973) and it is therefore regrettable that Tacitus (Agricola 17) says so little of his activities. From what he does say it is clear that he conquered much of Brigantia,

yet archaeological traces of this conquest are hard to find. The marching camps across the Stainmore Pass, activity at Malton, York, Carlisle and Hayton is perhaps to be attributed to him (Frere 1987, 84; Salway 1984, 136). But significant doubts have been raised about Wheeler's attribution of the site of Stanwick to Venutius' last stand against Rome (see the discussion in Chapter 2). Certainly it seems likely that Cerialis was enclosing the southern Pennines in a pincer movement with his own forces crossing Stainmore and those under his deputy, Agricola, moving up the west side of the Pennines (Salway 1984, 136).

It is possible that Cerialis (and or his successor Julius Frontinus) may have reconnoitered as far north as 'the Caledonian Forest' (Hanson and Campbell 1986, 87f), and indeed Hartley & Fitts (1988, 18f) would see him defeating Venutius both in the Vale of York and at Stanwick. But the important question for us is whether he took any steps towards the consolidation of his presumed conquests in the Pennines. As yet there is no archaeological evidence to suggest that any Pennine forts are Cerialian and it is probably unlikely that he had the time or manpower to consolidate as well as conquer the area in his brief governorship.

Conventionally most of the consolidation, and therefore

fort and road building, is attributed to Julius Agricola, the governor from 78 to 84. However, much debate surrounds both the placing of Agricola's campaigns and the role of his predecessor Frontinus (and indeed his successors) in the consolidation. All we know for certain of Frontinus is the bare remarks of Tacitus in the Agricola (17). That he subdued the Silures (and probably other Welsh tribes as well (Frere 1987, 87)) is clear. It is unlikely that he campaigned outside Wales since there was evidently still work to do there in Agricola's first year (Tacitus Agricola 18), though Hanson and Campbell (1986, 88) argue that he might have campaigned from Carlisle. However, that some of the consolidation in terms of fort and road building in the Pennines was done under Frontinus, a noted builder and administrator (Frere 1987, 87), is possible. Indeed, as Hanson and Campbell (1986, 89) & Hanson (1987, 64) point out, if all the forts at present regarded as Agricolan foundations are such there is a problem in terms of the size of the campaigning force that he would have had at his disposal.

In the absence of literary or epigraphic testimony on this point we are reliant on archaeology, a tool that cannot be relied upon to differentiate in many cases between a foundation date of 74/5 and 79 (to when Agricola's consolidation of Brigantia is usually dated; but see further below).

Thus, it is possible that some Pennine forts might be Frontinian (or indeed might have been founded c.86-7 after the withdrawal from the Forth-Clyde line). Perhaps as likely a candidate as any on strategic grounds for a Frontinian origin is Brough-on-Noe, dominating the most southerly Pennine pass (Jones, G.D.B. 1966, 6). It also now seems likely that Castleford was a Frontinian foundation (Abramson 1988, 44).

Agricola's second campaign in 79 (Tacitus Agricola, 20) is problematic in that we do not know with any precision where he was operating. He may have been completing the conquest of the Brigantes, facing new tribes (or sub-tribes of the Brigantes) or both. The latest re-evaluation (Hanson 1987, 65) suggests that he was operating in northern Brigantia. However, our concern is with southern Brigantia and it seems unlikely that this area saw major campaigning. We must therefore regard the conquest of the southern Pennines as complete, if not necessarily entirely consolidated, by 79. Clearly, even if some consolidation had taken place under Frontinius, much of the fort and road building in the study area must be attributed to Agricola. It can hardly have happened overnight and we can probably envisage work continuing well into the 80s (and perhaps in some cases not even being started until c.86-7). Indeed, that some 'mopping up' was still necessary in Brigantia, albeit probably in the

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northern parts, is indicated by Juvenal's (Satires xiv, 196) reference to the storming of hill forts and the taking of a British king.

ii) Subsequent History

If the details of the conquest of Brigantia are confused its subsequent history is almost completely obscure, and the part of the south Pennines in the few events that we do have some evidence for can only be guessed at. It must be presumed that the whole of Brigantia was organised into a civitas at some point after the conquest. Though since we are uncertain whether the whole of the study area was part of tribal Brigantia we cannot be certain that it was entirely part of the civitas Brigantium. Indeed, we cannot be certain what the relationship between the civil and military authorities was. The study area was extensively fortified up to Hadrian's time and much power must have been in military hands in effect, even if Frere (1987, 193) is right to deny actual military administration.

Unrest evidently continued in Brigantia for there was war in Britain on the accession of Hadrian in 117 and it seems most likely that it was the Brigantes and their allies the Selgovae and Novantae of southern Scotland who were in revolt (Frere 1987, 111; Salway 1984, 173). However, the implication of this must be that it was the north not south

of Brigantia that was involved. Indeed, many of the garrisons in and around the study area were removed or reduced under Hadrian (Slack reduced to less than a cohort c.122/5; Castleshaw, already reduced to a fortlet c.100, abandoned ?c.120; Brough abandoned c.120; Manchester abandoned c.110/25; Chesterfield abandoned c.120/30; and Derby, Castleford, ?Pentrich and perhaps Buxton, if a fort ever existed there, having already been abandoned; cf. Chapter 6 p.95ff). This implies that there was no significant unrest in the study area. These forts would hardly have been decommissioned with the important Derbyshire lead field, by now probably in full production and under imperial control (Chapter 8, p.235), if there had been any suggestion of trouble.

Further troop removals followed, probably to provide garrisons for the Antonine Wall (Slack abandoned c.140/60; Melandra abandoned c.140; cf. Chapter 6, p.95ff). However, this brings us to the question of whether there was a serious Brigantian revolt c.154. The evidence for this is both limited and its implications debated. Pausanias (Graec.descr. viii, 43, 4), talking of the reign of Antoninus Pius but giving no exact date, says that he:

deprived the Brigantes in Britain of most of their land because they ... had begun aggression on the district of Genunia whose inhabitants are subject to Rome.

Wilkes (1985, 295, n.8) has noted that the passage could refer not to a Brigantian revolt but to Antoninus' advance into Scotland, the aggressors being a small part of the Brigantes beyond Hadrian's Wall and the confiscated territory being lowland Scotland. It has also been suggested (Wilkes 1985, 295, n.8) that Pausanias might have confused the British Brigantes with the Brigantii of Raetia who were indeed bordered by a tribe called the Genauni. This tribal name is not known in Britain, though Birley (1973, 188, n.48) has suggested that it might in fact be a corruption of Venutian (also unknown) and apply to the future civitas Carvetii. Frere (1987, 133 and n.8) concludes that it is more likely to refer to the taking of lowland Scotland and that the term Brigantes was being used imprecisely to include all the peoples of northern Britain, not just the Brigantes proper (even if the land confiscation may refer to areas south of Hadrian's Wall being returned to military government for a time).

Whether the remarks of Pausanias refer to Britain or Raetia, and if they refer to Britain whether they apply to the cause of (or rather excuse for) Antoninus' conquest of southern Scotland or to a Brigantian revolt c.154 that forced him to pull back his troops it is impossible to say for certain, though perhaps Frere's analysis is the most likely. Therefore the reality or otherwise of the Brigantian

revolt must be tested on other evidence. This consists of coin types, one inscription and a number of deductions from the abandonment and reoccupation of forts.

The subdued character of Britannia on the reverse of coins of 154/5 can hardly be taken as evidence for a Brigantian revolt. It could equally well reflect setbacks in southern Scotland. The inscription (R.I.B. 1322) is problematic since the reading is debated. Wilkes (1985) has recently argued that it should be read as recording the dispatch of legionary reinforcements to Germany. However, Frere (1986) has argued that the formerly accepted reading, recording legionary reinforcements arriving from Germany, should be retained. It is clear from archaeological evidence that the taking of southern Scotland as far as the Antonine Wall was short lived and ended abruptly 154/8 with the forts north of Hadrian's Wall being abandoned and demolished. The forces so released recommissioned Hadrian's Wall and a number of forts in the hinterland, including in our area Brough-on-Noe (cf. R.I.B. 203). The problem is whether this indicates trouble in the rear (the Brigantian revolt) or serious defeat in southern Scotland. It clearly does not indicate an unforced withdrawal for within a year or so Roman forces returned to the Antonine Wall.

The Brigantian revolt scenario perhaps has a little more to commend it than the Scottish defeat alternative

(e.g. Hartley & Fitts 1988, 27f). The reoccupation of forts like Brough would have been a natural concomitant of the evacuation of Scotland since the spare manpower would have to be placed somewhere. However, the continued garrisoning of Brough, and for instance from 160 of Manchester (Chapter 6, p.100), after the move back to Scotland does suggest that some miscalculation had been made in leaving the Pennines so undermanned. Whether the garrisoning of Brough indicates that the south Pennines was involved in this revolt is difficult to say. It may be that the concern was with the trans-Pennine route (or the safety of the lead industry) as much with the actual area for there seems to be suggestions that it was west of the Pennines that was felt particularly likely to be troublesome (Frere 1987, 145; Hartley & Fitts 1988, 26).

Indeed the pattern of forts in northern Britain from the later second century on (Breeze and Dobson 1985 figs. 7-10) clearly shows that it was the northern and particularly the north western parts of Brigantia that were of concern to the administration. Further revolts are likely after the final abandonment of the Antonine wall c.163, demonstrating that holding both northern Britain and Wales and lowland Scotland was indeed too great a task for the available forces. We have little evidence for which areas were involved in these troubles. Wales perhaps in 169

(Frere 1987, 146) and probably the Hadrian's Wall region in 181-4/5 (Frere 1987, 147).

Almost inevitably there was probably further trouble when Clodius Albinus stripped the British garrison in his bid for the purple in 194-7. Again whether these troubles affected the study area is not certain but the fact that fort destruction deposits as far south as Ilkley seem likely to relate to this period (Frere 1987, 156; Hartley & Fitts 1988, 30) probably suggests that they did. Though the emergency seems largely to have been confined to forts it may have been prolonged since Hadrian's Wall was not restored for eight years. However, it may be that a punitive raid into Scotland was in progress (Frere 1987, 156f). Peace was eventually restored and was to last some time.

It is at this point that Britain was divided into two provinces (Herodian iii, 8, 2), Britannia Superior and Inferior. The details of the date and nature of the division are debated (e.g. Frere 1987, 162ff) but the study area seems to have been in Britannia Inferior (Salway 1984, Map 7). Little more of direct relevance to the study area is known in the third century. For a time Britain was part of the breakaway Imperium Galliarum, and later in 286/7-96 was an independent entity. The emphasis of military problems shifted from the north to the south with

the rise of raids on the Saxon Shore. As throughout the empire, this was a time of raging inflation. On his restoration of Britain to the empire in 296 Constantius further divided Britain, into four provinces. The border between Flavia Caesariensis (to the south) and Britannia Secunda probably passed through the study area (Salway 1984, Map 7).

It has been suggested that the later third, rather than the later fourth, century saw a running down of the size of the military force in Britain (James 1984). Whether this is so or not there is no evidence that it affected the study area. Indeed the only development for which we have evidence in the military sphere is the hurried rebuilding of the fort at Templeborough in the later third century (Chapter 6, p.103). If this represents the reaction to troubles or the threat of them they are absent from historical sources. Indeed, though the sources are scanty, there is little recorded that might apply to the south Pennines during the later Roman period. Constans' visit in 343 appears to have been to deal with problems on the Saxon Shore and north of Hadrian's Wall (Frere 1987, 337). The usurpation of Magnentius in 350-1 no doubt stripped the British garrison of manpower again and no doubt explains the troubles of the following decade and a half. But up to 367 there is no reason to think that the south Pennines were

seriously affected by these. It is probable that the Barbarica Conspiratio of 367 and the resulting desertion and brigandage had some effect on the whole of northern Britain. Though Hartley and Fitts (1988, 109ff) would see the trouble in the south not north. The area was by now without any garrison, Brough having been abandoned at some time before 360 (Chapter 6, p.97), and Templeborough was perhaps abandoned around this time, leaving only Manchester still garrisoned of the forts on the periphery of the area.

The restoration of order by Theodosius in 368-9 was to be the last of any duration. Subsequent troop withdrawals and dynastic struggles allowed increasing barbarian incursions, perhaps mainly on the south by sea, to go unchecked apart from one expedition ordered by Stilicho in 396-8. Denuded of troops and with the central government preoccupied by barbarian incursions elsewhere in the empire Britain was allowed to slip away from the Roman world. The study area, if it had not already, may then have reverted to something more akin to its pre-Roman nature like much of upland Brigantia (Hartley & Fitts 1988, 115).

Chapter 4: Population

i) Introduction

Estimates of the population of Roman Britain as a whole vary greatly and have in recent years been subject to considerable upward revision (Salway 1984, 542ff). Frere's (1987, 301f) latest estimate for the end of the second century is almost 3 million, which he notes is far greater than Collingwood or his own earlier estimates. Salway (1984, 542ff) suggests a much higher figure around 4-6 million based on the extrapolation of local studies. The revisions are due mainly to realisations that rural population estimates were grossly low, and seem likely to continue for some time. It is anyway unlikely that more than extremely crude population estimates will ever be available from archaeological evidence. The difficulties of establishing population densities at given points in time, particularly in the rural sector where the majority of the population lived but where relatively few sites have been excavated let alone produced reliable site chronologies, are largely insoluble. Approximate figures for urban areas and the military presence at given dates can be given, though again new discoveries are likely to necessitate revisions. But ultimately the best hope for assessing the overall population of Roman Britain is probably the collation of individual estimates for small areas.

ii) Problems and Criteria for Assessing S. Pennine Population

There are a number of serious obstacles to arriving at a reliable population figure for the study area. Firstly, as already noted, the majority of the population of Roman Britain lived in the rural sector, and this is likely to be true particularly for areas such as the south Pennines where few urban areas are known. Until recently this rural settlement in our area was limited to a handful of open sites plus a number of cave deposits (below p.167ff). Although far more open sites are now known there are serious problems in certainly assigning a Roman date to many, let alone actually demonstrating that they were in use at a given date within the period. Moreover some reassessments now suggest that the known cave 'habitation' was in fact an adjunct to open sites (below p.199). A further serious problem, even where activity at a site can be demonstrated at a particular point in time, is assessing whether the site is indeed occupational and if so what percentage of it was occupied. The small enclosures typical of upland settlement in the area (along with various types of field systems) may as often represent small fields or paddocks as house sites and it is rarely possible to differentiate without excavation (below p.193ff).

Even where this is possible we are frequently faced with a number of likely house sites that may or may not

have been used contemporarily. Again only excavation, little of which has occurred, is at all likely to solve these problems and the sites so far excavated suggest that the infrequency of datable finds allows of little hope of precision. Even were these problems not present we would be faced with a situation where a great number of further sites may await discovery or have been totally destroyed in the south of the area (Makepeace 1985, 151). Equally, their almost total absence in the north of the area could be due to a lack of archaeological work and the presence of modern urban areas (below p.167f).

Secondly, there is the problem of Romano-British urban areas. Five 'urban' or semi-urban areas are known actually within the study area but our knowledge of them varies considerably. At Melandra the extent of the site is relatively well established and at Brough excavation allows a good informed guess. However, at Slack we have only a maximum figure for the area settled given by the 'annex' defences which could include elements other than civil settlement. At Carsington the size of the settlement is obscure, and at Buxton only a scatter of objects gives any indication (for details see below p.95ff). Even were we to be able to reliably assess the extent of these sites there are considerable question marks regarding the density of buildings and the population densities that they

represent (some structures possibly being partly or wholly non-residential) (Dearne, forthcoming b; below p.136f). Even then, much as in the rural sector, there is the possibility that further major sites remain to be discovered, for instance in the Eyam area (Makepeace, 1985, 80).

Only one category of site can have its population reasonably accurately assessed, the military installations. Even here there must be some elements of doubt. Thus for instance the size of the fort at Brough at given dates and the nature and therefore size of the garrison is in question (Dearne 1986, 94).

Given these extreme limitations it is clear that any estimates of population must be very tentative and crude with large percentages of error, and almost certainly open to considerable future revision. In these circumstances it seems best to try and arrive at a maximum figure for the sites at present known and then suggest the sort of scale by which they would be reduced by the minimising factors discussed above. The exercise will be attempted for the late second century, though the date is largely arbitrary, having almost no effect on the rural sector since there is no precision of dating here.

iii) The Population of the S. Pennines

a) Military

By the late second century only one fort within the study area was still occupied, Brough-on-Noe (Navio). At this date the fort was in Jones and Wild's (1969) phase 2 a/b and may have had a mounted element (Dearne 1986, 94). The garrison size is debatable (e.g. Hart 1981, 87) but may have been less than a full cohort (480-500 men). However, the figure of 500 men will be taken as a maximum.

b) Urban and Quasi-Urban

Only three Urban or Quasi-Urban centres seem to have been occupied by the late second century, the military vicus at Brough, the town at Buxton and the Carsington settlement. Of the excavated parts of the Brough vicus four out of five sites seem to have been occupied at this time, the exception being the site outside the south east gate (Bishop et al forthcoming). To the south west there was activity, though not necessarily occupation (Branigan and Dearne in prep.), while the three sites towards the south east edge of the vicus (Lane 1973; Drage forthcoming) are probably best interpreted as occupation sites. This probably suggests a maximum area somewhat over 2.5 hectares. There are few indications of the density of buildings within this area, the only excavated site to have produced relevant and reliable information being the 1984 excavations (Drage forthcoming) on the edge of the vicus. Here up to three buildings at different times lay in an area of

c.189 m² (i.e. a density of one building per 63 m²). If extrapolated this would give somewhere around four hundred buildings in the c.2.5 hectares. It is difficult to say what average occupation density should be assigned to the buildings. Some of the largest would be unoccupied such as the military baths (for their probable location see Dearne 1986, 98ff) and it is possible that there were other non-residential buildings as at Manchester (Jones and Grealey 1974, building C p.49f and 125). Yet it is a reasonable assumption that the majority were 'strip buildings' probably used for both domestic and commercial functions as known at many vici (Sommer 1984, 49ff).

Taking such factors into consideration a guess at the average occupation density of a building would be 2-3 persons. This might give a figure around 800-1,200 for the vicus' population. This would be in the same area as Birley's (1977, 72) estimates for Chesterholm vicus II, which however covers only some 1 hectare (Sommer 1984, fig.7). Sommer (1984, 33) would at least halve Birley's figures for this and other vici. This would be more in line with the figures suggested in Chapter 6 (p.147ff) for the theoretical numbers that could be supported by the known grain equivalents of army pay scales (perhaps a maximum of just over six hundred if there was a full cohort at Brough). Further factors that may have affected the figures, such as the

presence of military contract craftsmen, are discussed in Chapter 6. It would seem therefore that, accepting the fact that there is a very considerable divergence of opinion about population levels in military vici, a figure of c.1,200 represents a maximum for the civil settlement at Brough.

If anything the other two major settlements are even more problematic. For Buxton we have almost no information. The distribution of finds at the site (Hart 1981, fig.8.5) perhaps suggests an area of somewhere over 1 hectare for the settlement, if it was constrained south of the R. Wye. At least some of this area was taken up with baths (below p.98), but beyond this there is no evidence for building, let alone population, density. Indeed, given Buxton's probable spa function (below p.160) it is possible that many buildings could have housed temporary visitors not a permanent population. A pure guess must be made that the present find distribution represents the extent of the site and that the population density was similar to the maximum suggested for Brough. This would give a figure in the region of 500 people.

Carsington appears to cover some 2.4-3.2 hectares (Branigan 1985, 41). Six to eight buildings are known, up to 15 x 18 m in size but more detailed information on their density is not yet available. Even if the buildings here,

as this maximum figure suggests, were bigger than those normally found in military vici, we do not know how representative the excavated examples were. Again there seems little choice but to take as a maximum a figure based on 3.2 hectares at the same density of population as the maximum at Brough. That would give over 1,500 which it must be suspected is too high but which must serve for the time being.

c) Rural

The very considerable problems of establishing a population density for rural settlements have already been outlined and to attempt to establish a maximum figure is fraught with difficulty and qualification. The distribution maps of known and possible rural settlements probably of Romano-British date published by Makepeace (1985, fig.30-34) cover the present study area as far north as the moorlands forming the headwaters of the Derwent river. They suggest 87 sites in the 97,643 hectare area, an average density of 1 per 1122 hectares (though the actual density varies greatly from 1 per 717 hectares in the Wye Valley to 1 per 9065 hectares in the middle Derwent Valley area). A further 18 cave sites of this date may be added since they could form separate occupation sites, bringing the density to 1 site per 930 hectares.

The nature of these sites vary greatly from those with only one or two possible habitation enclosures (e.g. Bradwell Dale (Makepeace 1985, 135)) to large settlements with nucleated 'villages' (e.g. Pilsbury-Banktop (Makepeace 1985, 132ff)). The thirty eight sites that were well enough preserved for Makepeace (1985, 130ff and fig. refs. therein) to describe and plan in detail contain at least 156 small enclosures that could, in the present author's opinion, contain houses. In reality only a proportion of them will actually have been habitation enclosures since many are likely to represent such functions as paddocks, small animal pens, barns or even small scale industrial areas. But it is frequently difficult to differentiate one from the other without excavation. The figure of 156 house sites at 38 settlements would however give an average of 4.1 house sites per settlement which may, considering that a number of the 38 sites are likely to be at least partly damaged or unrecorded, not be too far from a realistic figure. If this were the case we should be dealing with some 356 houses over the whole area. Assuming that each housed a nuclear family of 4-5 people, for they are rarely big enough to provide accommodation for an extended family (which is likely to be one of the factors in the scarcity of sites with only one habitation enclosure), this would give a population of 1,424-1,780. If the 18 cave sites are similarly regarded (though, if

habitation sites, there is perhaps a greater chance here that extended families were involved) the figures rise to 1,496-1,870.

A similar exercise is not possible for the northern part of the present study area. The two or three known sites are very unlikely to represent the total rural settlement of the area (below p.188). But without further information it would be unwise to speculate on what the real figures should be. Nor would it be justified to simply extrapolate the figures for the south of the study area.

d) Discussion

Taking all the maxima arrived at a figure of 5,570 is reached. This figure can only be thought of as even a very crude estimate for the area south of the Derwent headwaters, not for the study area as a whole for the lack of field work further north, where at this date no major sites were in occupation, prevents any opinion being formed. Clearly there are many factors that could act to minimise this figure. The uncertainty about the population of vici has already been discussed and similar arguments could be advanced for the other civil urban areas perhaps to the extent of halving the figures suggested for all three instances (a reduction in the total population of 1,600). For the rural sector the greatest minimising factor is probably that many of the small enclosures were not

habitation sites, followed closely by the suspicion that at many sites habitation sites were not in contemporary use. By what percentage these factors could reduce the estimates is difficult to say, but it may well be that 50% is again not an improbable figure (thus revising down the total to 3,035).

At least one probable sector of the population is unlikely to be represented here, except perhaps in part by the figure for Carsington, that is the lead mining community. More importantly the indications from pottery distribution etc. from both the south and the north of the study area are that a considerable number of rural settlements remain to be discovered or have been destroyed (below p.168). Therefore, it may well be that even a figure around five and a half thousand people is too low. However, on present evidence this must stand as a maximum figure for the known population indicators in the study area.

Chapter 5: Transport & Communications

i) Introduction

The functioning of almost any economy above subsistence level is reliant in part on the availability of suitable communication routes and modes of transport. In a modern context the cost, speed, reliability and scale of transport available play a large part in determining the success of an economy. How far this was also true in the economy of the Roman s. Pennines is an important question for it may be that, particularly for the army, purely economic considerations may not have been pre-eminent. Tactical considerations, for instance, may have outweighed financial ones. However, the transportation element in a number of areas of the economy, particularly the lead industry and army supply, must be regarded as significant.

Our evidence for the communications network both towards and within the area is likely to be far from complete but does allow us to draw a relatively detailed picture of its nature and extent. The road network, though a number of questions remain over possible but unproven routes, includes well established roads providing trans-Pennine and, in the south of the area, inter-settlement, communications (Margary 1973, 360ff; Wroe 1982; Hart 1981, 90ff). These are likely to have been supplemented by numbers of trackways, the identification of which is, however, problematic.

There is no evidence for the use of water transport within the study area though river transport on the Trent and Humber may have been important in communications routes towards the area. There is virtually no evidence within the area for the modes of transport in use and we are principally dependent here on parallel evidence from elsewhere in the empire.

It is clear that the communications network within the area was most easily accessed from and mainly intended to link to sites around the southern margins of the area (Fig.1). It consisted entirely of roads and tracks and the road element at least shows a distinct bias towards the south of the area, a fact which may indicate economic disparities between north and south.

ii) The Geographical Constraints

The communications of the study area were in part dictated by its physical geography. Most notably the lack of navigable rivers dictated the preponderance of terrestrial forms of transport. The presence of much highland, often rising steeply from the surrounding lower areas, limited the number of points of access to the area, particularly on the west and in the south east. The height of the land, and deeply dissected, steep sided nature of many of the river valleys in the central and western parts of the area, meant that the routes of many of the major roads were

restricted to major valleys such as the Hope and Woodlands. However, the lower, gentler landscape of the south of the area provided fewer constraints and the more level landscape of the north east provided considerable, though apparently largely unutilised, scope for communication routes.

It is clear, however, that the nature of the road network was not primarily dictated by geographical considerations. The Brough-Buxton road (Margary No.710a) heads straight across Bradwell Moor, making the steep climb up to it along Smalldale, rather than take the easier course around it. The lack of major roads in the north east of the area had little to do with the terrain, which is more suited to road construction than much of the rest of the area. Major natural communication routes such as the Wye and lower Derwent valleys were never utilised. Thus, though the influence of geomorphology is clear in the detailed planning of the major roads, the presence or absence of communications routes is clearly more a function of the military and economic needs of the road builders than of the terrain with which they were faced.

iii) Pre-Roman Communications

The pre-Roman communications of the study area are likely to have been based on trackways, some of which were probably re-used by Roman engineers (Cockerton 1953, 68),

and natural communication channels such as the Hope, Don and Calder valleys. Some of these trackways are identifiable from the presence of Bronze and Iron Age finds and burials along them (e.g. that between Arbor Low and the Bull Ring (Dove Holes) (Cockerton 1953, 67). However, little has been published on the subject.

iv) The Development and Function of the Road Network (Fig.1)

As with the main elements of the road system throughout Britain the principal routes in and around the south Pennines are to be attributed to military needs (Frere 1987, 291; Wroe 1982, 50). Indeed, the development of the road system is intimately bound up with the advance of Roman forces in the area and its dating is largely dependent on that of the forts which it connects, no independent dating evidence being available.¹ As Margary (1973, 496) notes many branch roads may have come into being at later dates and be connected with local economic needs rather than military ones. However, only limited numbers, mostly of partly proven or unproven routes, in the study area are likely to have originated thus.

As Cockerton (1953, 72) pointed out the initial development of the road system in our area was the extension of Ryknild Street across the Trent to the fort at Strutt's Park, Derby (Margary No.18c). Cockerton suggested that this

development occurred in or after 59 but the Strutt's Park fort is dated to the 50s (below p.101). Further the presence of forts at Chesterfield in the Claudio/Neronian period and at Templeborough 54-7 (below p.102f) on the subsequent extension of Ryknild Street (Margary Nos.18d and 18e/18ee) must suggest a date in the early 50s. Although Cockerton (1953, 83ff) was right to point out that Ryknild Street, at Wall 30 ft. (9.2 m) wide, is only 18 ft (5.5 m) wide in this northern extension and does not pass through Templeborough but is connected to it by a slip road, it seems unlikely that its construction would be left until c.80. Indeed, it is argued above (p.35) that these forts represented an advanced line watching Brigantia and so probably, contrary to Cockerton's view, a frontier line. It is, however, conceivable that the extension of Ryknild Street was a later occurrence and that Chesterfield and Templeborough were served (via slip roads) from a north-south road further east running from Broxtowe to ?York researched by Fullelove (1979) and Hornshaw (1982).

Some similar development west of the Pennines seems likely by 78, and probably rather earlier. Cockerton (1953, 75) suggests that Long Lane (Margary 70a and 181) from Warrington via Chesterton and Rocester ought to be attributed to c.71. However, the presence of the early fort at Trent Vale and of other possible early sites between it

and Manchester (above p.36) have led to suggestions that a road and fort remain to be found immediately west of the Pennines (Wroe 1982, 52). The majority of other proven routes (Margary Nos. 710a, b and c; 711; 71a and b; 712; 713; 714 and 720a) are probably to be attributed to the post-conquest consolidation of the Pennines. The dating of this is disputed (above p.40f) but Wroe (1982, 52) argues strongly for the network being complete by 78.

Other elements may have originated somewhat later, though again there is little or no firm evidence to cite. Margary Nos. 720aa, 182 and other roads such as that from Brough to ?Carsington seem to have only a limited military significance and may have been added later, as short cuts or for economic purposes. Many of these roads remain conjectural and they will be considered in more detail below.

Few of the roads are likely to have been of national importance. The most important north-south routes in Britain (Margary 2 and 28/8; and 7) lay considerably west and east of the study area, the nearest approach being where No.7a/b passed through Manchester. Margary No.710b/711 and No.712 perhaps had some importance as trans-Pennine routes, particularly the former, but were perhaps subordinate to Nos.72 and 82. Most of the routes were primarily of local importance, providing access both to forts, to the spa centre of Buxton and probably to the lead mining area.

Where known the construction of the roads within the study area follows the pattern usual for Roman routes as outlined by Margary (1973, 19ff). Eight of the major proven routes in the south of the study area have been sectioned (Wroe 1982, 54ff; Wroe and Mellor 1971, 54) and most show construction on aggers of various heights with roads founded on sand or clay, and sometimes also on foundations of stone blocks. In most cases the cambered road surface was of local Gritstone, Limestone or river gravel and in some instances was retained with kerbing. Scoop and rock cut ditches are present on one side of many of the roads examined and most roads, at least in the south of the area, exhibit at least two phases. Margary No. 720a shows remarkable stone slab construction with a central rut for a ?breaking device at Blackstone Edge (Margary 1973, 404), though its Roman date has been questioned.

The widths of the roads indicate that most are in the upper part of Margary's (1973, 21) range for roads of lesser importance (i.e. 15-18 ft. (4.6-5.5 m)) except for the routes from Templeborough to Melandra (Margary No. 710b/711) and Derby to Melandra (Margary No. 71a/714) which fall into his common width for major roads category (i.e. c.24 ft. (7.4 m)). Indeed, the Derby-Melandra route between Buxton and Carsington in its later phases was 9.25 m wide and Wroe and Mellor (1971, 54) suggest that its solid construction indicates that it was an important supply route. It may

also have had some importance in affording access to the Buxton spa. It is notable that where two phases have been detected in road sections the later is invariably wider than the earlier. This is particularly striking on the Brough-Carsington road (Wroe 1982, 58) where the road has at least three periods and widens from 4.5 m to 6 m.

It is regrettable that such detailed information is restricted to the south of the study area since it is possible that the widening and resurfacing of at least some roads in the south indicates greater economic prosperity than in the north, as well perhaps as the requirements of activities such as mining.

v) Description of the Road System (Fig.1)

The majority of the proven roads in and on the periphery of the study area were known to Margary (1973) and their courses will not be discussed in detail. For recent discussions of the routes in the south of the area see Wroe (1982) and Wroe and Mellor (1971). South of the Pennines ran Margary No. 181 from Derby to Northwich, where it connected to roads to Chester, Manchester and the north west. From Derby roads also ran south (No.18c) and east to the R. Trent at Sawley (No.182) as well as north (No.18d/18e and ee) to Pentrich, Chesterfield and Templeborough (where this road, Ryknild Street, seems to terminate). To the west

Manchester represents a major route centre connected to Northwich (No.7a), Ribchester (No.7b) and Wigan (No.702) as well as the road network within the study area.

Within the area roads ran from Derby to Manchester via Buxton (No.71a/b), Buxton to ?Leek (Chesterton) (No.713), Buxton to Melandra (No.714), from Templeborough to Manchester via Brough and Melandra (No.710b/711)^{2&3} and from Brough to Buxton (No.710b). In the north of the study area a single road (No.712) ran from Manchester to Tadcaster via Slack and two branches from this (Nos. 720a and aa) both led north towards Ilkley.

To this picture may be added a number of other routes, some now partially proven and others suggested or inferred with varying degrees of likelihood. The discovery of a major Roman site at Carsington between Buxton and Derby (Ling and Courtney 1981; Branigan 1985) provided a solution to the problem of the exact course of Margary No.71a beyond Minning Low (Wroe 1982, 54), the southern part of which has now been traced (Wroe 1982, 64)⁴. It also provides a destination for a route traced for some three miles south of Brough (Wroe 1982, 58). Wroe (pers.comm.) has now identified further stretches of this road. Part of this route had already been identified by Cockerton (1953, 85), though he thought that it represented only a trackway, the Old Portway.

Whether, as Cockerton seems to suggest, this road in fact ran past the fort at Brough and into Margary No. 711 is not certain but may explain the presence of an otherwise problematic possible Roman road section at Hope (Margary No.710a; Preston 1957).

There seems sufficient evidence to suggest that a road ran from Brough to Chesterfield (Wroe 1982, 64), though its exact course remains uncertain.⁵ Perhaps even more certain is a road west from Buxton to Northwich (Wroe 1982, 63), though much of its course lies under turnpike roads and urban areas. Wroe (1982, 64f) suggests four other routes that must remain largely speculative. Hart (1981, 90) has suggested the presence of a fortlet at Highstones, Tintwistle and this has led Wroe to suggest routes to it from Melandra and on towards Penistone in the upper Don valley, and from Brough towards Penistone. Although it is curious that there does not appear to be any military activity in the upper Don valley or any Roman utilisation of the Woodhead pass these routes are unproven and the fortlet is open to alternative interpretations (pers.comm. Hart). There also seems some evidence to suggest a route from Chesterfield into the study area, presumably towards Carsington (Wroe 1982, 65; Doe, Fowkes and Riden 1973, 5), perhaps following the 'Hareway' (Makepeace 1985, fig.23) or 'Hareward Street.' However, there is no evidence for Wroe's

suggested continuation of it towards Rocester. A road from Cleckheaton to ?Pontefract has also been suggested to exist in the north of the study area (Faull and Moorhouse 1981, 155 & map 9).

Beyond the study area both to the west and east there are problems with the road network as already alluded to. To the west we have noted Wroe's suggestion of a major north-south route. To the east there is the possibility of a north-south route east of Ryknild Street (above p.64). There are also other possible routes. Margary 189, proven only as far as Ryknild Street, may well have continued to the west via Spa House, Treeton (Dearne 1986, 111), but whether it joined Margary No.710b or represents a separate route to Brough is unknown. Roads running west from the north-south route on the east are also possible (Fullelove 1979; Hornshaw 1982). Only one of these is suggested to run into our area, a road from Ad Pontem to Buxton. Though there does seem to be some circumstantial evidence for such a route leaving Ad Pontem to the west (Fullelove 1979, 76ff) there is no evidence for it beyond Alfreton and, if it did exist, it is likely to have terminated at Ryknild Street.

It is clear that the road network of the study area forms a dichotomy between the single main road in the north with two northward branches and the full complex of roads in the south interconnecting a number of sites. Although it is not impossible that further roads remain to be

discovered in the north of the area, particularly in the Don valley and Woodhead pass, it is clear that it was considerably worse served by roads than the south, apparently not even being directly linked to Castleford, the main centre to the east. Moreover, the initial impression to be gained from Margary of the southern network being relatively isolated and accessible only from a limited number of centres on its periphery is increasingly called into question if roads between Brough and Chesterfield, Carsington and Chesterfield and Buxton and Northwich are accepted.

vi) Trackways

It seems likely that parts of the study area not served by roads possessed numbers of trackways. In particular the large areas of the northern part, especially the north east, must have contained trackways if there was any communications system there at all. Positive identification of such trackways is almost impossible, especially given that many may have pre-Roman origins and have continued in use in post-Roman times. Routes such as the Chariot Way, Portway and Old Portway in the south east of the study area (Makepeace 1985 fig.23; Kay 1962, 22 & 41) are perhaps prime candidates. Other probable routes can perhaps be inferred by the presence of settlement but lack of roads (e.g. the Wye valley) but there is insufficient evidence to produce any coherent picture of such networks.

vii) River Transport

No river within the study area is likely to have seen any significant role in the communications system. All are too small, shallow and problematic to navigation. However, the potential importance of rivers in the transport system that led towards the study area may have been significant. Whilst archaeological proof for the use of rivers is very limited a number of pieces of circumstantial evidence may be adduced in support of the idea that the Trent and Aire at least were of importance. Perhaps the strongest evidence is the distribution of lead pigs (Fig.13) from Derbyshire which shows a clear correlation to the R. Trent and the Humber estuary, suggesting water borne transport to the port of Petuaria (Brough-on-Humber). Second there is the fact that Margary No.182 from Derby ends at the R. Trent at Sawley where there is a possible forlet (Todd 1966). Whether or not Cockerton (1953, 81) was right to suggest that it is continued east of the river by a trackway, the South Portway, the fact that the Roman road ends here tends to suggest that its function was to give access to a trans-shipment point, perhaps the highest navigable point. Certainly the Trent ought to have been navigable as far as Littleborough (Segelocum) where it is connected to the Foss Dyke.

Similarly it seems possible that Castleford represents

the highest navigable point of the Aire. The possible warehouses in the annex at the site (W. Yorkshire Unit 1984, 29ff) may well be suggestive of a port function. Its continuance as a population centre after military withdrawal c.95 and its reappearance as an industrial centre in the third century both indicate that the site had an economic importance independent of the army. Indeed, the presence of numbers of stone buildings and possible urban planning make the site distinctly atypical.

There is no evidence for the use of other rivers which flow towards the area, though it is possible that some, including perhaps the Mersey to the west, were in use. It may eventually be possible to analyse the navigability of small rivers based on knowledge of Roman boats. But the techniques developed for this on the continent are not yet applicable to Britain (Eckoldt 1984) and fluvial changes since the Roman period are not yet sufficiently understood. Moreover, the extent to which Roman engineers could or did modify small rivers to make them navigable is currently a matter of debate (e.g. Selkirk 1983; Coupland 1988).

viii) Modes of Transport

The study of the types of transport available in the Roman period is one both technically complex and principally based on evidence from other parts of the empire (Greene

1986, 37f). Detailed discussion of these matters is regarded as being beyond the scope of the present work. The most basic form of transport, walking, may well have been the most common in the study area. For many trading functions elaborate methods of transport are likely to have been unnecessary since items of trade or tools could be carried on the back. If a pack animal, probably a mule given the terrain of the area, is added to the picture perhaps the majority of necessary civil transport is accounted for. In the first World War mules were considered quite able to carry loads of 200 lbs (90.7 kg) suitably divided between panniers provided that the load was not too bulky (Greene 1986, 38). The use of one or more mules would therefore likely allow a variety of activities, including taking produce to market, trading pottery and even perhaps transporting lead ore, to be accomplished.

Only for particularly heavy or bulky loads such as lead pigs or large quantities of grain must we necessarily think in terms of vehicles. In this category we are talking principally of ox, or perhaps mule, drawn carts. These were well known to both Romans and Celts, though there is only limited evidence for the details of their construction (Greene 1986, 36). It is possible that the bronze terret from Melandra (Webster 1971, 113f) came from such a vehicle. It is unlikely that the horse played a

significant role in drawing carts for it was a prestige animal used for riding and passenger vehicles. As Greene (1986, 37) has pointed out, its occurrence pulling carts on funerary reliefs may well be intended to allude to the status of the deceased rather than be factually accurate. However, mules could cover 80 km (50 miles) in a day pulling a cart depending on its load (Greene 1986, 39).

A range of water craft are known from the Roman world from simple rafts through skin boats as seen by Caesar (Civil Wars 1, 54), log boats and small planked boats to giant grain ships such as the 1200 ton 'Isis' (Lucian The Ship or the Wishes). We are principally interested in the lower middle part of the range, that is small river boats and barges. At their simplest these are extended log boats, essentially dug-out canoes split down the centre with planking added to form a flat keel and to build up the sides. A number of these could be joined end to end to form larger vessels such as the three larger boats from Zwammerdam (which are 20.25, 22.75 and 34 m long) (Greene 1986, 20). These merge into the lower end of the true planked boat category and together probably represent just the sort of boats that might have carried goods and supplies on the rivers Trent and Aire.

ix) The Economic Implications

The brief survey above has outlined what is known of

the communications network within and on the periphery of the study area. It remains to examine the economic implications of the nature of this system, both in terms of what it indicates about the relative prosperity of different parts of the study area and in terms of its effect on transport costs, trading patterns and army supply questions.

a) Transport Costs

We do not have specific evidence on the cost of transport in the study area. However, despite the often anecdotal nature of the evidence Greene (1986, 38ff) shows that, where available, water transport was clearly far cheaper, not to say quicker (an important consideration when perishables are being transported), than land transport. Relative figures for sea, river and land transport in the Roman period may have been similar to those in the eighteenth century. Duncan-Jones (1982, Appendix 17) has calculated that the ratios were in the order of 1 (sea): 4.9 (river): 28 (land). Though Greene (1986, 40) feels that these may be the best achieved and not the norm, the figures are likely to be of the right order.

Clearly the lack of river transport within the south Pennines means that any trade would attract transport costs as great as in any area. Indeed the hilly nature of the

south Pennines would likely make them greater than in lower and flatter riverless areas. However, we have seen that some rivers may have been navigable to the periphery of the area, an important fact if we are considering long distance trade where the transport costs within the area were only a small part of the total. Nor should we assume too readily that greater transport difficulties, and therefore costs, were necessarily of as great an importance in Roman times as today. The major elements in the cost of transport were the upkeep of any animals used and the time expended by traders in the transport. If mule transport was used the former may have been almost negligible since mules can be fed principally by casual browsing (Greene 1986, 39) and are hardy.

The second element may not have had the same significance as it does in modern economics where 'time is money'. Rather an individual trader might regard transporting his wares to the point of sale much as travelling to a place of employment. There would undoubtedly be a tendency to sell goods as soon, and therefore as near, as possible. But we do not necessarily have to think of a situation where the final vendor of goods had transported them from the point of production, or even paid for the transport. Not only may people travelling outside the area have brought stock back for traders without charging them but numbers of traders could have co-operated in transporting their stock. Few

items were probably brought great distances anyway.

The disadvantage of a lack of river transport is therefore only likely to have affected a very small area of trade. Trade in high value commodities was probably little influenced since the percentage of the selling price represented by transport, even if boat men or hauliers were employed to move it, would be small. Thus, the economies of using river transport (not to mention the greater quantities that could be moved in one go) probably meant that lead was sent by river once practicable. But the likely necessity of taking it by road as far as Sawley did not prohibit its exportation from the study area. The less bulky the commodity the more this would apply. Thus samian ware, or amphorae of wine would be able to withstand the cost of transport by road for some distance even if transport costs were assessed on a modern basis.

Nor would short distance transport be affected, short hauls by road would be unlikely to add unduly to prices. Only for long distance trade in low value, especially bulk, commodities can any case be made out for transport costs having a very great effect on price or availability. Few such commodities can be traced in the archaeological record. Most low value items are impossible to provenance. Those few that may be tend to suggest that trade in low value items was indeed relatively localised, or was carried over greater

distances because there were waterways that could be used for part of its journey. Small quantities of Gritstone may have been exported as far as Lincoln (Ramm 1978, 48) and quernstones to various areas to the east (pers.comm. L. Wright). But the latter might in fact have been reasonably expensive at point of sale and both might have benefited by travelling part of the way by river, therefore making their transport costs much lower.

The best evidence is provided by coarse pottery which was certainly a relatively low priced item of trade. Only a limited number of coarse pottery assemblages have been studied in the area and almost all are from military or sub-military (mostly military vicanial) contexts. This is problematic since we cannot be sure that non-economic factors, such as the presence of subsidised military supply lines, are not present. Indeed, Black Burnished wares are generally present, commonly associated with military contexts and when produced in southern England perhaps transported largely by sea (cf. Greene 1979). However, this being said most of the coarse wares in the assemblages are from Little Chester, south Yorkshire, Trent Valley and the Cheshire Plain or products of small localised kilns such as the ones excavated at Manchester (Jones and Reynolds 1978, 9ff) and suggested at Melandra (Webster 1971, 99 No.147). Whether coarse pottery was a bulk trade item though is difficult to

say. With few major sites within the area and the extent of pottery use in the rural sector as yet not properly quantified there is as yet little indication that the trade was on any great scale.

Probably the most likely items of trade in bulk low value commodities are the most illusive in the archaeological record, grain and meat. If there was significant trade over any distance in the latter, presumably in terms of its exportation to other areas, transport was unlikely to have been a concern. The animals would likely be driven on the hoof. Grain is more problematic. We cannot be sure that the area was self sufficient in its grain needs, especially with an army presence but equally we have no evidence for the importation of grain. This problem is an important one, particularly in terms of army supply, and is discussed in more detail below along with other army supply questions.

b) Trading Affinities

To an extent the nature of the transport network leading out of the study area suggests the areas with which it traded. However, two important qualifications must be made. Firstly the road network, or at least the major routes within it, are likely to be military in inception and need not therefore imply anything about the pattern of civil trade. They do perhaps imply something of the pattern of military supply (at least at the time they were built),

suggesting for instance that Margary 71a/b was an important supply line. But whether the apparent disuse of at least two roads (Margary 710a from Buxton to Brough and 711 from Brough to Melandra; Wroe 1982, 67 and 70) at unknown dates implies merely a military failure to keep them in good repair since they were of little use to them or their lack of importance for trade it is impossible to say. Secondly we must remember that the pattern of roads is likely to be only half the story. We are almost totally ignorant of the role played by trackways.

These qualifications made it does appear that the south of the study area may have traded with a far wider range of partners than the north. The pattern of roads in the south affords access to south, east and west while that in the north gives only minimal access to the south west, north and north east. We have already noted that much of the coarse pottery (though the well published assemblages come from sites in the south of the area) originated to the south and east. It is possible that the presence of navigable waterways to the east leading to the major port of Petuaria (Brough-on-Humber) made trade to the east particularly prominent. However, it is difficult to go far beyond this since we do not have the excavated material to prove trading affinities.

c) Army Supply

The question of army supply, and in particular of whether the army had to bring grain into the area and if so from where, is a central problem of the economy of the whole of upland Britain in the 'military zone.' The argument is a complex one that must be considered from a number of standpoints including the arable potential of the area (below p.170f), the evidence for actual arable production (p.199 ff) and the likely population and therefore pressure on the land (above Chapter 4). Here I wish only to examine the likely transport problems faced by the army given a variety of supply scenarios.

Essentially there appear to be three scenarios to be considered, local grain production, the transport of production from outside the area but not from great distances (e.g. from the Magnesian Limestone ridge area to the east) and transport from distant production areas such as southern Britain or even the continent. In the first instance transport costs would perhaps be zero. If local production was taken by the army as a tax in kind or other onus, perhaps compulsory fixed price purchase or even a requisition, the farmers may well have been required to deliver it to the fort. Indeed, some have suggested that the army itself may have grown at least some of its food (MacMullen 1963, 2), though there is no general agreement

on the point (e.g. Sommer 1984, 36). If the grain was privately grown and the army collected it from the farms, many of them small and isolated, a great expenditure of time and effort would initially seem to be required. However, it may be that any surpluses would be sold in markets either in vici outside forts or at rural markets, involving less transport.

The second scenario probably also involves fairly limited transport costs, even calculated in modern terms. For the forts in the south of the study area supply from the lower areas to the south, east or west would be relatively easy since there is a full road network. However, in the north of the region the problem would be greater and the supplying areas restricted to the Cheshire plain and the Vale of York quite some distance away. This of course assumes that proper roads were needed for carts to run on. If mule trains were used further relatively low lying areas within the study area and beyond it to the east also become candidates for supply areas.

The third option is by far the most problematic. Manning (1975) in an influential paper pointed out the high costs of long distance land transport, suggesting that a 1200 lbs (544 kg) cart of grain would double in price if taken 300 miles. As with most figures put forward for ancient transport costs this is of course an approximation,

and indeed largely theoretical since a single journey of 300 miles in Britain would be very rare. However, as Manning (1975, 114) notes, water borne transport might be entirely different. Returning to Duncan-Jones' ratios (above p.76) the same load of grain would double in price if carried by sea in 8400 miles and in 1470 carried by river. Again these are theoretical figures. In practice other elements such as economies of scale due to boats being able to carry more than carts would have to be considered.

To illustrate the difference a cargo of 1200 lbs of grain moved from Cambridge to Brough-on-Noe and beginning its journey at a price of x would arrive costing $1798x$ (a 51.5% rise) by road, $1440.612x$ (a 20% rise) by the shortest combined canal/river and road route and $1447.2x$ (a 20.58% rise) by a route including sea transport.⁷ The use of water transport clearly reduces the costs very considerably, though, for instance, the costs of repeated trans-shipment have not been taken into account. However, it is still clear that any long distance transport would be expensive. Again we must be careful not to accept too readily that these figures had such an importance to Roman supply organisers as they do to even the modern army. To what extent transport was requisitioned is unknown and the tactical significance of keeping northern forts fed probably

outweighed financial concerns. Besides which it was the provincial tax payer not the army itself that bore the cost in the end. Probably a far more pertinent concern to the army was the amount of manpower that such a supply exercise might take up.

One further point ought to be borne in mind. The supply of the south Pennines is only part of the larger question of the supply of the whole of the military zone. If supply was reliant on areas south of the zone it would overall be cheaper to supply the most northerly areas from the south of Britain, taking advantage of the fact that the majority of the route would be by sea. More southerly areas, such as the south Pennines, could be fed from rather further north where the benefit of sea travel was not available but the road and or river routes were relatively shorter. A little supporting evidence for such a scenario may be provided by the number of granaries at the port of South Shields, where there is also evidence, in the form of remains of a species of dormouse not native to Britain, for at least some continental grain supply (Bidwell 1987).

Similar comments apply to other categories of army supply, for instance to the supply of arms and armour. Where possible the supply of metalwork would have been cheaper if production was possible in regional centres rather than in only one or two major legionary bases. Even

with the economies possible in some instances by using rivers rather than roads the costs would still overall be decreased if numbers of regional centres supplied forts in their areas by road rather than only a few centres supplied the whole country. Although this might produce a tendency for destandardisation it would make tactical sense in that equipment could be furnished quicker. Only in the preparations for major campaigns would mass production at one centre seem to be necessary.

d) The Implications for Relative Economic Prosperity

As noted above the pattern of roads within the study area shows a notable dichotomy between the single north east-south west route in the north and the interlocking complex of roads in the south. The lack of more than the single route in the north of the area, plus its two northern branch roads, may be slightly false since the built-up areas of West Yorkshire could have obliterated other roads. Indeed, Faull and Moorhouse (1981, 155 and map 9) suggest a possible route leaving Margary No.712 near Cleckheaton and passing through Dewsbury and Wakefield to head for the Pontefract area. However, even if one or two roads remain to be discovered, it is clear that the lack of roads in the north is a real phenomenon and is complimentary to the lack of major sites. The reason for this lack of forts, civil settlements and roads seems likely to lie in a disparity in

economic development and or military significance between the south and north of the study area.

However, this should not necessarily be seen in terms of the northern part being particularly backward, but rather in terms of the southern part being particularly advanced. If the roads in the study area unknown to Margary (1973) are added to his Fig.14, even allowing for some increase in the numbers of known roads in other parts of the north, it will be seen that the southern part of the south Pennines is curiously well served by roads for its size compared to much of the rest of northern England. A number of reasons might be suggested for this. Firstly Buxton's importance as a spa is a unique factor and some of the roads leading to it are likely to have been used if not built largely to provide access to it. The lead mining industry may also have necessitated a road network and roads such as that from Brough to Carsington may well have had their origins in such needs. Thirdly the route from Templeborough to Melandra and Manchester was an important trans-Pennine road guarded in particular by the long garrisoned fort at Brough.

None of these factors alone explains fully the presence of so many inter-connected roads, but taken together they provide the *raison d'etre* for a number of probably prosperous

settlements in the Roman period and therefore for the road network. In the north by contrast only the trans-Pennine route factor was present and, to judge by the relatively early and final abandonment of the forts at Slack and Castleshaw, its importance was short lived. Since there was no other reason for major settlements to survive in the north they closed and there was no need for roads to be built.

For the same basic reason there is no direct connection between the road network of the south of the study area and the north. There was nothing of interest to the Roman administration in the north and so no need for official travellers to foray north of, about, the Hope Valley. Indeed, broadly north of Margary No.710b/711 and at least south of Margary No.712 was probably something of a back-water, more isolated from the penetration of Rome than other parts of the study area. This is perhaps not surprising in view of the concentration of moorland in much of the area, especially in the west, but it is not to say that the area was necessarily unoccupied, only that beyond the collection of taxes few Roman officials (or perhaps traders) had any reason to go there.

Having said this a note of caution needs to be sounded. Many of the river valleys in the north east of the study area are relatively fertile and, perhaps more importantly

here, their natural communications are to the east, north or south. That no north-south route is known should cause far less surprise than that no other east-west roads are. In particular, as noted above (p.69), a road ought probably to be expected through the Woodhead and upper Don valleys, whether or not the possible fortlet at Highstones is a military installation. The possible route from Cleckheaton to ?Pontefract reinforces the likelihood that any lines of communication that remain to be discovered in the north are likely to be east-west, though it must be suspected that it is principally trackways rather than roads that should be looked for.

The road system of the south of the study area provides further hints about the relative economic prosperity of this part of the region in that most of the roads show a number of phases in which the roads get successively wider (above p.67). This is particularly true of the Brough to ?Carsington road and, given the likely significance of Carsington to the lead industry (below p.286), one wonders if this does not indicate that lead mining was a particularly significant factor in the area's development. Indeed, it could be significant in this connection that the two roads known to have been abandoned at some time in the Roman period (above p.81) are in the north west of the southern part of the study area away from the lead mining area.

Notes

1. The Domitianic coin from Ryknild Street (Cockerton 1953, 84) is of little use since it comes from the road surface. The attribution of a Roman date to the roads discussed below depends upon their characteristic construction (p.66f), the use of straight alignments in their courses and the fact that they run between known Roman sites.
2. Note that the generally accepted course for this road between Templeborough and Brough-on-Noe (Margary 1973, 361f; Wroe 1982, 58f) has been questioned by Welsh (1984). However, little credence can be given to Welsh's alternative route (pers.comm.Hart).
3. Margary (1973, 364f) suggests that the route from Melandra to Manchester is through Lydgate and Mossley to connect to his No.712 at High Moor. However, his map (Fig.14) appears to contradict this and show a direct course to Manchester, omitting the route through Lydgate. See also Wroe (1982, 65).
4. The route from Minninglow north of Carsington to Buxton was never in doubt, but Wroe (1982, 54f and 64f) has now shown that it did not veer east from here as Margary (1973, 311) suggested but continued its known line south to Carsington and thence fairly directly on to Derby.
5. Wroe (1982, 64) believes that it can be traced to a crossing of the Derwent at Leadmill, but other routes are possible. It should particularly be noted that coin finds could indicate a route through Great Hucklow (Dearne 1986, 96), while another series of coins form a line north from this possible route towards Leadmill (cf. Makepeace 1985, fig.31). One wonders whether the second set of coins in particular does not indicate the line of a trackway rather than a road.
6. The major modern well published assemblages within the area are Webster (1971, 91ff) (Melandra vicus); Drage (forthcoming) and Branigan and Dearne (in prep.) (Brough vicus). On the periphery of the area note also Wheeler (1985a, 90ff) and Wheeler (1985c, 259ff) (Derby); Jones and Grealey (1974, 92ff) and Walker (1986, 85ff) (Manchester).

7. The calculations are based on the equation:

$$(\text{Constant } \sqrt{y} + 1) \times 1200$$

where the constants are for road 300, for river 1470, and for sea 8400, and where y is the length of the journey in miles. Most of the calculations involve more than one road/river/sea element worked out separately and then added together. Distances have been calculated from the O.S. Roman Britain map (1978 edition) and from Margary (1973). The figures for road distances are broadly correct, though minor inaccuracies are inevitable due largely to some road courses being uncertain. Sea journeys are based on the shortest practicable inshore routes. River journeys are likely to contain a degree of inaccuracy due to the problems of measuring meandering waterways and the uncertainty in many cases about the possibility of course changes since Roman times.

For the journey from Cambridge to Brough the details are:

Road: (148 miles) via Leicester, Mancetter, Wall, Derby and Buxton.

River/canal and road: (190 miles including 54 by road) via Car/Cnut's/Foss Dykes and the R. Trent to Sawley then by road via Derby and Buxton.

Sea, river/canal and road: (254 miles including 54 by road) via river and canal to the Wash, by sea to Petuaria and the R. Trent to Sawley then by road via Derby and Buxton.

The example of Cambridge has no particular significance, except that it is a known Roman site in a grain growing area with reasonable road and water communications nearby. Similar calculations could be made for any southern centre; each would show its own variations but all would show the general principle.

Chapter 6: The Major Sites

i) Introduction

Within the study area there are six major sites so far known (Slack, Castleshawe, Melandra Castle, Brough-on-
Noe, Carsington and Buxton). Seven further major sites on the periphery of the area will also be considered in this chapter since they may well have played a role in the economic life of the study area (Manchester, Rocester, Little Chester (Derby), Pentrich, Chesterfield, Templeborough and Castleford). Our evidence for them varies considerably and even at the best known sites is fragmentary. However, it does afford us a fuller picture of their natures and development than for other aspects of the economy such as rural settlement. Thus it may allow us to assess which factors were most important in stimulating the south Pennine economy. Of particular importance is to try and assess the relative significance of the presence of military garrisons at many of the sites and of other factors such as lead extraction, market functions and religious/spa roles.

The degree to which towns were integrated into the economy is debatable and, though their existence could be taken as potential proof of economic development within the area, they must be shown to be involved in the economy in general (and not just be islands of mainly militarily

inspired service industries) before this can be asserted with any confidence. Similarly assumptions that they acted as centres from which processes such as the adoption of a monetised economy could be disseminated require supporting evidence, particularly since few of the major sites appear to have been able to function without the presence of salaried military units. It is also intended to examine the likely nature of the exact links between civilians and the army in military vici by modelling elements of the vicus's micro-economy.

ii) The National Context

It is clear that major civil towns, perhaps with a few exceptions such as Carlisle, were absent from the essentially military area of northern and north western Britain (e.g. Wachter 1979 map 11; Hartley & Fitts 1988, 39). The study area in fact forms the most south easterly part of this area, with sizeable civil settlements to the north east (e.g. York), east (e.g. Lincoln and East Stoke) and south (e.g. Wall). The predominant 'urban' form in the military zone appears to be the military vicus, a relatively small town, or if Wachter's view of the terminology is accepted (Wachter 1974, 20) a village, adjacent to an auxiliary fort which rarely survived the withdrawal of the military garrison (Sommer 1984, 51; Dearne 1986, 16f and 158). The study area contains three such vici at Slack,

Melandra and Brough, no vicus having yet been demonstrated at the fort of Castleshaw and no fort having been proven at either Buxton or Carsington. All of the major sites on the periphery of the area where civil occupation has been demonstrated (except for Rocester where the situation is still obscure) were military vici, though Castleford, Rocester (if it began as a military vicus) and perhaps Little Chester (Wheeler 1985d, 303) subsequently became civilian towns.

The presence of two sites within the study area that have not been shown to have origins as military vici appears to be at variance with the general trends in the military zone. Though it is not impossible that forts remain to be found at the sites, it may be that there were particular economic reasons for the establishment of these sites as purely civil centres. However it must be stressed that none of the typical features of towns further south and east can be paralleled at these settlements. There are no indications of public buildings (except mansiones), regular street systems or defensive walls. Indeed, in many ways the term village would be more appropriate than town for these settlements.

iii) Pre-Roman Background

No site in the study area or on the periphery of it

has a direct precursor¹ and there is no evidence to suggest that any recognisably urban form existed within the study area in the immediately pre-Roman period. The only possible candidates for such precursors would be the limited number of hill forts in the general area, few of which have seen much excavation, but most of which seem to have gone out of use long before the Roman period. The largest and best known are Castle Hill, Almondbury and Mam Tor. The former went out of use probably in the fourth century B.C. (Faull and Moorhouse 1981, 116), while the latter, although displaying several hundred hut circles, appears to have gone out of use by the sixth century B.C. (Coombs 1977; Hart 1981, 73). Thus, on the basis of present evidence, no urban or proto-urban tradition can be recognised. However, it may be that the Celtic elements in the names *Aquae Arnemetiae* and *Camulodunum* (Rivet and Smith 1981, 254f and 295) indicate earlier activity in Buxton and at a hill fort in the Slack area (perhaps Almondbury or more likely on Old Linley Moor (Rivet and Smith 1981, 295)).

iv) The Evidence²

a) Sites Within the Study Area (Fig.1)

Slack (Camulodunum)³

The auxiliary fort at Slack is regarded as an Agricolan foundation and consists of three phases (Hunter, Manby and

Spaul 1967-70, 78ff). Its garrison was probably reduced to less than a cohort c.122/5 and completely withdrawn c.140-60 (op cit., 80). The extra mural settlement included a military bath house (Barber 1869/70; Dodd and Woodward 1922) and an 'annex' defended by a bank and ditch not before c.120 (Hunter, Manby and Spaul 1967-70, 84ff; Br. 1970, 281). Occupation within this area has been demonstrated to parallel the dating of the fort, i.e. c.80-140 (Br. 1970, 281), though few details of its nature are available. At least two cemetery areas are known beyond the 'annex' (Richmond 1925, 44ff; Br. 1970, 281).

Melandra Castle (?Ardotalia)⁴ (Fig.3)

The auxiliary fort at Melandra Castle near Glossop was garrisoned from c.79 to c.140 (Conway 1906, 126; Petch 1949, 1-40 & 49-63; Wild, J.P. unpublished interims). Sizeable areas of the vicus to the south and east of the fort were excavated by Webster (1971), revealing two areas of multi-phase occupation and a large building interpreted as a mansio as well as part of the road network and two phase civil defences. The first phase of these defences are perhaps to be dated to before c.120/30 (but see further Dearne 1986, 72ff). Civil occupation appears to begin c.79 and to cease c.140 (Webster 1971). The military baths north of the fort have been examined by Wild (Unpublished interims),

who has also identified a further area of ?civil activity east of the road leaving the north gate of the fort. At least one cemetery area is known (Webster 1971, 79).

Castleshaw

The auxiliary fort at Castleshaw is assumed to have been founded c.79 and was reduced to a fortlet c.100 before being abandoned c.120 (Start 1985, 13; McNeil, Start & Walker 1989). Recent ex-excavation has indicated that the fortlet held a relatively large granary and a workshop as well perhaps as a mansio. Its role may have been as a grain depot and road station (McNeil, Start & Walker 1989). No civil occupation is known. A ?signal station has recently been suggested near Castleshaw (Start 1987/8), between it and a site of unknown function at Worlow.

Brough-on-Noe (Navio)⁵ (Fig.4)

Again the fort at Brough is assumed to have been founded c.79. A break in occupation is indicated c.120-155/8 and the re-established fort may have gone out of use before c.360 (Jones and Wild 1968b). This later phase may have represented a reduction in size, perhaps to accommodate a unit with a mounted element (Dearne 1986, 93). Five areas within the vicus have been excavated, demonstrating occupation to the south east of the fort and some form of activity to the southwest. Immediately south east of the

fort occupation is dated to ?80-?120 (Bishop et al forthcoming), while further south east across the Bradwell Brook three sites indicated occupation mainly within the second and third centuries (Lane 1973; Drage forthcoming). To the south west activity is dated exclusively to the second half of the second century (Branigan and Dearne in prep.).

Buxton (Aquae Arnematiae)⁶

Little is known of the probably important Roman settlement at Buxton. A little circumstantial evidence may suggest the presence of a first century fort at Silverlands (Hart 1981, 12f; Bishop 1984; Dearne 1986, 83f) but proof is lacking. The civil remains consist only of a number of fragments of a well built bath complex or complexes of some size (Whitaker 1773; Turner 1903, 159-63; Tristram 1916, 84-104; Bishop 1984) and an unidentified ?building (Rooke 1789). A dedicatory ^{of coins at} accumulation_^ the baths indicates activity from at least c.79 to the reign of Arcadius (395-408) (Hart 1981, 12f; Bishop 1984) and casual finds suggest an occupied area of c.1 hectare + (Hart 1981, fig.8.5).

Carsington (Fig.9)

The main site at Carsington covers some 6-8 acres (2.4-3.2 hectares) and, despite severe plough damage, has produced evidence for an early second century foundation

with timber buildings and lead working (Branigan 1985, 41; Anderson and Branigan in prep.). The timber buildings were replaced in the mid-late second century by stone founded ones (six to eight of which are known or likely) up to 15 x 18 m, perhaps including a smithy. They gave way to agricultural activity in the later Roman period (op.cit.). Continued activity, or a resurgence of it, in the fourth century may be suggested by the stratified lead pigs (Appendix 1 Nos.54 and 55; Branigan, Housley and Housley 1986). Some 0.5 km south west of the main settlement a rectangular stone building 9.2 x 23.8 m has been excavated by Ling and Courtney (1981) and Probert (unpublished). Evidence was found for sub-floor flues in at least one room of the six located. Its date is probably fourth century (op.cit. 71), though there are indications of earlier occupation on the site from the mid-second century, probably including buildings of some refinement (op.cit., 68).

On the possible identification of Carsington with Lutudarum, its probable role in the lead industry and suggestions of the presence of a fort see below (p.278 and 286f). For further discussion of the fourth century building and its possible villa function see below (p.186f).

b) Sites Beyond the Study Area (Fig.1)⁷

Manchester (Mamucium)⁸

Despite its poor state of preservation it is now clear that the fort at Manchester was occupied c.79 to the late fourth or even early fifth century, with a break from c.110/25 to c.160 (Walker 1986, 141f). A number of elements of the vicus are known from antiquarian accounts including the baths (Roeder 1899, 129-32 and 209), a number of burials (op.cit., 109) and indications of a Mithraeum (op.cit., 116; Bruton 1909, 34-9). Modern excavations north of the fort have revealed an early ?military and ?civil 'annex' (Jones and Grealey 1974, 41ff; Jones and Reynolds 1978, 6). It was superseded by a number of phases of civil buildings, many of which may represent ?non-residential smithing activity (Jones and Grealey 1974, 49ff; Walker 1986, 37). The plans of a large ?courtyard building (Jones and Reynolds 1978, 7-9), a possible inn (Jones and Grealey 1974, 49f) and a small pottery kiln (Jones and Reynolds 1978, 11) have also been recovered. Indications are that civil occupation was continuous from c.79 until the mid-late-third century, at least in the northern part of the vicus (Jones and Grealey 1974, 92).

Rocester

The limited amount of research carried out at Rocester indicates the presence of a sequence of three forts, the last abandoned by the mid-second century (Br. 18 (1987), 323; Cleary & Ferris 1988), and of a defended perhaps agricultural

civil settlement of some nine acres or more (3.6 hectares +) with a date range including the third and fourth centuries (Webster 1962; Br. 17 (1986), 391; Cleary & Ferris 1988). It is not clear whether a military vicus developed outside the fort and if so whether the civil settlement developed directly from it.

Derby (Derwentio)

The first fort at Derby (on the Strutt's Park site) seems likely to have been founded in the 50s (Dool 1985a, 25). It seems to have been replaced c.80 by a new fort on the Little Chester site (Wheeler 1985d, 300). A third reconstruction on the latter site is indicated in the Antonine period, although continuity during Hadrianic times is not absolutely certain (Wheeler 1985d, 302). Military occupation may have ceased c.200 to be replaced with civil re-use of the fort site until c.330. However the possibility that military occupation continued until the latter date in a different form cannot be dismissed (Wheeler 1986d, 303f). A number of elements of a potentially large vicus to the east, north and south of the Little Chester fort are known (Birss and Wheeler 1985). Whether they represent parts of a settlement continuous as far as the known potting and subsequently metalworking areas at Derby racecourse (Dool 1985b) is to be doubted. Beyond the racecourse industrial area a walled cemetery and a number of

road side mausolea have been excavated (Wheeler 1985c). The remains of the vicus near to the fort include three phases of pre-Antonine timber buildings and a third to fourth century colonnaded buildings (Birss and Wheeler 1985, 11), and occupation here and on the racecourse site seems to have come to an end in the fourth century (Wheeler 1985d, 303f).

Pentrich

The nature of the military activity at Pentrich, where very little archaeological work has taken place, is not clear. Although a late first century fort appears to be present (Smithard 1911; V.C.H. Derbyshire, 261) the significance of the much larger enclosure around it noted by St. Joseph (1953, 87) is unknown. No civil activity is known at the site.

Chesterfield

The first fort at Chesterfield, found as recently as 1974, was probably Claudian/Neronian and was reconstructed in Agricolan times before being abandoned to at least temporary civil usage c.120-30 (Courtney 1975, 4ff; Br. 1976, 322; Br. 1978, 430ff). The confused remains of at least one annex are known to the east of the forts (Br. 1977 387; Br. 1978, 430ff and fig.9; Br. 1979, 292f; and discussion in Dearne 1986, 134). No civil activity except

that within the fort is known at present.

Templeborough

The first fort at Templeborough was probably founded in the governorship of Didius Gallus (54-7) (May 1922, 6; Simpson 1973, 84). An occupation break in the late 70s and 80s has been suggested (Simpson 1973, 84 and 89) preceding the construction of a new fort which was itself abandoned, perhaps in late Antonine times (May 1922, 62ff). A third fort was built, apparently hurriedly, probably in the later third century (Simpson 1973, 89). Military occupation may have ceased by the second half of the fourth century. However, this is only a terminus ante quem for there is extensive evidence of probably civil occupation of the fort site post-dating it (Simpson 1973, 88f; Dearne 1986, 127ff). The vicus is almost exclusively known from antiquarian and poorly published mid-twentieth century work. Although it is clear that occupation was extensive and existed to the south east, north east, south and south west of the fort little is known of its nature (Dearne 1986, 114ff). The military baths north of the fort are well recorded (May 1922, 29ff) but most other recorded remains are problematic. Very limited dating evidence indicates, not necessarily continuous, civil activity between the late first and late third centuries (Dearne 1986, 114ff).

Castleford (Lagentum)

Initial military activity at Castleford soon after 72/3 and probably in the governorship of Frontinius is indicated by a midden deposit containing damaged auxiliary leatherwork. The midden was adjacent to a wattle building, subsequently overlain by another building (Abramson 1988, 44). Subsequently a large fort (some 2.8 hectares (c.7 acres)) seems to have been occupied until 95 (Sumpter 1984; W. Yorks. Unit 1984, 2 and 14). At the same time as, or at least during the occupation of, the fort's second phase (?c.84-?c.95) an annex covering perhaps 1.4 hectares (3.5 acres) was constructed between the fort and the R. Aire. It contained a military baths and stone buildings, some preceded by timber phases, that may be open to interpretation as warehouses (W. Yorks. Unit 1984, 29ff). To the south and west a military vicus of at least 4 hectares (c.10 acres) was probably occupied c.71 to c.150 (W. Yorks. Unit 1984, 34ff). It included a stone built mansio and another stone ?courtyard building that could have had a market function (W. Yorks. Unit 1984, 38ff; Abramson 1988, 44).

The vicus had a Hadrianic floruit, having survived the military withdrawal from the site, and was reoccupied in the third and fourth centuries. Spoon-making and lime production are indicated within the former fort and parts of the vicus were re-used as cemeteries (W. Yorks. Unit 1984, 44ff;

Abramson 1988, 48). Re-use of the baths and some religious activity were also probable features of the activity (Abramson 1988, 44ff). The possible significance of the site as an inland port is discussed above (p.73). The apparent rectilinear planning of the civil settlement's streets and property boundaries (Sumpter 1984, 85), the degree of vicanal prosperity, the numbers of stone buildings, the post-military survival of the vicus and the later civilian reoccupation make Castleford perhaps the most atypical military vicus in the military zone south of the Hadrian's Wall area.

v) Site Distribution (Fig.1)

There is a clear pattern to the distribution of the above sites that comprises three elements. (1) A horseshoe of sites around the southern part of the study area (Manchester, Rocester, Derby, Pentrich, Chesterfield and Templeborough). (2) A number of inter-connected sites in the southern part of the area. (3) Two isolated sites in the north west of the area (Slack and Castleford) and one to the east of it (Castleford) with the rest of the north of the study area and its peripheries blank. This is a fairly stark contrast between a concentration of sites in and around the south of the study area and a lack of them in the north. It becomes even more striking when it is remembered that Slack stood alone within the northern part

of the area by ?125 and itself closed by c.160. Although some southern sites also closed (Melandra c.160; Chesterfield ?c.120-30; Pentrich, on negative evidence, ?early second century) many seem to have continued at least down to the later third century.

It has already been noted (p.86ff) that the road network presents a similar picture and suggested that this reflects a greater degree of economic development in the south due to a combination of lead mining, strategic concerns and Buxton's spa function. The lack of major sites in the north of the area is complimentary to this and not a result of it. It seems likely that we have both sites whose existence, at least in part, was due to the presence of a road (?Brough) and roads whose courses were partly dictated by the presence of settlements (?the Brough-Carsington road). The distribution of both seem likely to have the same essential progenitors.

Clearly geographical factors had some effect on settlement distribution. The semi-circle of sites around the southern margins of the study area reflect the transition from the surrounding lower areas to the Pennine uplands, while the siting of Castleford may well reflect a trans-shipment point or upper limit of navigation on the R. Aire. The natural communications of the study area, which partly dictated the course of roads such as Margary 710b/711

(Manchester-Templeborough), more or less directly influenced the siting of such settlements as Brough and Buxton in the Hope and Wye valleys. However, it is clear that geographical constraints alone did not determine the settlement pattern or we should expect major sites in the lower lying river valleys in the north east of the study area such as the upper Don valley, and along the lower Wye valley. Certainly ideas of distributions based on the transport principle of the central places theory, already rejected for Roman Britain by Frere (1975), cannot be sustained for our area.

vi) The Types of Sites Represented

We have noted that the sites within and on the periphery of the study area are predominantly military vici in their origins, but that there are also sites that do not conform to this pattern, at least in their later history. It is now necessary to define the nature of each settlement, in as far as our evidence will allow, and to try and establish the economic base and significance of each class. Our first class are the military vici where there is no evidence to suggest civil activity without a military presence, or development into a form not predominantly reliant on a military base. This includes Brough, Melandra, Templeborough, Slack and probably Manchester (where however there may be suggestions in its size, prosperity and continued civil

occupation during a break in that of the military that the site falls into our second category).

The second category is that of the military vicus that also seems likely to have had significant 'civil town' functions; industrial, administrative or market roles that did not primarily serve the military. Such sites appear to have been too large and prosperous to have been surviving on the profits to be made from the garrisons at the sites alone and frequently continued in occupation after the army left. Derby, with its 'satellite' industrial settlement, possible post-military continuance and perhaps more than usually (for the area) Romanised character (suggested by the colonnaded building and mausolea), must clearly fall into this category. So must Castleford, atypically large and prosperous and again continuing as a settlement after military withdrawal. Rocester may also have fallen into this category since it appears as an independent civil town after the abandonment of the fort. However we do not have any proof that this civil town grew out of a military vicus.

Castleford, re-established as a civil town in the third and fourth centuries, Rocester as we have seen and perhaps Derby (depending on the dating of the military abandonment) in their later histories also fall into our third category, that of 'towns.' These are the sites where there is no

evidence at the time for a military presence and so some other economic base must be present. In addition to these three sites this group includes, throughout their histories as far as we know, Buxton and Carsington.

This leaves three sites, Chesterfield, Pentrich and Castleshaw, where we have no evidence for civil occupation (except perhaps briefly within the abandoned fort at Chesterfield). Whilst it is quite possible that these sites may yet yield such evidence, we must at the moment class them as a separate group of solely military sites.

vii) The Military Vici

As has been indicated military vici are the predominant 'urban' form in northern Britain. Until recently well known examples were largely confined to the area immediately south of Hadrian's Wall (Sommer 1984, 2f). Although much pioneering work which is still of considerable importance was done in this area (synthesised in what is still the standard work, Salway (1965)), it is clear that a number of important questions remain unanswered even here (e.g. Casey 1982). Moreover, the concentration on sites such as Chesterholm (Vindolanda) (Birley 1970, 1977a, 1977b) is in some ways regrettable since their evidence is not necessarily entirely transferrable to other areas of northern Britain. More recently increasing numbers of military vici elsewhere in the military zone (e.g. just beyond the scope of this

work at Doncaster (Buckland and Magilton 1986)) have attracted attention somewhat redressing the balance and providing new material for works of synthesis such as the volume of papers edited by Blagg and King (1984).

The present study area is relatively well represented in this recent work with major research at Brough (Bishop et al forthcoming; Drage forthcoming; Branigan and Dearne in prep.), Melandra (Webster 1971; J.P. Wild unpublished interims), Manchester (Jones and Grealey 1974; Jones and Reynolds 1978; Walker 1986), Castleford (Sumpter 1984; W. Yorkshire Unit 1984; Abramson 1988) and Derby (articles comprising D.A.J. 1985). It is therefore possible to try and examine the economic role of the military vici in our area without too great a reliance on parallel evidence. The study of military/civilian contacts in forts/vici is a wide one and I have discussed elsewhere a number of aspects of it with reference to the study area (Dearne 1986; Dearne forthcoming). However it will be useful to outline a number of general points of relevance that have some bearing on economic matters.

The legal status of military vici is unknown. Sommer (1984, Chapter 3) has argued that the res publica, the higher administrative authority, of military vici was the civitas capital not a military authority, but we have no direct evidence on the point. The ownership of the land on

which military vici stood, and therefore to whom if anyone the vicani paid rent, is equally obscure. It is possible that large areas, territoria, owned by the military and including the areas occupied by the vici existed (as for instance suggested by Higham 1986, 217). But others have argued that actual ownership was restricted to the fort site not including the vicus (e.g. Sommer 1984, 13f who summarises parallel German evidence). The evidence on the point (for Britain principally R.I.B. 583 and 1049) is insufficient to reach any satisfactory conclusion.

The population of vici has been discussed above in the context of the archaeological evidence available (p.51ff) and we shall consider below (p.147ff) some estimates of the numbers of vicani that a garrison's salaries might support. However, it is clear that we are likely to be dealing with settlements of hundreds of people at least. The evidence for the identity of these people is slim, and from our area restricted to two epigraphic records from Templeborough (R.I.B. 62 and 621), but tends to suggest a largely immigrant population (Salway 1965, 17).

We shall now consider in turn the evidence for the economic basis of military vici, first military and then from other sources. Then the presence or absence of a monetised economy, and the probable economic interactions of the

various groups of people that may have been present. Then we shall suggest a possible model for the internal workings of the economy of a military vicus.

a) The Primary Economic Base

The reliance on the military as a primary economic base is demonstrable at a number of our military vici. The principal evidence for this is in the correlations to be found between the occupation dates of the forts and their vici. Within the study area civil occupation at Brough, Melandra, Slack and on the periphery of it at Manchester, Templeborough, Castleford and perhaps Little Chester appears to begin at approximately the same time as the foundation of the forts at the sites ⁹ (above p.95 ff). This can hardly imply other than an initial military stimulus (intentional or not) as the origin of the civil sites, though the security factor should not be ignored as a subsidiary element. Equally in those vici that do not fall into our second category of vici with 'town functions' the military base seems to remain pre-eminent. Melandra and Slack both close down simultaneously with their forts. At least one site at Brough was abandoned with the fort c.120 while others may begin with its re-occupation in the mid-second century or show a second and third century floruit. Manchester shows a decline reflected by a lack of samian

ware during the fort abandonment c.130-60 (Jones and Grealey 1974, 87). Templeborough, although the evidence is very limited, probably contracted or closed during the fort abandonment(s) (Dearne 1986, 115). Similar trends have been noted in forts/vici further north (Higham 1986, 219).

The situation is complicated however, as it is elsewhere in northern England, by the fact that those sites with forts still in commission in the late third and early fourth centuries (Manchester, Templeborough and Brough) have vici that decline or close completely. The reasons for this are not fully understood but seem likely to relate to one or more of three factors. Firstly, the possible large scale removal of troops in the third, and not, as often thought, the fourth century (Daniels 1980; James 1984). Secondly, a decline in the discipline of the army and a tendency towards payment in kind (MacMullen 1963, Chapter 2). Thirdly, the debasement and devaluation of coinage in the third and fourth centuries (Casey 1982, 129). The implication in the second and third factors that vici had monied economies will be returned to later (p.119), but what is important here is that the probable reasons for vicanal decline do not suggest that any economic base other than the military presence was of significance. Indeed they stress its importance.

b) Evidence for other Economic Stimuli

Having demonstrated the importance of the economic relationship between forts and military vici it is now necessary to ask whether there is evidence for any secondary economic stimuli.

Lead

We have little evidence to demonstrate any direct economic stimulus from the lead extraction industry on any purely military vicus (the implications for Derby, Carsington and Buxton will be discussed below p.159 ff). Only Brough, perhaps just beyond the extraction area, seems at all likely to have been directly influenced, conceivably acting as a supply centre for the northern part of the lead field. However there is no specific evidence for this. Indeed, the likelihood of it is largely a function of how far north extraction took place and, though pigs from Bradwell and Castleton (Appendix 1 Nos. 46 and 52) may indicate some activity in the north, the concentration of pig finds is much further south (Fig.1) (but see further below p.285). Nor is there much evidence for any spin-off lead working industry (below p.344f). It is possible that some vici derived some income from transporting lead pigs, however it is argued below that this role is most likely to have been of importance to Derby (p.258). Indirectly Brough (and

perhaps Derby) may have benefited from the lead industry in that it provided at least part of the reason for the continued garrisoning of their forts. The possibility that the unit at Brough was part-mounted is particularly significant in this context for if it policed the main lead extraction area it probably did so by mounted patrols.

Travellers

Though in a relatively isolated area it would be foolish to assume that no travellers ever stopped in any of the vici in our area. Indeed, the presence of mansiones at Melandra, Castleshaw and Castleford (and the possibility of another at Templeborough on the periphery of the area (Dearne 1986, 124 & 150)) shows that they did. Travellers may have been a significant element in the economy of some of the military vici on the periphery of the area. We have already mentioned Castleford & Templeborough, at the end of Ryknild Street and initially perhaps an advanced post in northern England (above p.35). Manchester, an important road junction, probably also derived benefit from such official and private travellers. However, such people have left no evidence of their presence (except for the indirect evidence of mansiones) and it is difficult to estimate either their numbers or economic significance. Even in the case of mansiones this is problematic. I have argued elsewhere (Dearne 1986, 150) that the Melandra mansio could have served both as accomm-

odation for official travellers (who would likely not contribute to the vicinal economy since their accommodation was probably a burden placed upon the vicani (Salway 1984, 566ff)) and as a local drinking house. Only private travellers, who cannot have been very numerous in our area, are likely to have represented an input to the economy of military vici.

Administrative Functions

We have no evidence, locally or nationally, to indicate whether military vici ever acquired any administrative role (except in administering their own affairs). Since towns were so few in the military zone it may be suspected that some did, and it may be that those which continued after a military withdrawal, to be considered below, are the most likely candidates. Possibly Manchester is also a candidate for such a role with its excellent communications and permanently held fort, but in the absence of any direct evidence it must remain speculative.

Markets and the Rural Sector

By far the most important potential source for a secondary economic stimulus is interaction with rural producers, a market or consumer function. Indeed, we have noted above (p.92f) that this must be present if we are to demonstrate that military vici were integrated into the general economy, and can therefore be used to indicate a

genuine development from an 'Iron Age' economy throughout the area. If we cannot demonstrate some integration the nil hypothesis that vici were solely parasitic on forts and 'islands' of, not indicators of, Romanisation, as supported by Walker (1986, 168), must be strengthened.

We must first look at what we understand by the term market. To take it in its most literal sense we should be looking for evidence of an open area where produce could be exchanged or sold, the poor relation of a forum. To take it a little more abstractly we are looking for evidence of an exchange of some sort between rural producers and vicani/soldiers. As the differentiation implies 'marketing' need not occur in a market place. The implications are the same for rural/'urban' integration whether a farmer sells his produce through a shop keeper or sets up a stall in the market place. There is a further point as well, a market function is not demonstrated by one way trade. Both parties must get something from the exchange and the situation where a farmer sells only enough produce to obtain money to pay taxes does not demonstrate a market function implying rural/'urban' integration. It is not sufficiently different from paying taxes in kind under military threat. Thus, we must look for a flow of coinage or Romanised goods out of vici as well as for a flow of produce into them.

Taking the literal question first, can we identify any

market places in our military vici? One candidate is the gravelled area west of the Melandra mansio (Webster 1971, 65-70). This area seems too wide to be a road, even though it replaced one, but its relationship to the mansio is problematic. Is it to be seen as an adjunct to it or as a separate entity? We have no certain evidence on the point. Another possibility is the ?courtyard building at Castleford (Abramson 1984, 44). But few details are yet available for this and suggesting it as a macella would be premature. Indeed, it is difficult to attempt to identify market places since they need not leave any trace. A piece of waste ground suffices as a place to set up stalls. Even if we were to be sure that we were looking for some form of surfaced area this might take many forms, most probably open to more than one interpretation. Was Richmond's (1925, 32) 'parade ground' at Slack really a market place? Cobbled surfaces fulfil a variety of functions including both of these and working areas (e.g. north of the fort at Melandra (J.P. Wild unpublished interims)). Equally, perhaps we should be looking for incongruously wide roads that stalls could have been put up on. Moreover, as we have noted above, it is possible to have a market function without a market place.

The other line of enquiry, the identification of flows of money or goods, is potentially more likely to give definite

results. It is unlikely that we can identify an inflow of rural produce since it would be mainly perishable. But it ought to be possible to identify any outflow of coins or Romanised goods. It is on rural sites that we must search for our evidence for market functions. Detailed evaluation of the evidence is reserved for Chapter 7 but it may be commented that the present state of knowledge does not allow definite conclusions to be drawn. What indications there are are somewhat contradictory with possible correlations between coin finds and the fort/vicus at Slack being noted by Faull and Moorhouse (1981, 153f) but a lack of finds on the more numerous sites in the south of the study area. Better known parallels further north in England (Higham 1986, 224ff) and from Wales (Davies 1984, 112) tend to suggest that in many cases military vici were not performing a significant market function and had relatively little effect on the rural sector.

c) A Monied Economy?

It is necessary now to examine through what medium any transactions in forts/military vici took place. Although the use of coinage is so basic to modern life that it is taken for granted it is far from the only medium of exchange known. However, coinage (or rather money, since coinage is only one form of money) is the most versatile exchange medium. Generally it includes low enough denominations for

the smallest transactions, high enough ones so that large exchanges do not require a sackful of coins, and its value is guaranteed by a recognised authority.

Initially it perhaps seems unnecessary to ask whether military vici had monied economies. After all we have demonstrated that they were primarily dependent on an army presence and all the evidence (summarised by Speidel 1973) indicates that soldiers were paid in money (at least until later Roman times when in-kind payment became more common (MacMullen 1963, Chapter 2)). Indeed, we have called attention above (p.113) to the fact that vicanal decline coincides with the debasement of the currency and the trend towards in-kind payment. If either or both of these factors was important in the decline of military vici then it may be evidence for the operation of a monied economy. However, it should be noted that in-kind payment, though it would decrease the quantity of goods that the soldiery wished to purchase in vici, does not entirely imply a cessation in demand from soldiers. There were some things, particularly services, that the army is unlikely to have been able to supply and, even without money, a soldier might barter for these.

There is another important objection to any suggestion that money was not used in military vici which has already been alluded to, soldiers had money. It would be very difficult to maintain that soldiers supported military vici

in any other way than through spending their pay. They had little or nothing to barter with at least until in-kind payment became important. Their economic interactions seem likely to have been in terms of many small purchases not a few large ones so that there was a need for 'small change,' a feature only available with money. A second objection is similar, at least some vicani must have used money since items such as samian ware reached military vici. Even if we were to conclude that vici did not use money the Romanised world beyond did and it seems unlikely that merchants supplying goods from southern Britain or the continent would accept any other form of payment.

This is not to say that military vici necessarily operated on a wholly monied basis. It is reasonable to speculate that some transactions not involving soldiers (or their dependants) were carried on without money. The baker might barter bread with the cutler for a new knife, or with a scribe to write a letter for him. More importantly perhaps transactions between vicani and rural producers, such as a butcher buying a sheep from a farmer, need not have been monied. The presence of Romanised goods on rural sites would not necessarily imply monied transactions. The butcher may buy brooches or pottery from other vicani and then barter with them for the farmer's sheep. Coins on rural sites may imply rural participation in a monied economy, yet, at least

in low numbers, even they may not have been in circulation as such.

The foregoing discussion is important in view of the ambiguity of the archaeological evidence from the military vici in our area. Only one stratified coin has been recovered at the Brough vicus (Branigan and Dearne in prep.), and that a denarius of 19 B.C., although a number of *coins* have been found by metal detector away from the vicus (pers. comm. Wendy Huddle). Webster (1971) lists no coins from the Melandra vicus, nor are any published from the Slack vicus. Yet, from the vici and vici/towns on the periphery of the area there are far more coins (e.g. 41 coins, including the 'small change' we should expect if a monied economy were operating, from the industrial settlement at Derby (Dool 1985b, 209f)). Whether there is any real difference between coin loss rates at military vici within the area and at sites on the periphery of it it is too early to say. However, the presence of only one coin at Brough where five sites, some quite large and at least one likely to be in an economically important part of it, have been examined is curious. The possibility that there were in some ways two economies within military vici within our area, one monied and the other not, should not be ignored. It is only in transactions with the soldiery, their dependants and external traders that we need necessarily envisage the use of money for all transactions.

d) Economic Groups and Relationships within Military Vici

In assessing the sorts of people that may have been present within the military vici in our area, and the roles that they may have fulfilled within its micro-economy, we are faced with a serious problem of evidence. Only limited numbers of occupations can be directly identified from the area and we are frequently reliant on parallels from elsewhere, and indeed on presumption.¹⁰ Groups such as prostitutes are almost impossible to identify in the archaeological record but their omission for this reason would probably produce a distorted picture of military vici. Thus, much of the ensuing discussion and the ensuing modelling of the economy has to be regarded as hypothetical.

For the purpose of this analysis it will be necessary to establish the definition of certain terms. It is not sufficient to refer to 'the army' or 'the military' interchangeably as we have so far, we need more precise terms. Thus we shall refer to 'soldiers' meaning individual enlisted men acting as private individuals not under orders. To 'garrisons' meaning the units at each fort as distinct from their role as part of a larger unit (that is to say in situations where they could take decisions without reference to headquarters). And to 'the military' meaning the army generally, and in particular those elements of its procedures that were regionally, provincially or imperially codified.

'Vicani' will be used exclusively to refer to permanent residents in military vici at which an auxiliary fort is in commission. The word 'merchant' will be applied to a supplier of goods as opposed to a 'shop keeper,' essentially a wholesaler in modern terms (the equivalent Roman terms, mercatores and negotiatores are not sufficiently clearly defined for our purposes). Further terms will be defined as they are met with.

Soldiers

Soldiers are probably the easiest identified economically active group in military vici. They, and the military (see below p.132), represent far and away the most important input into the micro-economy as the dating correlations above (p.112ff) demonstrate. The presence of, usually, 480-500 salaried men provides the basis for the economy, and it should be noted a monied basis. Their economic interactions with the vicani are likely to have fallen into two principal categories, as supporters of their dependants (below) and as consumers of goods and services.

Veterans

The importance of veterans to military vici is a vexed question. Sommer (1984, 30) has questioned the assumption that large numbers of retired soldiers were present and I

have argued elsewhere (Dearne 1986, 30), following Hopkins (1980, 124f), that on average only some 0.586 veterans per unit per year would have retired. Even then some may have returned to far away homes or, more importantly, moved to towns and more productive lowland farming (Sommer 1984, 30). Assumptions that military vici were the poor equivalent of coloniae cannot be maintained on present evidence. This is not to dismiss a veteran presence totally. A veteran, Crotus son of Vindex, is known from the vicus at Templeborough (R.I.B. 62; Birley 1980, 100) and, with their savings, such men perhaps played a disproportionately large role in vici. Yet it would be dangerous to claim great economic significance for them without more evidence. Economically they may have acted much as they did when still enlisted, supporting dependants and acting as consumers. However, some may have joined the ranks of craftsmen or shopkeepers.

Soldiers' Dependants

It was illegal for soldiers to marry until Severan times (Campbell 1978) but it seems certain that, whatever the legal position, soldiers did contract unions that were in effect marriages before then. It is advisable anyway to take the term wives loosely (for its significance is largely social and legal not economic) to include any permanent arrangement by which a soldier supports a civilian partner, wholly or partly. R.I.B. 62 again provides the only certain case of a

military, or to be exact a veteran, wife in our area, though it is possible that R.I.B. 621, also from Templeborough, records a military wife. Children naturally enter the picture as well, though they are rarely represented archaeologically, as indeed may other relatives such as aged parents. The economic relationship of a soldier's dependant is fairly obvious and represents a direct transference of pay from a soldier to a civilian. In reality the picture is likely to be complicated by dependants fulfilling other roles as well (such as military wives producing textiles) but primarily the dependants act, like soldiers, as consumers.

Merchants

Merchants are problematic in relation to military vici in that, having defined the term as suppliers of goods, we must ask whether they are in fact likely to have lived there. The problem is partly one of scale. It is quite likely that merchants included a spectrum of people from those organising bulk supplies over long distances, perhaps to both the army and to civilians, to small operators who organised small scale supply such as that of coarse pottery to a limited number of shopkeepers. Indeed, at the lower end of the spectrum the group merges into that of shopkeepers. Whilst those merchants at the lower end of the spectrum are clearly more likely to have lived in military vici than those at the top end there

is little direct evidence for either being present. Those such as Barathes of Palmyra, a trader in fags, (R.I.B. 1065 and 1171; Birley 1980, 127) that are recorded are few in number and it seems likely that most merchants lived elsewhere and therefore, as Highan (1986, 219) has emphasised, represented a significant removal of profit from military vici; an outflow to the micro-economy.

Shopkeepers and Craftsmen

In some ways it is a misnomer to talk of shopkeepers since the term carries modern connotations of the assembly and retail of the products of a greater number of craftsmen and other producers. We cannot be certain that the 'general store' did not exist in military vici but the evidence we do have suggests the presence of numbers of specialist shops such as the pottery shop at Castleford (W. Yorkshire Unit 1984, 36). Indeed, most probable shops are of the strip building form and probably sold items produced in a workshop behind or in the shop (Sommer 1984, 48). The shopkeeper and the craftsman were usually one and the same.

We can identify a number of these 'retailing crafts' from archaeological evidence. Smithing is commonly represented in military vici, for instance on the 1984 site at Brough (Drage forthcoming). Leather working is represented, usually by worked leather fragments as at Melandra (Webster 1971, 63). Small scale potting as at

Manchester (Jones and Reynolds 1978, 11) is not uncommon and pottery retail has already been mentioned. In the same broad category but involving less of a craft element are establishments like the butcher's shop at Chesterholm (Birley 1977b, 40), but the survival of sufficient evidence to attribute such a specific function as this is rare. Thus we may suspect that certain of the buildings in complex 2 at Melandra (Webster 1971, 62f) are shops but there is no indication of what they sold.

Such people and their dependants must have made up a large proportion of the vicani. Essentially they represent the people who, with the service sector, profited from the spending power of the soldiers in that they bought goods from merchants, or made them themselves and sold them to the consumers of the military vici. However, these consumers were not exclusively the soldiery and their dependants, for there would be trade between the craftsmen/shopkeepers themselves (and with the service sector, below). The blacksmith had to buy pottery from other shopkeepers just as the soldier did, though, as we noted, this might not necessarily involve a monied transaction. Nevertheless, though they acted as both producers and consumers, the craftsmen/shopkeepers (and their dependants) as a group ultimately represent one of the two groups that profited directly from the soldiery.

Providers of Services

This is a broad title for a group probably more diverse than craftsmen/shopkeepers. The two groups probably overlapped somewhat (for instance an inn keeper may sell beverages but also offer accommodation) and economically acted in very similar ways, being both consumers and service providers, but deriving profit from the soldiery. Perhaps the main difference between them for our purposes is that few have left identifiable traces. A list of those that would be expected to be present may be given (prostitutes, priests, fortune tellers, scribes, ?teachers, barbers, doctors, oculists, masons, inn keepers, ?entertainers, washer women etc.). But direct evidence for their presence, let alone relative numbers, is rare. From the study area we have only the inn at Manchester (Jones and Grealey 1974, 49f and 125 building A), which however rests on limited evidence, and the mansiones at Melandra and Castleford (if these establishments were run by civilians not the military, as that at Castleshaw must have been). From other sites there are a few other pieces of evidence such as for priests who are indicated by the existence of temples and R.I.B. 1124, 1129 and 2065, and for stonemasons who are implied by the existence of civil tombstones and perhaps worked in regional schools (e.g. Phillips 1967; Kewley 1974).

As we have noted the service sector probably acted

economically much as the previous group. But there is also a likelihood that some of them such as doctors and priests also provided services to garrisons (as we defined them above) as well as to individual soldiers and other vicani. A further complicating factor could be that soldiers, some of whom may have had specialist skills, could have provided services to the vicani. For instance, could a military engineer have been paid to show the vicani how to build the clavicula entrance in the civil defences at Melandra (Webster 1971, 72f)?

Slaves

Casey (1982, 125) has called attention to the likelihood that some slaves were present in military vici and indeed they were clearly numerous enough at one vicus to form a burial club (R.I.B. 1436). Some clearly belonged to soldiers (R.I.B. 1064) and could be thought of economically in a similar way to other dependants of soldiers. However, if there were many slaves set up in business, like the goldsmith at Malton (R.I.B. 712), and owned by soldiers then they may represent soldiers making a profit from, as well as acting as, the consumers in vici.

Farmers

We have some evidence to suggest 'market gardening' at the edge of vici (Sommer 1984, 36ff; and the possible allot-

ment boundary at Manchester; Jones and Reynolds 1978, fig. on p.6) but none for farmers as such living in vici. Nor is there any specific evidence for the farming of the land in the vicinity of forts by or for the military (though this must remain a possibility; see particularly MacMullen 1963, Chapter 1). Farmers must then be thought of principally as living outside vici, and, as we have already noted above, the degree to which they interacted with them is uncertain. It is likely that at least some military needs were provided by rural farmers without passing through the hands of merchants. Thus, at least in the early days of occupation, some forts probably relied partly on food bought, taken as direct taxation, or simply confiscated from rural farmers. Yet how important such direct military supply was it is impossible to say. What is clear is that such direct supply represents a loss of potential profit to vicani and or merchants.

Peripatetic, Regional and Itinerant Traders etc.

Some of the above groups amongst the shopkeepers/craftsmen, service sector and particularly merchants may not have been, strictly speaking, vicani. We have already noted the probable regional masonry/sculpture schools and such regional activity may well have applied equally to other traders and service providers. For some groups a single military vicus may well not have provided a sufficient

market and we may envisage a number of centres being served by the same individual. There are three separate ways in which this may have happened. Firstly, there is what we may term regional activity where a number of centres within a region are served by, for instance, a mason living at one centre. He would probably travel to other settlements on demand or perhaps take commissions. Secondly, we may suggest peripatetic activity where, for instance, a doctor or a trader in high priced commodities visited a number of settlements on a regular basis in turn but lived permanently at none of them. Thus perhaps in our area he may perhaps have lived at Derby but regularly visited Brough, Carsington, Melandra, Buxton etc. Thirdly, there is the possibility of itinerant activity, essentially similar to eighteenth and nineteenth century tinkering, where the trader or provider of a service has no permanent home but continuously travels a large circuit.

Much as we may suspect that merchants' profits rarely stayed in vici the profits of these Regional, Peripatetic and Itinerant people must largely represent an output to the economy of military vici, or at least a concentration of profit in one centre at the expense of others.

Military Contracts

We have already noted how merchants might have profited from the army by fulfilling supply contracts. But it is

possible that numbers of vicani may have made a similarly direct profit from the military, or at least garrisons, by working for them as artificers. If a garrison required a new axe and could not or chose not to make it themselves they would buy one from a craftsman/shopkeeper. However, if they required thirty new axes the implications begin to change. Every garrison of the Roman army would have needed a large amount of gear, armour, weapons and ordinary tools and fitments in a range of metals, quite apart from the equipment made of leather, of wood and textiles. Even if, as seems likely under the early empire, the cost of much of it was ultimately borne by individual soldiers (e.g. MacMullen 1960, 24f; James 1984, 270) sums of money were deducted from soldiers' pay for at least some equipment. This implies that it was the army, or at least garrisons, that actually arranged the manufacture or purchase of the equipment. The vast majority of this would have to be repaired or replaced more or less regularly. Did the army undertake this work 'in house?'

Bishop (1985) has recently discussed this question with reference to the early Principate. He concluded that legions were, as Vegetius (De Re Militari, II in Bishop (1985)) suggests, largely self sufficient within a flexible framework of city state production in the east and fabrica production, particularly in winter camps, in the west, at least until the establishment of arms factories under

Diocletian. Although it seems that such factories never appeared in Britain (James 1988, 262ff). However, the question of how equipment was repaired and produced for auxiliaries in permanent non-campaigning bases has some important differences from this.

Since we are talking of units in permanent forts in essentially peaceful times loss and damage of equipment is likely to have been less common. More importantly legionary bases were at some distance from the auxiliaries and our evidence for those apparently responsible for the operation of fabricae (the optio fabricae and immunes etc.) seems principally to apply to legions (e.g. MacHullen 1960, 26ff). Although some auxiliary fabricae are known in Britain, such as at Chesterholm where we have two duty rostars probably for the fabrica (Bowman and Thomas 1983, tablets 1 and 3), their numbers are too few to suggest that every auxiliary fort produced and repaired their own equipment. In our area we have one probable fabrica, at Castleshaw. Its presence may well have been connected to the needs of travellers since there seems little other role for the fortlet in which it lay (McNeil, Start & Walker 1989, 229).

The small ?quasi-military ?fabrica at Templeborough on the periphery of the study area (May 1922, 55ff) seems to relate to the early days of the first fort on the site when, as probably an advanced post east of the Pennines, some

campaigning is likely (Dearne 1986, 145). The industrial activity within the fort at Derby is not certainly military, as we noted above (p.101). Was auxiliary equipment then produced and repaired at legionary bases such as Corbridge as MacMullen (1960, 29) has implied? We have pointed out above (p.85f) that were this the case then transport costs might have been considerable. Another factor is the re-use of scrap bronze, and even iron, convincingly argued for by Bishop (1985, 8f), which would in these circumstances have to be taken to the legionary base as well as transporting repaired or new equipment back. This seems unduly time-consuming, even ignoring the cost argument. Damaged equipment and scrap would have to be assembled at a fort till a quantity worth taking to a legionary base was ready. It would take some time for the return journey, let alone the time taken for the repairs to be carried out (though new equipment might be exchanged for damaged). Unless we are to see each fort carrying large surplus stocks of equipment it could be months before a broken piece was repaired or replaced.

As Bishop (1985, 11f) emphasises flexibility was a key note of the army supply and repair system. Therefore it seems reasonable to postulate that auxiliary equipment in areas such as the south Pennines was not repaired or replaced by the military at all but by using civil craftsmen on a

contract basis. As I have argued elsewhere (Dearne 1986, 152f and 161ff) numbers of buildings at Manchester, Melandra and perhaps Brough that lie near to fort gates appear both to be non-residential and involved in metal working on some scale. The clearest example is at Manchester where for much of its history the whole of the 1972 site seems to have been dominated by metalworking (Jones and Grealey 1974) and buildings C1, C2, D, F and ?O at least were non-residential. There is no suggestion that the area was in any way military. But the use of areas near to the fort gates, probably the most sought after commercial sites in military vici (Higham 1986, 219), for such activities must reflect a lucrative and constant demand for metalwork. The isolated metalworking areas outside the north gate of the fort at Melandra (J.P. Wild, unpublished interim reports) may even be suggestive of a functional differentiation between residential areas (which may however include small scale metalworking) and essentially industrial ones.

Casey (1982, 129) has commented that soldiers cannot have constituted much of a market for metalwork, even supplemented by vicani, and he may well be right. However, it is suggested here that it was perhaps the military, or at least garrisons, as distinct from ordinary soldiers who were providing the market. A similar suggestion might be made for the ?weapon shop at Llanio (Davies 1984, 105). This is

not necessarily to suggest that every auxiliary fort had all its gear repaired and replaced by civil artificers on contract at each vicus. The evidence suggests far more iron than bronze working and it may be that it was mundane gear principally in iron that was repaired/replaced by such contractors. Equally the evidence perhaps favours a number of regional centres not major workshops at every vicus. The principal evidence comes from Manchester, which Hartley & Fitts (1988, 90) also regard as a regional metalworking and smelting centre, and perhaps from the industrial settlement at Derby (below p.157f). The indications are of smaller areas at Melandra and ?Brough. Thus, to conclude, what is being suggested is a situation where after the pacification of the area (during which we might suggest legionary supply and small auxiliary fabricae like Templeborough) much of the day to day repair and replacement of iron work was done for auxiliary garrisons by vicinal contractors. Perhaps the bulk of it at the larger and more permanent forts (?Manchester and Derby) with smaller, mainly repair, jobs being done by smaller numbers of contractors at each military vicus. Davies (1984, 107) has noted similar possibilities in Welsh vici. More elaborate items in bronze, such as horse trappings seem less likely to have been replaced in this way. Legionary production, or at least production at the most major auxiliary fabricae, is far more likely, though such items seem to have been produced in at least one German military vicus (Benea and Petrovsky

1987).¹¹

We have restricted ourselves so far mainly to metal-work, and in Britain any evidence for similar developments in other trades is unlikely to survive. Though see Davies (1984, 107) for possible leather working evidence at Brithdir, to which may possibly now be added some evidence from the ?military site at Walton-le-Dale and the Papcastle vicus (Adrian Oliver in lecture). Van Driel-Murray has studied the evidence for military leatherwork from northern Europe and, despite its limitations, has suggested that in the early second century shoe manufacture at least passed into the civil sector (Van Driel-Murray 1985, 55ff). Although other military leatherwork remained standardised this does not necessarily imply military production, only the enforcement of a uniform pattern (Van Driel-Murray 1985, 66). Even if centralised military production is accepted there remains the question of the repair of leather-work, surely an important factor given the vast amounts of raw materials required to replace items (Van-Driel-Murray 1985, 46). But for the lack of evidence we might also consider whether woodworking and even textile production were not also at least partly undertaken by civilians.

The whole problem of who supplied the army, let alone who repaired damaged gear, is one that has only begun to be studied in depth. To suggest any one answer for all

equipment at all periods would be wholly false. It is clear that there were significant differences between various classes of equipment and parts of the empire. In particular there also seems to be a distinction between possible self-sufficiency in the first century and increasing use of non-military sources in the second and third centuries leading to the establishment of 'private arms factories under Diocletian (Bishop 1985; Oldenstein 1985, 82ff). Yet vicanal involvement, at least in repairing gear and in producing its more mundane elements like shoes, tools and iron fittings, seems a strong possibility in the second and third centuries.

e) Modelling the Vicanal Micro-Economy

Despite the lack of archaeological testimony in some areas it seems possible to suggest a model for the operation of the micro-economy of a military vicus. Of necessity much of it must be based to a degree on speculation and it is offered as a theoretical model to illustrate the ways in which the wealth derived from the military and soldiers may have subsequently circulated. It is not intended to reflect the actual economy of any particular vicus since we have insufficient evidence for that. Therefore some elements considered may have been of little or no importance at one vicus whilst they were very important at another. The above discussion seems to allow the identification of three broad

groups who act similarly in an economic sense within the micro-economy of a military vicus; those who provide the input, those who benefit from it while remaining within the system and those who are outside the system but benefit from it. We may term these three groups the Primary Consumers, the Producers/Secondary Consumers and the Distant Producers respectively. It will be advantageous to examine each of these groups briefly before progressing.

Primary Consumers

Primary Consumers, those who did not make a living from the vicinal economy but from outside it and whose main importance was as consumers of goods and services, include five groups of differing importance. Pre-eminent were soldiers, garrisons and the military (as defined above). A smaller, but in some cases perhaps not unimportant, group are travellers and the fifth group are those, such as in our area might be represented by lead miners, who use the military vicus as a supply centre or similar.

As Fig.5 indicates these groups represent the inflow to the economic system which disseminated to four groups, soldiers' dependants, craftsmen/shopkeepers and service providers, artificers working for the military on a contract basis and merchants fulfilling military supply contracts. Only in the last case is there much likelihood of much of the input leaving the vicus at this point.

Merchants supplying the military will form our main group of Distant Producers (below).

Producers/Secondary Consumers

Producers/Secondary Consumers, those who make a living from being craftsmen, shopkeepers or the providers of services, and are resident vicani, probably make up the bulk of the vicanal population. They act not only as producers profiting from the Primary Consumers but as consumers themselves, spending part of their incomes within the vicus. They include craftsmen working on military contracts as well as the retail and service sectors generally. As Fig.6 shows in the case of contract craftsmen the profit derived from the Primary Consumers is in part passed on to other Producers/Secondary Consumers as the contract craftsman buys items from them. The same is true of the rest of the group, except that the flow is circular within the craftsman/shopkeeper and service sector.

Distant Producers

As we have intimated the most important group within the Distant Producers are merchants who do not live in the vicus, both those who supply the military and those who supply shopkeepers in the vicus. They represent a likely significant outflow in that they profit from Primary and Secondary Consumers without putting anything back into the

system (for instance by buying things from shopkeepers). Other groups who act in the same way (though on a smaller scale) are the Regional, Peripatetic and Itinerant Traders etc.

Other Outputs

There are two other outflows to the economic system. The first, taxation, is likely to have been of importance. As Fig.7 shows, it essentially represents a return of part of the profit made from the Primary Consumers in that army pay and expenditure was ultimately derived from taxation. The second is savings, or perhaps more exactly profits above the level of essential living expenses, whether kept in monetary savings, used to construct better housing or civic amenities, or invested in, for instance, a farm. To be pedantic there is also a third output, the accidental loss of coins (or in the strictest sense any loss such as a house burning down).

The Model

Fig.7 represents diagrammatically our model of a vicinal micro-economy. The inflow to the system, derived mainly from provincial taxation which in part represents a return of the profits of the vicani, is entirely through the Primary Consumers. This inflow is channelled through four groups, soldiers' dependants, two groups of Producers/

Secondary Consumers and, perhaps of particular significance, Distant Producers. In the latter case this is probably the point where the inflow leaves the system. But in other cases some of the inflow continues on into a circulatory system at the centre of the diagram representing the bulk of the vicani trading amongst themselves. The main outflow shown is represented by Distant Producers profiting from a system that they put nothing back into. But other ones are taxation, and savings/coin loss (which is not shown diagrammatically since it is of limited importance).

Qualifications

There are a number of factors which are not allowed for in this model. Firstly, we have made no allowance for the vicus having a market function for the rural sector. We have noted above (p.116ff) that the question of a market role is unresolved for our area but that in other areas many have minimised its role. In a situation where a farmer sells only enough produce in a vicus to obtain cash to pay taxes he is not influencing the vicanal economy very much (except perhaps in taking some of the Distant Producers' market share). Where he sells more produce than this he may in fact be profiting from the system in the same way as a Distant Producer. However, it seems likely that in this case much of the profit would be spent in the vicus

itself on Romanised goods and the farmer would be acting little differently to the bulk of the vicani. The only real difference would be in extending the geographical limits and size of the micro-economy.

Secondly, we have made no allowance for soldiers or their dependants acting as Producers (in terms of soldiers charging for providing expert advice say on building, or of soldiers making a profit through setting up slaves in workshops, or of soldiers' wives selling textiles). To show all these possible interactions would make the model unduly complicated and we have little evidence for their existence. Even where present they were likely of limited importance.

Thirdly, and perhaps more importantly, we have assumed that there are no merchants who are not Distant Producers. If merchants making significant profits from military supply contracts were vicani the model would change in that far more of the initial input would remain within the system. We have seen that the evidence for such merchants being present in vici, let alone resident, for the two are significantly different, is slim. However, if such evidence should be forthcoming our assessment of vicanal micro-economies would require some revision.

The Implications

The model implies a number of things about the economic

life of military vici. Firstly it reinforces the point that the economy was mainly dependent on a military presence. Secondly it demonstrates that the economy did not necessarily represent a simple trading arrangement between soldiers and craftsmen/shopkeepers/service providers. It is clear that the presence of soldiers' dependants and perhaps of artificers working on military contracts implies a far greater variety of economic contacts between the army and civilians than this. If significant numbers of contract workers were present it must alert us to the possibility that it was not only the actual salaries of soldiers that were important as inflow to the micro-economy and that shopkeepers and the like were not necessarily restricted to making profits out of them. It would therefore imply that vicinal populations were not limited by the spending power of the soldiery alone. It might suggest that there was sufficient scope in some cases for the development of a civil centre based not on serving soldiers but on supplying the military (this suggestion will be returned to below, p.154).

Thirdly, however, the model suggests that much of the profit potentially available from army sources may have left the economic system at an early stage before any vicani were involved. The relative profits made by the Distant Producers and the Producers/Secondary Consumers are the crucial element

in deciding whether the economies of military vici ever had a chance of booming.

f) Quantification

As with much of the economy of the south Pennines there are very great problems in attempting to quantify the economies of military vici, or indeed individual elements within them. Some tentative estimates of their maximum physical sizes are now possible (above p.53; Dearne 1986, 137ff; Dearne forthcoming) but much further work is required to confirm them. Also, as noted above (p.54f), they are of limited use in determining population figures because of uncertainty about building densities, the numbers of non-residential buildings and the contemporaneity of occupation on different sites. Thus, we cannot establish a correspondence between the size of military vici and the populations that their economies supported. In the broadest terms apparent differences in the maximum physical size of different vici probably do correspond at least in part to economic factors. Thus, military vici abandoned before the close of the second century and not developing into towns (Melandra, Slack, and the first phase at Brough) appear to be of more limited extents than those continuing later (Manchester and the later phase at Brough). However, much further evidence is required to confirm this. It is clear at Melandra and probably Brough that occupation expanded

through time (Webster 1971; Dearne 1986) indicating a growing economy but we are not yet in a position to quantify that growth.

Quantification of the various elements within the military vicus' economy is even more difficult. We have no way of knowing how many soldiers' wives were present, how many or what type of service providers lived in the vici, or even how many inns, for example, the market supported. We have noted the evidence for metalworking above but the very fact that it is recognisable in the archaeological record makes it unusual. Its relative importance cannot be assessed since we have little evidence for other trades to compare it with.

Thus, it is clear that at the present time attempts at quantification based on archaeological evidence are impossible. It is worth however exploring a more theoretical approach. We cannot hope to assess the impact of the rural sector, travellers etc. on the economy, but we have demonstrated that the primary economic base was the army. Taking what we know of army pay rates it may be possible to suggest notional figures for the number of vicani that a garrison might be able to support. Although clearly this will not take into account factors such as vicani working as artificers on contract to the military it may give some minimum basis for calculating the size of economy that could be supported by the soldiery alone.

The exercise will involve a number of assumptions which must be stated explicitly before we proceed (some of which will be re-examined at the end of this section). Firstly we are making a number of assumptions about our evidence on army pay (and about grain prices which will be examined later). We are assuming, for the period 84 to the time of Septimus Severus (which is the period for which we have reasonable figures and therefore must be the period to which the exercise is limited), that Speidel (1973), is right to argue that auxiliary pay rates were either $5/6$ or $\frac{2}{3}$ of legionary standards. That is for an ordinary foot soldier (miles cohortis) they were 250 or 200 denarii per year, for a mounted soldier in a foot regiment (equus cohortis) 300 or 250 denarii per year and for a mounted soldier in a mounted regiment (equus alae) 350 or 300 denarii per year.

We will assume too that the document P.Gen.Lat recto, part 1 (Fink 1971 No.68) is an auxiliary pay record of 81 (and therefore sufficiently close to the period that we are considering to be of use) as Speidel (1973) has argued and not a record of deposita (for such previous interpretations see Fink 1971). We must also assume that this evidence, from Egypt, is applicable to Britain (with the exception of the 1% deduction which may have been for the conversion of denarii to drachmae (Speidel 1973, 144)) and is complete enough to include the main items for which pay deductions

were regularly made. The term faenaria, 'hay money' that occurs in the document (col.ii, lines 5, 16, 25; col.iii, lines 4, 15, 25) will be assumed to refer to money for bedding and not for feeding a horse (on the detailed arguments on this point see Speidel 1973, 145). As Speidel (1973, 145) suggests this last assumption if correct ought to mean that it was the $5/6$ not $\frac{2}{3}$ relationship to legionary pay that applied and therefore it is these pay figures (200, 250 and 300 denarii) that we shall actually use.

Two further assumptions, both known to be wrong, must be made for the moment and discussed later. That soldiers saved no money and that all soldiers in a *regiment* were paid at the same rate. We know that higher pay scales (sesquiplicarius and duplicarius) existed but have no evidence for the numbers of soldiers entitled to them. Attempts to allow for the presence of higher paid officers and soldiers at this stage would unduly complicate our calculations.

We will start with a miles cohortis on 200 denarii per year. From this sum we need to deduct the following amounts: ¹²
 for food (in victum) 60 denarii; for boots and socks (caligas, fascias) 9 denarii; 'to the standards' (ad signa) 1 denarius;
 for clothing (in vestimentis) $36\frac{1}{2}$ denarii; ¹³ and for 'hay money' (faenaria) $7\frac{1}{2}$ denarii. This gives us a total figure

for deductions slightly over 119 denarii per year, leaving a surplus of 81 denarii. To make use of this we need to convert it to a grain equivalent.

Again we face problems of evidence here, for we have no wheat price information from Britain and that from the rest of the empire needs to be treated with care. For instance the prices at Rome are known to have been much higher than in nearby towns (Duncan-Jones 1982, Appendix 8). Indeed, we cannot hope to do more than use a price that reflects the right general scale. Since we are talking primarily of the second century we require a figure drawn from then. Perhaps the most likely to be reliable, although again we must acknowledge that we are transferring evidence from Egypt to Britain, is that of 2.5 sesterces per modius quoted by Duncan-Jones (1982, Appendix 16). Thus, at 4 sesterces to the denarius, the 81 denarii surplus would buy 129.6 modii of grain.

To use this figure as a guide to the number of vicani that the soldier could support we now need to establish how much grain, or rather what grain equivalent, would be required to support each vicanus. Again we can only hope to establish a figure in the right general area. Davies (1971, 123) has calculated that a soldier would eat $\frac{1}{3}$ ton of corn a year, and there seems no reason to think that a civilian would consume less. However, the grain equivalent

of the full diet of a vicanus must be greater than this. Doubling the figure might allow for this (perhaps even over-compensate). Therefore, at 6.74 kg per modius (Duncan-Jones 1982, Appendix 18 (the figure is derived from averaging figures given by Pliny and assumes the use of the modius Italicus)) we arrive at a figure of 873.504 kg. Since $\frac{2}{3}$ of a ton is 677.265 kg it is clear that a miles cohortis could support some 1.3 vicani.

The situation for equus cohortis and equus alae is more difficult. Although the deductions that we have listed above are likely to have applied equally to them, there must be some doubt as to whether other deductions were required of mounted soldiers in respect of the upkeep of their mounts. P.Hamb. 39 (Fink 1971, No.76) seems to indicate that equus alae received an extra allowance (of 25 denarii) for their horses' hay. Therefore we will assume that no extra deductions were made from cavalry pay. An equus cohortis, then, would have a surplus of 131 denarii, and an equus alae one of 181 denarii. The grain equivalents of these figures are 209.6 and 289.6 modii. This in turn gives us vicanal support figures of about 2.0 and 2.8 respectively.

Applying these figures to garrisoning units we have, firstly for a cohort of 480 foot soldiers,¹⁴ a figure of 618 for the number of vicani that could be supported. For

an ala quingenaria of 512 the figure would be 1475 vicani, and for a cohors quingenaria equitata of 608 men including 64 mounted it would be 752. To apply these figures to actual sites is more difficult since in many instances we are not certain what sort of unit was in garrison. Quite apart from the problems of the changing of garrisons over time. One site where the situation is fairly clear is Melandra where a cohors, perhaps I Frisiavones (Dearne 1986, 37 and 61), is likely to have been in garrison. Therefore the vicanal support figure ought to be 618.72. Bearing in mind that the full extent of occupation at Melandra may not be known this figure is not unreasonable compared to the excavated vicus (Webster 1971).

It is now necessary to re-examine one or two of the assumptions on which our calculations were based. As we noted some soldiers were undoubtedly paid on a higher scale (e.g. P.Brit.Mus. 2851=Fink 1971 No.63 i 27 & 28; ii 2, 3, 15, 16, 40, 42, 43). From the same text we can see that there were also higher paid officers. In this case the commander, six centurions and four decurions. The numbers of higher paid soldiers and officers are not great but must push estimates for vicanal support figures upwards. Conversely another likely false assumption, that soldiers did not save money, must push our figures down, perhaps by a greater amount than the previous factor raised them. It

is clear from P.Gen.Lat. recto part 1 that soldiers might save considerable sums, though the amount saved must have been influenced by the presence or absence of a vicus in which to spend money.

There is of course a further unacknowledged assumption that we have been making, that the profit from the army was equally divided among the vicani to allow the support of the maximum number of people. This is very unlikely to be the case, and the occasional larger and better appointed structure such as building AA at Manchester (Jones and Reynolds 1978, 12f) may confirm this. However, whether the distribution of wealth in military vici was pyramidal or characterised by just a few rich men and a majority of fairly equal wealth it is impossible to say at present. A similar complication to the picture, pointed out above by our attempts to model the economy of a military vicus, is the fact that some of the profit made from soldiers by vicani was in fact lost again straight away, both in the form of taxation and as payment to Distant Producers who supplied the goods sold to soldiers in the first place.

Overall it seems likely that reassessment of these assumptions ought to decrease the vicanal population that a given number of soldiers could support, or at least to suggest that the figures should be taken as maxima. Whilst this is not problematic for sites such as Melandra it may

suggest that other, perhaps considerable, sources of support should be looked for at sites such as Brough. We very tentatively suggested a maximum population of c.1,200 for this site in Chapter 4 (p.55f) and it appears that, given its likely small garrison (above p.97), even halving the figure could be problematic if the soldiery's salary was its only important income. Again it appears that the possibility of economically significant military contract working or even of functions such as regional administration or markets cannot be ignored.

viii) The Military Vici/Towns

We have noted that three sites, Rocester, Derby and Castleford, and possibly a fourth, Manchester, were probably military vici but simultaneously fulfilled other economic functions. For want of a better term 'town' functions (cf. e.g. Walker 1986, 168). Although much of our examination of purely military vici may well apply to these sites it seems likely that there were further important elements in their economic bases, elements that are far more difficult to identify and model. This is particularly clear where settlement outlasted a military presence. An economic stimulus, either present earlier or which developed on the military withdrawal, was clearly able to take over from the army in supporting the vicani.

At Rocester we do not yet know whether a civil town

developed out of an earlier military vicus/town or whether it simply re-used the fort/?vicus site. Continuity of settlement would need to be established in order to use Rocester as evidence for 'town' functions being combined with a military vicus. This continuity is present at Castleford, along with many other indications, such as the size of the settlement and the incidence of stone buildings, that it was more than just the garrison that was supporting the vicus.

For Castleford it seems likely that we must think of a river port function as providing at least some of the additional economic base. The question occurs of who or what such a port would be serving. If we are thinking in terms of 'imports' they would be coming from the east coast, probably from Petuaria. Yet it is difficult to see to where they would be distributed from Castleford, unless it were to other forts. To the west we have seen (p.67ff) that there is no road system, and neither are there major settlements. To the north and south there is a single road towards York and Doncaster respectively. Yet to north and south other Humber tributaries would seem to offer more direct routes from Petuaria. Unless the R. Aire was far more navigable than other Humber tributaries Castleford seems pointless as an 'import' centre.

What if its function was mainly to export to Petuaria? Again there is a problem. What was being exported and where

was it being collected from? It seems highly unlikely that there was any connection with Derbyshire lead, however it is possible that it was involved in the movement of grain. It is suggested in Chapter 7 (p.185) that the lower lying areas of land in the north east of the study area, including the upper Don valley north could have provided scope for villa farming. Certainly the Magnesian Limestone areas to the east in the environs of Castleford and further south should have provided productive farming land. An objection to suggestions that Castleford was exporting a grain surplus may be the lack of a known road network to its west or in its general vicinity to facilitate collection (though trackways may have been of considerable importance (above p.71)).

As yet we cannot be certain what the factor(s), other than the garrisons presence, contributed to Castleford's prosperity, though they may perhaps have been varied. Subsequent craft activity is represented on the site by spoon manufacture when the settlement was re-established in the third and fourth centuries. It may have taken advantage of any inland port function to decrease transport costs and thereby have boomed. It is also possible that Castleford took on some administrative functions. Certainly the regularity of its plan suggests a degree of Romanisation that might be in keeping with such a function.

At Derby we are not certain that the settlement survived

a military withdrawal. But even if it did not there is reason for thinking that other stimuli than those we outlined for purely military vici were present. Even if the otherwise incongruous features such as the colonnaded building and mausolea were ignored the presence of a 'satellite' industrial area, probably indicating production above that required by the garrisoning unit and vicus alone, suggests that some other role was being fulfilled. Indeed, it is on this industrial area that attention must initially be focused in looking for other stimuli. Wheeler (1985d, 300) has suggested that the potting industry that initially used the area may have had a military orientation, but in the sense of supplying numbers of garrisons in the area and, perhaps, the late first and early second century campaigns further north, not just the local garrison. Equally it seems possible that the lead mining industry may have provided a market.

The industrial area was taken over in the mid-second century by metalworkers and, since it remained on the same site, it is possible that its markets remained the same. In particular it seems possible that the area could have been acting as a regional centre for military contract metalwork, the existence of which was postulated above (p.132ff). As with Castleford there are a number of other possible stimuli to consider. Derby may have seen a number

of travellers passing through it and could have acted as an administrative centre. Moreover here on the southern periphery of our area it may be that there is a greater likelihood of a significant interaction with the rural sector in a market role. It is also possible that Derby derived some benefit from the lead industry. It is perhaps possible that rich lessees lived there, near enough to their mines to direct their exploitation yet in far more Romanised conditions than in the mining area itself. Equally, it is suggested in Chapter 8 (p.258) that lead exports may have passed through Derby to the R. Trent and that its transport at least might have provided some with a living.

Manchester illustrates the problems of identifying sites where military vici are in fact performing other roles than serving individual garrisons. Its size is uncertain but could be great (Dearne 1986, 38f) and possible ancillary stimuli could be suggested. Again there appears to be a large metal working area, it was an important nodal point in the communications network and it could have played a role in administration (Walker 1986, 167). Yet we have no direct proof that it did not live off of the garrison alone, mainly because the fort was almost permanently occupied into the late Roman times. We have no chance to test whether the settlement could exist without it.

The problems of assessing the nature, let alone degree, of other elements than the presence of a military garrison in the economic basis of such settlements are ones that are only likely to be illuminated by further excavation, both within the settlements themselves and in some cases in other areas such as rural sites. For example, we cannot yet say whether it is significant that all the sites where we suspect ancillary stimuli lie on the periphery of the study area. Did they all share an entrepôt function?

ix Towns

Towns, or more correctly civil settlements where there is no known military garrison at the time, are relatively few in the study area. On its periphery the later occupation at Castleford, Rocester and perhaps Derby is of this form. The exact nature and extent of the activity at the first is not fully established, the second is relatively poorly known and the inclusion of the third is dependent on the dating of the fort abandonment. At the first and third sites the limited indications are that some industrial basis should be sought, mainly metalworking. But in view of the lack of evidence and the range of possible economic roles that the sites may have fulfilled (synonymous with those discussed for the sites in their earlier military vicus/town stages above) further discussion would be too speculative.

Two further 'towns,' both within the study area proper, remain. Neither Buxton nor Carsington is well known but both are likely to have been of some importance and could have had economies similar to military vici in that a single main source provided their basis. No military presence is known at either, though a first century fort has repeatedly been suggested at Buxton based on limited evidence (e.g. Hart 1981, 87) and a fort has been suggested on more speculative grounds at or near Carsington (Makepeace 1985, 70ff).

We have already suggested (above p.86ff) that Buxton's special functions were partly responsible for the disparity in the prosperity and provision of roads between the north and south of the study area. We need now to look at it in a little more detail. The evidence is sufficient only to allow some basic conclusions to be drawn. Firstly, it had a spa function. Such is obvious from its name and the known bath house remains which seem to be too extensive to be explained in any other way. Secondly, it had a religious function. Again its name, as well as a probably dedicatory coin hoard, provide the evidence. Thirdly, its spa at least, appears to have been patronised into the late fourth or early fifth centuries from the composition of the hoard.

We cannot say how big Buxton was, though the limited numbers of provenanced finds mapped by Hart (1981, fig 8:5)

probably suggest more than just an isolated spa complex. A figure of 1 hectare plus seems to be indicated. It is one of only two spas known in Britain, the other being Aquae Sulis (Bath). But it would be unsafe to draw parallels from the latter since it lies in lowland civil Britain and represents a far more Romanised town than Buxton is likely to have been. Thus, we are left with a potentially important site that we know only the barest facts about. As we have noted it may be that it had an economy essentially similar to a military vicus', but with the economic base being provided by those who came 'to take the waters' or for religious reasons.

It seems likely that the religious and spa functions of the town were closely allied and that Arnemetia, the Romanised Celtic deity who gave her name to the town, may have had a healing cult. It is also probable that much of Buxton's 'population' was transitory, consisting of those who visited it for religious or medical reasons. Many of the permanent residents may have lived principally to serve and profit from these visitors. We ought probably to envisage numbers of priests, bath attendants, doctors, inn keepers and artificers selling decorative mementos and religious objects. Indeed, it may be that the possible metalworking in caves of the Wye Valley system (below p.198f) was related to such activity.

The identity of the patrons of Buxton's spa is unknown.

They might have been rich civilians from further south and east, in which case there would perhaps be some likelihood of their trade being seasonal. But equally they may have been soldiers on leave or recuperating from injuries. If so the question would occur as to whether there was a military hand in the running of the town. Only a single altar (R.I.B. 278) probably removed from Brough to Bakewell in post-Roman times gives any clue to the identity of any patron, in this case a soldier at Brough. We have no way of knowing whether spa/religious functions were the only ones on which Buxton survived. Administration of the surrounding area must again figure as a possible further stimulus to the economy. So must the possibility that mine lessees lived here in more Romanised conditions than in the actual lead field, as we have suggested they could also at Derby. Indeed, it is possible that miners **were** amongst those who took the waters at the town.

The other 'town,' Carsington, is slightly better known than Buxton but perhaps more enigmatic. It was clearly of some prosperity since it contained a number of stone buildings (stone buildings are rare in other settlements in the area; Dearne 1986, 151). But there is little direct evidence to indicate on what this prosperity was based. Even if the isolated structure excavated by Ling and Courtney (1981) was a villa (see further below p.186f) it

would not explain the town's prosperity. The most likely explanation for the existence of the town at present seems to lie in the lead mining industry. The site is in what was probably the main area of mining (p.285). It is argued in Chapter 8 (p.287f) that it is the best candidate for the administrative centre of the industry, and therefore for Lutudarum (if the name applied to a town rather than a general area). If this is the case we may again be dealing with a settlement largely geared to the requirements of a single group, miners and mining officials. Further than this it would not be safe to go on present evidence (but see below Chapters 8 and 9 for more extensive discussion of the possible nature of mining administration in the area).

x) Solely Military Sites

Three sites have not so far produced evidence for civil settlement, Pentrich, Chesterfield and Castleshaw . It is probably to be suspected that this is as much due to a lack of excavation as to a genuine absence. Chesterfield is a relatively recent discovery as a fort but the find distribution is not restricted to the fort site (Hart 1981, fig.8:6). I have suggested elsewhere (Dearne forthcoming) that the annexes attached to the fort might hold a vicus. Pentrich is almost completely unexplored and even its military history is obscure. The lack of evidence for a civil presence cannot be taken as significant in these circumstances. Castleshaw, where there has been rather more work (Start

1985; McNeil, Start & Walker 1989), may not have had a large civil presence since its role as a full fort seems to have been short-lived. However, work beyond the defences is required to confirm or deny this.

xi) The Economic Significance of the Major Sites

It is clear that a number of important questions remain unanswered with regard to the major sites within and on the periphery of our area. Perhaps most importantly their relationships to the rural sector are obscure and are only likely to be elucidated by much more excavation on rural sites. However, a number of provisional conclusions have been drawn about other matters. Firstly, it is clear that the dominant quasi-urban form, the military vicus, was sufficiently dependent on a military presence in many cases (and in all cases actually within the study area) not to be able to survive its withdrawal. Conversely though, and notably in all cases on the periphery of the area, a few military vici appear to have acquired other functions, some perhaps still with a military orientation. These broadened their economic bases and allowed them to survive military withdrawals. Only two sites within the study area appear to have found a non-military basis for survival, Buxton and Carsington. This is likely to be indicative of the presence of two exceptional factors in the south of the area, a religious spa and the lead extraction industry.

Notes

1. Lane's (1985, 57) belief in an Iron Age settlement below the Chesterfield fort cannot be supported. No Iron Age material has been published and the very poor publication of the alleged Iron Age ditch at Alpine Gardens (Lane 1985, 28, Plates 9 and 10) is not convincing. The ditch is in fact likely to be that of the phase 2 fort (cf. Courtney 1975, 4; Dearne 1986, fig.18), apparently disregarded by Lane because of his belief in a foundation date for the fort of 65-85 (Lane 1985, 17) despite the evidence for a Claudio-Neronian date (Courtney 1985, 8; Br. 1976, 322; Br. 1978, 430ff).
2. For fuller details of the civil remains at Melandra, Brough, Buxton, Manchester (for which see also Walker 1986), Templeborough and Chesterfield see Dearne (1986). The work to date on Derby is summarised by Birss and Wheeler (1985) and excavation is continuing (pers.comm. Chris Drage). Start (1985) summarises the early work at Castleshaw where again work is in progress and has made advances (McNeil, Start & Walker 1989). No up to date synthesis exists for the other sites and references to all published work are given in the text.
3. The attribution is almost certain (Rivet and Smith 1981, 295) and probably a transference.
4. The attribution is not certain (Rivet and Smith 1981, 256f).
5. There is no connection between Navio and Brittonium Anavionensium recorded in C.I.L. x No.5213 (Rivet and Smith 1981, 249f). For the latest discussion supporting an attribution to Annandale in Scotland see Rivet (1982).
6. The variant spelling of the name (Arnomete) in R.I.B. 281 is likely to be an error (Rivet and Smith 1981, 154).
7. The settlements at Ilkley, Adel, Newton Kyme and Tadcaster are regarded as being too far north of our area to be relevant. Cleckheaton cannot be shown to have been a significant Roman site (Faull and Moorhouse 1981, 145f). Leeds (?Cambodunum; Rivet and Smith 1981, 292) might have been a significant settlement but this awaits confirmation (Faull and Moorhouse 1981, 146 and 157ff). Ferry Fryston (Faull and Moorhouse 1981, 151) is too far east (for its size) to be important to us.
8. Rivet and Smith (1981, 409f) reject Hind's (in Jones and Grealey 1974, 159-63) suggestion of Manduvicium.

9. It is not possible to demonstrate precise correlations due to the imprecision of the ceramic dating evidence.
10. The archaeological and epigraphic evidence is most recently and conveniently summarised in Sommer (1984, 30-40), though Salway (1965) and Birley's (1980) works must in many ways remain the more important. It is not intended here to give an exhaustive account of all the identifiable occupations even within the study area (for such an account for much of the area see Dearne 1986, 154f), only to identify the economic groups that they fall into.
11. I am grateful to Dr. M.C. Bishop for drawing my attention to this.
12. The deductions are from P.Gen.Lat. recto, part 1 (Fink 1971, No.68) and are those occurring in both col. ii and col. iii with a regularity and agreement of amounts that suggests that they were standard and automatic deductions. Two apparently non-standard deductions have been ignored: ... r .. torium 60 drachmas (Col.ii line 9) and an extra deduction of 100 drachmas for clothing (on top of the regular 245½ drachmas) in Col.iii line 8. The figures have been converted to denarii at the rate of 4 drachmas to the denarius following Fink (1971, 244). The food deduction is assumed to cover the whole of a soldier's diet which may be questionable.
13. The exact conversion is 36.375 denarii; it may be suspected that deductions for clothing varied by small amounts from area to area anyway.
14. The composition of many units is disputed (quite apart from the fact that many may on the ground have been regularly over or under strength). The figures for their compositions are from Keppie (1984, 184).

CHAPTER 7 - RURAL SETTLEMENT AND AGRICULTUREi) Introduction

Of all the areas of the Roman South Pennines rural settlement is the most difficult to assess because of the highly limited and regionally disparate nature of the evidence and because of the lack of excavation on rural sites. Systematic study of rural settlement in the area is a relatively recent occurrence. Advances such as aerial photography have added somewhat to our knowledge in the north of the study area, though in the south the advances have been the result of time-consuming field survey (on the particular problems of which see e.g. Greene 1986, 98ff). However, such surveys have greatly increased our previously almost non-existent knowledge of likely Iron Age and Romano-British sites in the Peak District. The pioneering work of L.H. Butcher (Beswick and Merrils 1983; Sheffield Museum Butcher Archive) has been built on by two further works (Hart 1981; Makepeace 1985). These cover the area as far north as the Derwent headwaters and provide sufficient information for some provisional analysis. However in the north of the study area the only systematic work is Faull and Moorhouse (1981) which is a summary as opposed to a primary survey and newer aerial finds are as yet undated and little known.

Analysis of this evidence, and particularly comparisons between the north and south of the study area, is therefore very difficult. The apparent lack of settlement in much of the north compared to the south could be at least partly due to the far greater incidence of detailed fieldwork in the Peak District. Equally urban settlement in the north may have obliterated proportionally more sites. Huddersfield in particular represents a potentially important settlement area around tributaries of the R. Calder and near the fort of Slack now obliterated by urban development. Even in the south there are likely to be^a, perhaps very significant number of sites that await discovery or have already been obliterated (Makepeace 1985, 194f). Field survey is not a technique that can be expected to locate every site (e.g. Greene 1986, 123). Thus, the distribution of isolated coin and pottery finds is an important source of evidence, perhaps indicating areas where settlements remain to be found or have been entirely lost.

The problems are exacerbated by the lack of excavation on rural sites. With the exception of a number of cave deposits in the south of the area which were examined, though rarely scientifically, by antiquarians (e.g. Turner 1899) only a handful of sites, exclusively in the south of the area, have been excavated and published. Whilst those that have (e.g. Hodges and Wildgoose 1980; Makepeace 1983, 1987, 1989;

Makepeace 1985b) provide important information, their numbers are rarely sufficient to allow valid generalisations to be made. This is particularly problematic in dating since some sites have produced little surface material and dating is therefore too often reliant on dubious morphological considerations (see further below p.193).

Conclusions drawn from our present evidence for rural settlement, particularly in the north of the study area, must be highly provisional and subject to considerable future revision. However, many important questions concerning the economy of the study area turn largely on the role of the rural sector, the largest single element of any Romano-British economy. In particular it is only in the rural sphere that we are likely to be able to gauge whether there was a real expansion in the economy in the Roman period or whether the establishment of military vici and a lead industry were isolated phenomena not affecting the general populace. Equally it is in the rural sector that any evidence for the extension of a monetised economy must be sought, and indeed any evidence for the presence of the military, vici and lead mining representing a stimulus to the economy.

The forms of evidence with which we are concerned in answering these questions are firstly the density of rural settlement in the Roman period compared to the Iron Age. Secondly the presence or absence of concentrations of settle-

ment in the former period. Thirdly the presence or absence of Romanised goods and particularly of coins on rural sites, and fourthly the nature of the farming regimen of the sites. The latter in particular has a bearing on the question of how far the military may have been able to supply themselves with food from the local area. An expansion of arable farming in the Roman period might well indicate a militarily inspired stimulus to the rural economy, though there is also the possibility that any expansion was simply the continuation of an Iron Age trend (below).

ii) Natural, Technological and Social Constraints

The overriding economic activity of the rural sector was directed towards farming. Except perhaps for some connection with lead mining (below p.335) and the rural based quernstone 'industry' (below p.352) there is no evidence for any other economic activity on open sites at above a self-sufficiency level. Thus the natural environment was of the utmost importance to the rural population. Although there is some debate about the exact nature of the relationship between rural population, natural resources and technological development, the idea that the 'resource-potential' of any combination of soils, climate and topography is infinitely elastic must be rejected (Hawke-Smith 1979, 7ff). For any given level of technology (taken in its broadest sense to

include the types of crops and stock available etc.) the exploitation of a set of natural resources can only produce a finite maximum yield. Indeed, as Greene (1986, 88) emphasizes, the achievement of this maximum is dependent on ideal social conditions such as land inheritance customs. Similarly the same restraints govern to an extent the type of farming possible.

The basic natural resources are those of soils, climate (micro- and macro-) and topography described in Chapter 1. As was pointed out there they cannot automatically be assumed to have been the same in Roman times as today. Particularly in the case of soils many changes may have occurred, and indeed environmental degradation may have already been a significant factor in the late Iron Age (Higham 1986, 119). The information that we do have on the natural resources of the study area in the Roman period, particularly on the likely crucial matter of pedology (Fisher 1985, 33), does not provide a sufficiently sound basis on which to attempt to estimate potential yields. Even if it did we know nothing of the social factors affecting the maximum yields and have insufficient information on the siting, density, farming type and longevity of Roman rural settlements.

Even the level of technology available to the Romano-British farmer is not firmly established. Recent reassessments of the development of ploughs and other agricultural

tools have tended to suggest that some technological innovations were made by or in the Roman period (Salway 1984, 622; Rees 1987, 498; Hartley and Fitts 1988, 70) and M. Jones (1982, 104) has argued that the introduction of new crops c.1,000-500 BC represented the most important period of change before the sixteenth century. The yields of disease resistant crops such as emmer and smelt have also now been suggested by practical tests to have been much greater than was previously thought (e.g. Greene 1986, 76). Yet, there is virtually no direct evidence from the study area to indicate the level of technology in use.¹ Whilst field forms (below p.195) may give a clue to the type of cultivation tools in use, the tools themselves are illusive. The possibility that social attitudes may have provided some resistance to the spread of any innovations that there were should not be ignored. Equally there is almost no information on the forms of arable crops in use in the study area. The possible impressions of celtic beans on Derbyshire ware (Kay 1962, 27) hint that arable production may not necessarily have been geared primarily towards cereals. But it is again only from field forms (plus quern finds and a few pollen diagrams) that the extent let alone nature of arable farming can be assessed.

iii) The Iron Age Background

Perhaps the largest single problem in assessing Romano-British rural settlement in the study area is differentiating

between Iron Age and Romano-British remains in order to compare the settlement patterns of the two periods. The area was probably, at least in part Brigantian territory in the late pre-Roman Iron Age (Chapter 2) but has produced very few indications of a material culture. Although a number of sherds have recently been recovered from Harborough Rocks (pers. comm. C. Hart), the lack of Iron Age pottery is particularly notable. Only eleven further findspots of possibly Iron Age type pottery are known from open sites in the south of the study area (Makepeace 1985, 252-6; Hart 1981, 77f; Pers. Comm. C. Hart; Derbyshire S.M.R.) and the dating of many may be questionable (pers. comm. C. Hart). Up to eleven cave sites may have seen some Iron Age activity, though at very few does the material amount to more than one or two artefacts or sherds, the main exceptions being Harborough and Thor's Caves (Branigan and Dearne research in progress).

Whether this indicates a lack of settlement or a largely aceramic culture, as has been suggested for north west England (Walker 1986, 160) and for much of Brigantia (Hartley and Fitts 1988, 6 and 13), is uncertain. However, it means that Iron Age attributions usually rest on negative evidence. This problem is equally present in the case of aceramic horizons below dated Romano-British features, for doubts remain as to how early Romano-British pottery penetrated much

of the rural sphere (e.g. Hodges and Wildgoose 1980, 52). It is also increasingly clear that morphological considerations are often unreliable for dating purposes, at least to differentiate Iron Age and Romano-British sites (e.g. Jones 1975, 93f; Taylor 1983, 69f; Higham 1986, 133; Turnbull 1986). Thus, even in the rare instances where excavation has taken place, it may be impossible to be sure whether a dated Romano-British settlement has an Iron Age precursor and in many cases to assign a date at all except for 'Iron Age/Romano-British.'

In effect this means that there cannot be any certainty about whether there was a significant rural population in the Iron Age or not. If there was it does not seem to have been based on hill forts. As with most Brigantian examples (Hartley and Fitts 1988, 6f) those in the study area do not seem to have been occupied after the earlier Iron Age. Of the three excavated in the south of the study area Markland Grips only produced two pottery sherds, the settlement at Mam Tor is dated to before the sixth century B.C. (at the latest; Smith 1985, 107) and Ball Cross had a primary occupation horizon dated to the late Bronze Age or early Iron Age (Hart 1981, 73ff). Although the latter had a Romano-British phase (Makepeace 1985, 54) there is no evidence for continuity of occupation. Similarly in the north of the study area the only hill fort, Castle Hill, Almondbury, appears to have been

abandoned in the fourth century B.C. until Medieval times (Faull and Moorhouse 1981, 116). Whilst it is possible that some hill forts as yet unexcavated such as Fin Cop, Combs Moss, Burr Tor or Castle Ring, Harthill saw later Iron Age occupation the present evidence suggests that they had been abandoned, perhaps in favour of more open settlements (Makepeace 1985, 63). The evidence for such open sites is, as we have seen, beset by dating problems.

None of the sites that have been suggested to relate to this type of settlement at this date (Faull and Moorhouse 1981, 124ff; Hart 1981, 77ff; Makepeace 1985, 59ff) within the study area has definite dating evidence, though recent discoveries at Staden near Buxton may provide a date in the very late pre-Roman Iron Age (Makepeace 1987; Pers. Comm. C. Hart). Essentially there are two groups of these, the circular/ovoid, and in some cases ?palisaded , enclosures and the groups of sub-rectangular enclosures. The first group includes (Faull and Moorhouse 1981, 127f) Crosland Moor (Huddersfield), Digley (Holme), Lee Hill (Huddersfield), Moor End (Halifax), Tower Hill (Halifax); and (Hart 1981, 77) Cratcliffe Rocks (Harthill), Castle Ring (Harthill), The Holmes (Bradwell Moor), Dirtlow (Bradwell Moor) and Pindale (Bradwell Moor). Of these Castle Ring is perhaps better seen as a hillfort (above), Cratcliffe, part of a complicated relic settlement pattern (including Castle Ring) on Harthill Moor, has also been suggested to be a Bronze Age promontory fort

(Lakepeace 1985, 59).

In fact within this group there are perhaps a diversity of site types. Dirlow and Pindale represent parts of a more extensive landscape of circular or ovoid enclosures on Bradwell Moor (Dearne forthcoming) along with smaller circular and rectangular enclosures. Their construction is of single or double lines of large boulders (or in one case perhaps of small orthostats/boulders) infilled with rubble (excavation on two sites and survey at others by the author). There is no associated bank or ditch. Other curvilinear enclosures such as the Holmes appear to correspond much better to a ?pallisaded form with earth banks and perhaps ditches. Parallels for these such as Staple Howe, Huckhoe or Scratwood (Hart 1981, 77; Higham 1986, 119) seem to suggest that their origins are Iron Age but that they had a long life into the Roman period or beyond as a settlement form. Dating individual examples by parallel is therefore dangerous.

The second group consists mainly of largely unexplored groups of rectangular or sub-rectangular enclosures in West Yorkshire (Faull and Moorhouse 1981, 126) including Burnt Cumberworth, Danby, Holmes Road, Kirklees Park and Norton. The attribution of such sites is problematic for many similar sites further south such as the Pilsbury/Banktop complex have been assigned to the Romano-British period, and

generally on rather better evidence (Makepeace 1985, 132ff). Again however, there is the possibility that elements from both periods are present. Sites of the type beyond the study area have evidence to suggest an Iron Age date (e.g. Rothwell Haigh; Faull and Moorhouse 1981, 125) and continuity into the Roman period (at Rothwell into the fourth century). Broadly speaking therefore it is clear that both groups of open sites could be related to Iron Age and or Roman settlement. However, where there is any dating evidence within the study area it is Romano-British.

Further curvilinear and rectilinear enclosure sites, many with traces of associated tracks and fields, have now been identified in W. Yorkshire by aerial photography (Fig.8 e-f). These are mainly in the lower lying north east of the study area and have no associated dating evidence. Whether any or all relate to the Iron Age remains unknown but some at least may equally relate to the Romano-British period (below).

Pollen diagrams from the highlands north of the study area and from the north west and south east of it indicate major late Iron Age clearance phases (Haselgrove 1984b, 16; Coles 1985, 13; Hicks 1972, 10ff). This is a feature which appears to be common to much of northern England at this time (Higham 1986, 119) though clearance of Limestone areas may have been an earlier phenomenon, in train by 1,000 B.C. on

palynological and molluscan evidence (Coles 1985, 13ff). As Higham (1986, 122) has pointed out the 'increasingly impoverished environment' of later prehistory in Northern England probably led to widespread land abandonment. Indeed, the expansion of Bronze Age settlement on to Gritstone environments may well have abated in the study area in the Iron Age, any activity being restricted to Limestone areas as in the Neolithic (Fisher 1985, 35). It may also be that there was a change to stock ranching, an activity less identifiable in the archaeological record (Haselgrove 1984b, 17). Makepeace (1985, 179f) has pointed out that the use of caves in Limestone areas could be connected with less identifiable open settlements. Equally Hart (1981, 77f) lists isolated Iron Age finds, from the same areas, that could indicate impermanent open sites. A similar correlation with cave finds has been suggested north of the study area in Wharfedale by Haselgrove (1984b, 16). However, we have seen (above p.173) how few in number Iron Age finds are.

On the basis of the present evidence it is clear that we are unable to answer many important questions about the Iron Age occupation of the study area, and consequently about the degree of change represented by the Romano-British settlement pattern. Whilst extensive Bronze Age, and particularly early Bronze Age, activity is well documented (Hart 1981, 53ff; Faull and Moorhouse 1981, 93ff; Makepeace 1985, 21ff) and new studies continue to add to our knowledge of it (e.g. Barnatt

1986), Iron Age sites remain illusive. Whether this represents a genuine lack of settlement, either because of the abandonment of the area or its use solely for cattle ranching or transhumance, or an inability to recognise it remains uncertain. Iron Age clearance of woodland on the East Moors hints that the area was not totally abandoned (Hicks 1972, 10ff) and the possibility that an Iron Age settlement pattern exists, either aceramic or obliterated/veiled by more recognisable Romano-British activity, cannot yet be dismissed. But as noted below (p.144) excavated Romano-British sites show no signs of having direct precursors.

iv) The National and Regional Context

The national pattern of rural settlement forms in Roman Britain is dominated by a distinction between 'native' settlement and Romanised 'villa' forms. This distinction is usually equated with another between smaller landholdings and agricultural estates (e.g. Frere 1987, 257f). Such a distinction is a simplification and many questions regarding the relationship between the types remain (e.g. Ramm 1980, 28; Hingley 1989). However, it is likely that the distribution of villas (e.g. Wachter 1979, 93; Hartley and Fitts 1988, 81) with its correspondence to the lowland zone does indicate differences in the pattern of the exploitation of natural resources. This difference is perhaps best seen in terms of

the scale of farming undertaken, though Salway (1984, 602) is right to point out that no firm dividing line can be drawn between the types, especially on the basis of the associated settlement forms alone (see further Greene 1986, 89).

Although 'native' settlement forms, more or less Romanised, are far from absent from the so-called lowland zone they are particularly characteristic of the 'upland zone.' It is almost exclusively such sites that are known from the study area. However, native settlement forms represent a considerable diversity of form and perhaps of function. The myth that villages, in the sense of sizeable nucleated farming communities, did not exist in Roman Britain has long since been dispelled (Frere 1987, 258f). Yet the isolated single unit 'homestead' equally remains an important part of the settlement pattern of areas such as that under consideration. We have already seen that some rural settlement forms present in the study area may have had their origins in the Iron Age. Equally though others may have been introduced or modified in the Roman period, though the value of these morphological considerations for dating has already been suggested to be limited (above p.169).

Villas represent the most Romanised of rural settlement forms but, conceivably with one or two exceptions (below p.185), are absent from the study area. In fact the area's southern and eastern edges approximately correspond to the limits of

villa distribution (O.S. Map of Roman Britain; Branigan 1980, Fig.3.1). This reflects a broad bias of villa settlement towards the eastern side of the Pennines, with a particular concentration in the territory of the Parisi (Branigan 1980), and southern England. To the south west in the territory of the Cornovii villas are scarce (Webster 1975a, 79) and to the west unknown. The absence of villas, or at least of villa-type farming economies, from the study area probably reflects the unsuitability of the land for large scale continuous agricultural estates. Yet other factors may also have been of significance in the absence of both villa economies and villa-type Romanisation of settlement forms. Branigan (1980) has argued that the 'northern villas' in the territory of the Parisi and of the Corieltavi (Coritani) represent social reorganisation, land ownership changes and the adoption of a farming-for-profit attitude. We shall see (below p.187) that a similar phenomenon on a more impoverished scale could be suggested to have occurred in the study area. But it must be possible that the lack of Romanised rural settlement forms is partly due to the retention of social structures, land holding arrangements and subsistence regimens alien to the Roman system (Hingley 1989). This again highlights the difficulty of assessing the Roman period without information on the preceding Iron Age.

Although 'native' settlement forms in northern Britain have seen increasing work in recent years (e.g. Higham 1982)

it is still difficult to generalise about them as one may with villas. Their forms vary considerably not only from region to region but from site to site, though how far this reflects variations in function is uncertain. Regional studies, often relying heavily on aerial photography, have shown that settlement densities were higher than previously anticipated (e.g. Higham 1982), as indeed is clear from the present study area. Yet, how far these densities represent a common type of farming economy, given their morphological variations, and how far a variety of responses to differing natural environments, remains in doubt in many cases.

Some (e.g. Clack 1982, 378) have argued for a simple division, at least in form if not function, between curvilinear site types on upland environments and rectangular forms in lowlands. There is some evidence from certain areas that suggests that some distinction along these lines may have existed (e.g. Jones 1975). However, it is increasingly clear that both rectangular and curvilinear settlement forms occur in lowlands (e.g. Ramm 1978, 69ff) and uplands (e.g. King 1986, 184). Indeed, they often form elements within the same settlement (e.g. Grassington: Rainstrick 1939, 119f; King 1986, 182ff).

There are settlement forms, such as the ditch or bank enclosed circular 'homestead,' which appear to be common to much of the north and particularly to the 'upland zone.'

However, many regions display settlement forms which are more insular. An example is the 'brickwork' field pattern and associated settlements east of the study area (Riley 1980). Branigan (1984, 30) has suggested that this particular field arrangement could be connected with the supply of sheep or cattle to the army. Some of the associated settlements such as Dunstan's Clump (Br. 13 (1982), 356ff) are indeed of the Roman period. However, others such as Pickburn Leys (Sydes and Symonds 1985; pers. comm. Bob Sydes) have yielded Iron Age pottery and this highlights the problems of identifying Romanising influences on rural settlement.

Whatever the variations in the form of northern 'native' sites other evidence than that of their morphology has led to a considerable revision in recent times of views of their economies. Field forms, quern finds and pollen evidence now suggest that arable production was important. Not just on relatively low, well-drained areas such as the Magnesian Limestone ridge east of the study area (e.g. Haselgrove 1984, 10ff), but also on high, today marginal land such as at Malham (King 1986, 186). Even in lowland areas some sites may have remained entirely pastoral (e.g. Ramm 1980, 31), and a degree of variation between arable and pastoral preponderance may be expected from region to region. But the significance of arable production was clearly far greater than was formerly imagined. Regions comparable to that under study have produced evidence for both small 'homesteads' and

nucleated villages on Limestone plateaux with field systems that may be regarded as arable (Rainstrick 1939; Haselgrove 1984).

The settlement pattern of northern Britain generally is difficult to assess with any confidence as yet since most surveys have been regionally based and coverage is as a result discontinuous. Where surveys have been carried out the result has often been to greatly increase the number of sites known. Yet, there remain areas, even where surveys have been carried out, that appear to be blank of Iron Age and Romano-British rural sites (e.g. the Manchester region: Walker 1986, 160f). How far these blanks are genuine and how far the result of problems with identifying sites must remain uncertain (e.g. the new aerial finds in the greater Manchester area: Nevell 1987/8). However, one of these blanks occurs partly within the present study area.

The Limestones of Craven, the mid-Pennine Wharf and Ribble drainages north of the study area have long been known to have had a relatively dense settlement pattern (Rainstrick 1939). Aerial photography has added further elements to this pattern (Riley 1975; 1976) and it has been suggested that further sites remain unrecognised (Haselgrove 1984, 10ff). Though few of the sites have been excavated or dated, and so may in part relate to Iron Age activity, this pattern is in contrast to the area south as far as the Derwent headwaters.

Northern north Derbyshire (as well as the western and eastern margins of the study area except for parts of the Don valley) is almost devoid of sites. Further, southern W. Yorkshire has only recently begun to produce numbers of possible but rarely dated sites, mainly in the lower areas between the Calder and Dearne valleys in the east (fig.8). Although it seems likely that some parts of W. Yorkshire such as the Calder valley will eventually be revealed as fairly densely populated, the blank area in the highland south and west of the Calder and Dearne valleys remains.

The apparent contradiction of dense settlement and blank areas has led to a variation of opinion as to how far the rural environment was integrated into the Romano-British economy. Blank areas have tended to produce negative views (e.g. Walker 1986, 160f), whilst other areas such as Cumbria, where tracks between vici and rural sites have been noted, have suggested a far more integrated economy (e.g. Higham 1982).

v) Villas within the Study Area

We have seen above that the present study area does not form part of the main area of distribution of villas. However, at one site in the south of the study area and at two just beyond it to the north there are possible villa sites. Tesserae from Birstall and Lupset in W. Yorkshire led Faull and Moorhouse (1981, 147) to suggest that villas

existed under modern housing. The sites on the relatively low and flat land of the Calder valley do perhaps represent areas suitable for villa type farming. However, the evidence of tesserae is not sufficient to allow an opinion to be formed as to whether villas did actually exist.²

The third site is at Carsington in the south of the study area. Carsington, perhaps Lutudorum and likely a sizeable settlement connected with the lead mining industry (above p.69f; below p.198f), also lies on relatively flat, lower land. Some 600m from the main settlement, in the angle of two streams, Ling and Courtney (1981) excavated a large building. As excavated it was a rectangular structure 9.2 x 23.8m, built of stone with a sandstone slate and or tile roof. Internally it was divided into two northern and at least three southern rooms with a large central room containing two hearths (Fig.9). In one of the northern rooms an incomplete under-floor heating system or corn drier was recovered. There was also some evidence for the presence of an earlier structure with tessellated floors and glazed windows. The general shape, construction and apparently domestic use of the building led Ling and Courtney (1981, 71) to compare it to small villas in south and west Britain though Hingley (1990, Fig.16) prefers to regard it as a 'cottage house.' A further room, at ninety degrees to one

end of the building, has now been located (pers. comm. Branigan; Fig.9), though this need not invalidate a villa interpretation.

In fact there are other points in favour of the suggestion that this might be a villa. Perhaps the most important is the proximity of the settlement at Carsington, for it would provide a ready market for produce. Moreover its possible involvement in the lead industry might provide individuals rich enough to invest in large areas of land and a well-appointed home. Yet, this very possibility suggests two more alternative interpretations for the building. There must be at least an equal chance that a rich miner would build himself a Romanised home at Carsington without a villa estate as with one. Equally, if Carsington did play a role in administering the lead industry, would one not expect Romanised housing for a procurator metallorum or similar?

The problem is largely one of context. If the building had been found within the main settlement there would have been no question of it being a villa (in the sense of the centre of an agricultural estate). Particularly in view of the problems in recovering information from the highly disturbed clay subsoil of Carsington (pers. comm. Branigan) a separation of 600m between the known settlement and the building cannot be seen as significant enough to be sure that

the latter was not a solely residential structure. Indeed, just such a separation is seen with the official building and ?lead processing settlement at Pentre, Flintshire (O'Leary 1989; below p.283).

vi) Romano-British Rural Settlement: Form and Function

Due largely to the publication, often for the first time, of the primary source material by Makepeace (1985) it is now possible to undertake some very provisional analysis of the form and function of Romano-British rural settlement in the south of the study area. However, of the sites in West Yorkshire allocated to the period by Faulk and Moorhouse (1981, 151ff) only one (Thornes) lies within the study area. It consists only of a rock-cut ditch and a few finds. Clearly settlement was not as sparse in the north as this would initially suggest for isolated finds of Roman material (Fig. 8 e-f) may in some cases indicate unrecognised settlements (below p.205). Indeed, we have seen (above p.176) that some 'Iron Age' sites could be Romano-British. However, morphological evidence is largely restricted to aerial photographs of undated sites and the caveat that we may be dealing with sites of varying dates must always apply to the little that can be said of form and function in W. Yorkshire.

a) Nucleation

The degree of nucleation of sites in the south of the

study area is variable. Some, such as the Bank Top/Pilsbury complex (Makepeace 1985, 132ff) appear to provide evidence for fairly nucleated settlement, though whether it was a hamlet, village or a cluster of separate settlements is not clear. Many others however are clearly relatively isolated single farms or 'homesteads' e.g. Ricklowdale West (Makepeace 1985, 130f). Establishing the degree of nucleation of individual sites is problematic. At many it seems possible that we are dealing with sites that had a relatively long life e.g. Pearson's Farm which has second to fourth century pottery (Derbyshire S.M.R.) and therefore may contain a number of non-contemporary elements. Since few sites have been excavated certainty about the number of phases represented at most is impossible. Even where there are indications from field surveys that there is more than one phase present at a site (e.g. Chee Tor/Blackwell: Makepeace 1985, 138) it is rarely possible to detect which elements belong to which phase or to establish even relative dates for them.

In many cases too it is likely that the remains that have been identified are only part of a larger complex which has been destroyed e.g. Robin Hood's Stride/Watcliffe etc. (Makepeace 1985, 139) where four or five sites (Fig.8b) may represent a sizeable nucleation of settlement perhaps deserving of the epithet village. Indeed there are a great number of sites that do not survive sufficiently for any

comments on their likely morphology to be made. A further problem is that many sites have a great many enclosures, but which relate to domestic and which to agricultural functions it is impossible to say (pers. comm. G. Makepeace). We are therefore limited to considering those well preserved sites that are recorded (as catalogued by Makepeace 1985, 130ff) and this may not be a representative sample. Moreover the evidence provided by the few sites that have been excavated must colour our interpretation, perhaps unduly.

Settlement nucleation to one degree or another seems to be present at up to eleven sites in the south (Thorpe Pasture, Bank Top, Pilsbury North, Rainster Rocks, The Burrs, Chee Tor, Robin Hood's Stride, Little Dungeon/Wensley, City Folds, The Liffs and Wetton), though in many cases we are unable to say whether the site is of single or multiple phase. This problem applies as much to field systems in many cases as to the actual settlement. It also prevents us from drawing conclusions as to whether the site represents^a nuclear or extended family sized group or indeed, a 'hamlet' or a larger unit. However, it seems likely that a range of nucleated forms is present. As we have seen these may have included villages and also perhaps paired settlements (e.g. Chee Tor), recently highlighted by Hingley (1989, 95ff) as perhaps indicating the holding of land in common by two families.

Some twenty-one more isolated sites may be listed; Riclow

Dale East and West; ?Wolfscote Grange; Coombsdale; Roystone Grange; Mam Nick; Lombards Green; N. Lees: Dowel Dale; Staden; Brushfield; Millers Dale Back Road; Wheston Cliff II; Cherry Slack; Monksdale Lane; Hargatewall; Litton Frith; Johnson's Knoll; ?Lawrence Field; and Hay Top; plus one not covered by Makepeace 1985, Wharncliffe (Makepeace 1985b). Three of these sites have been properly excavated, Roystone Grange (Hodges and Wildgoose 1980); Staden (Makepeace 1983; 1987; 1989); and Wharncliffe (Makepeace 1985b). Roystone represented a 'butterfly shaped' settlement consisting of two c.30 hectare paddocks, one probably for arable and one for pastoral use. There was a small domestic area containing at least two houses, one aisled with two phases, in existence from the earlier second century until the later third or early fourth century. Staden, a complex set of enclosures including pear-shaped and rectangular elements slightly terraced into a hillside, may have been an intensive mixed farming settlement (Makepeace 1983, 85) but many of the enclosures represented cattle pens. Its dating is late-first and second century, and recent finds may tentatively suggest a pre-Roman origin (Makepeace 1987; pers. comm. C. Hart). One or two domestic structures are likely at the site, along with at least one ?non-domestic structure. Whitley, Wharncliffe (Fig.8d) was a small settlement site adjacent to an important beehive quern production area where further fragments of

settlements have been recovered (Makepeace 1985b, Fig.1; Butcher 1951/7). It included an aisled building (as at Roystone) of sub-rectangular form adjacent to rhomboidal and D-shaped enclosures dating from the early-second to mid-third centuries.

Whilst these sites have some elements in common (a tendency towards mixed farming, perhaps a start date in the earlier second century, and rectangular (and in two cases aisled) buildings) there are also clear differences between them. Roystone appears to be a self-contained integral unit whereas Wharncliffe might well be part of a wider settlement pattern. At least two domestic phases are seen at Roystone but only one at Wharncliffe. Staden might have begun as a pre-Roman settlement unlike the others. Its large number of small enclosures argue for some difference in its farming regimen compared with the larger and less numerous enclosures at the other sites. These similarities and differences point out the great problems in trying to establish a coherent picture of isolated settlements from the few excavated examples. However, it does seem likely at the moment that we are dealing with mixed farms run by family groups and perhaps often founded in the earlier second century, though the precise morphology of the sites may clearly have varied greatly. Thus, Hingley's (1989, 39ff) belief that aisled buildings represent egalitarian extended family groups living

communally might be applied to two sites in the area which have been excavated. But, if it is accepted, it cannot yet be shown to represent a common pattern. Indeed, unpublished excavations at Hay Top and Robin Hood's Stride both produced evidence for hut circles (Derbyshire S.M.R.) emphasising the variability of house types.

In W. Yorkshire there is little sign of nucleation in the undated but possibly Romano-British sites known from aerial photography, although some could be connected by lanes. Most are relatively isolated rectangular enclosures, in some cases with indications of field systems and trackways (pers. comm. B. Yarwood; photographs at W. Yorks. Archaeology Unit). Since none has been excavated or is upstanding there are no details of any internal structures, although their size often gives the impression of 'homestead' rather than nuclear forms.

b) Morphology

As we noted above the shape of settlements or of units within them is increasingly regarded as an uncertain dating criterion (p.169). Indeed, we have seen that there is quite a variation in enclosure and house shapes between excavated examples. However, it is clear that, though a lack of excavation frequently prevents the differentiation of house and other enclosures, rectangular or sub-rectangular elements are more common in the sites documented by Makepeace (1985) than rounded or curvilinear elements. There are rounded

elements at Bank Top/Pilsbury, Mam Nick, Bonsall Wood, Robin Hood's Stride, Ricklow Dale E., The Burrs, Hay Top and Staden. Yet, as at the latter site, these are often to be found with rectangular enclosures beside them and many sites display only rectangular or sub-rectangular forms.

Roystone provides another case where both curvilinear and rectilinear elements may be seen to co-exist with no chronological significance. The 'butterfly' form is composed of two connected rounded elements. Yet the houses and their enclosure are rectilinear despite the agreement of both their dates and 'double orthostat' walling styles with the rounded elements (Hodges and Wildgoose 1980, 50f; Wildgoose 1987). On such present evidence the only significance that can be attached to curvilinear and rectilinear elements is perhaps functional and practical. The shape of cattle paddocks is largely unimportant. But rounded forms, or at least non symmetrical ones, take less laying out and may allow the easier utilisation of, or avoidance of, natural features. Rectangular elements perhaps show a little more planning and may be easier to string together if many small areas are required as at Staden.

In the north of the study area the undated aerial photograph sites generally suggest a tendency towards rectilinear forms, though there are also circular, ovoid and D-shaped

examples (Fig.8 e-f). However, with no details of any internal structures and continuing doubt about their dating further comment on their morphology is impossible.

c) Fields

An important part of rural settlement in the area is the associated pattern of fields, though in many cases these are suspected to have been wholly or partly removed by later activity. The presence of 'celtic' fields, though there are many variations on the classic type, and of positive and negative lynchets on valley slopes, strongly suggests that the use of ploughed land was important to many settlements in the south of the area (Makepeace 1985, 85). In some cases these fields are found in large blocks with possible territorial division banks between the blocks (e.g. Hartington/Pilsbury; Makepeace 1985, 85).

As Makepeace's(1985, 85ff) discussion makes clear, despite the problems of deciding whether settlements without fields were pastoral communities or have simply had their fields eroded away, many sites did have often extensive field systems which may show functional and even chronological differentiation. Smaller enclosures near to domestic areas may reflect spade or hoe 'garden' cultivation, or in other cases as at Staden be for animals. Medium-sized infield examples were perhaps cultivated with a light plough/ard.

Large, often elongated, more distant fields were probably cultivated with a heavier plough. It seems too that where fields tend to be rather squarer they may be earlier since they would be more suited to a light plough or ard than the more typical long thin fields. Much work clearly remains to be done on field morphology and function (cf. Makepeace's (1985, 87) comments on the function of the 'arable' fields at Roystone, contra Hodges and Wildgoose 1980). But it is increasingly clear that an arable element is likely to have been of importance to many if not most settlements in the south of the study area. Similarly the evidence from aerial photographs of undated sites in the north east of the study area is for enclosures associated with fields, perhaps with ditched tracks through field systems used to bring livestock into enclosures (pers. comm. B. Yarwood).

d) Site and Situation

One of the few aspects of rural settlement in the south of the study area in which we may see a clear pattern is the siting of settlements. In common with the pattern of settlement in the area in Neolithic and Bronze Age times Romano-British settlement was principally concentrated on the White Peak Limestone outcrop and its margins (e.g. Fisher 1985; below, p.141f). Makepeace (1985, 95ff) has identified four basic settlement location types, all essentially using

sheltered positions on valley slopes. Most known Romano-British settlements in the south of the study area appear to lie in these locations and such site preferences are a common feature throughout upland Brigantia (Hartley and Fitts 1988, 68). The four types of site preferences are sheltered areas between valleys and high plateaux, shelves projecting into valleys, the sheltered tops of valleys, and sheltered parts of valley slopes.

Generally sites lie at between 500 and 1,000 feet (150-300m) and the variations in the type of valley slope site chosen in any given case may reflect a range of land use (Makepeace 1985, 97f). Thus, higher sites may have been utilising poorer soils for pastoral activity (and perhaps using the adjacent plateaux for transhumance). Lower situations, benefiting from lime enrichment due to Limestone weathering, may have been more suited to arable production. Particularly on south facing slopes where direct sunlight would be maximised. These sites would be able to escape temperature inversions at valley bottoms without the problems of low air temperatures at higher altitudes.

A fifth type of site preference, in low and level valley areas, is of far less importance but Makepeace (1985, 97) is right to point out that such sites often lie near to Carsington, Buxton, Brough etc. Such sites include the limited number known in the Derwent tributary valleys

north of Brough such as the group at Ladybower and N. Lees, and a group of possible settlements around Matlock (Figs.8 b and d). These sites lie not on Limestone but on the Limestone Shales in contrast to sites such as Demon's Dale (Fig.8c) which lie in Limestone valleys such as the Wye. These sites are those for which a 'colonising' origin might be particularly likely and their use of deeper, damper soils might indeed reflect technological developments. However, as Fisher (1985, 35) has pointed out, such settlement locations have been demonstrated to have been used elsewhere as well and further work is required to clarify their significance.

In W. Yorkshire sites known from aerial photographs, although as yet none has been dated, tend to occur on the flat land of the Coal Measures in the north east of the study area. If any or all of them should prove to be Romano-British as seems likely they would represent a distinctly different set of site preferences compared to further south, perhaps reflecting a less variable, broadly mixed farming regimen.

e) The Role of Caves

The south of the study area, and in particular the Wye, Dove and Manifold valleys contain a number of caves that have yielded assemblages of Romano-British material. Indeed, until the work of Butcher the finds, and particularly metal-work, recovered from such sites by antiquarians (e.g. Turner

1899; Storrs-Fox 1911) provided the main evidence for Romano-British activity away from major sites. The implications of the finds from caves have recently begun to be re-evaluated (Makepeace 1985, 82 and 176ff; Branigan and Dearne research in progress) but provide a number of problems. Few of the finds assemblages have any associated stratigraphic records even where cave deposits were originally undisturbed and the wealth of some assemblages appears at variance with simple rural occupation of caves. Some sites clearly represented hideaways (e.g. Ossum's Eyrie) or temporary shelters but others may have provided adjuncts to open settlements for funerary/religious functions (Makepeace 1985, 82) or have been rural sites in their own right. Yet sites such as Thirst House (Turner 1899; Branigan and Dearne forthcoming) and Poole's Cavern (Bramwell et al 1983; Branigan and Bayley forthcoming) both near Buxton may have been involved in high quality metalworking. Indeed, with a few exceptions such as the millefiori glass bowl from Robin Hood's Stride (Price 1985), certain cave finds remain overwhelmingly richer than those from open sites. Though in some instances this might represent some form of concentration of rural wealth it would at present be unwise to see them as representative of the rural economy as a whole.

f) The Function of Rural Settlement

As the ambiguity of the use of caves points out the

function of rural settlement need not be restricted to farming. However, with the exception of caves and quern production there is little evidence as yet for other roles being fulfilled. It is therefore to agriculture that attention must be primarily directed. Assumptions that rural settlement in upland northern England was overwhelmingly pastoral in character have been increasingly questioned in recent times (e.g. Jones, R.F.J. 1986, 232f; above p.130). Features such as grain storage pits, once taken as a necessary concomitant of arable production are rarely present on northern sites (though they do exist, e.g. Hartley and Fitts 1988, 9). However, it is now recognised that other, above ground methods of grain storage may have been in use (e.g. Hawke-Smith 1979, 14). Moreover, the evidence from other sources strongly suggests that arable production was a significant element in the regimen of many northern sites. Pollen evidence (Jones 1982, 103) indicates a general arable expansion in the late Iron Age or early Roman period. The increasing number of known field systems and of quern finds point in the same direction.

In the study area itself the evidence is far less complete than elsewhere in the north. Again there is little information from the north of the region though the implication of recent aerial finds here with possible droveways through fields is probably that mixed farming was important. The

lack of excavation even in the south largely restricts evidence to that of field surveys uncorroborated by pollen or actual grain identifications. Yet, Makepeace (1985, 58) has drawn attention to the distribution of beehive querns, which are generally associated with sites yielding Romano-British material. He has argued that these querns, more usually regarded as Iron Age, may have developed later in the Peak District than elsewhere and the likelihood of conservatism in quern types throughout Brigantia has been pointed out by Hartley and Fitts (1988, 10). If these querns do indeed relate to Romano-British settlement, and not to unrecognised Iron Age horizons at the sites, they indicate the presence of grain in the rural community and probably its production. Beehive querns are not common in the north of the study area but there are isolated rotary quern finds (Fig.8e).

The distribution of both rotary and beehive querns in the south of the area falls into two categories, site and isolated finds. Most sites which have seen excavation or produced significant surface material yield querns (e.g. Staden: Makepeace 1983, 1987, 1989; Closes Farm, Pearson's Farm, Robin Hood's Stride, The Burrs: Derbyshire S.M.R.) Of isolated finds excluding those in the vicinity of probable quern production sites (Figs.8 b and d), there are a notable number in the upper Derwent tributary valleys (Figs.8c-d),

along the Wye valley (Fig.8a) (complementing a number of site finds), and on the lower lying parts of the Dove/Derwent interfluve (Fig.8b), again complementing site finds.

Perhaps more direct is the evidence of the field systems (above p.195). The shape of the 'celtic' fields and the presence of positive and negative lynchets suggest that many were arable fields (Makepeace 1985, 85ff). In some cases these fields are extensive and many others may have been lost through erosion. Known field systems, often directly associated with settlements, cluster in the Wye and Dove valleys and the Dove/Derwent interfluve (Figs.8a-b) and, if the sites are indeed Romano-British, in W. Yorkshire between the R. Calder and R. Dearne, though far less is known of field distributions here and mapping the pattern is as yet impossible.

However, the crops grown were not necessarily cereals as the possible use of Derbyshire ware as a container for the export of celtic beans emphasises (below p.351). The significance of such leguminous crops to preserving soil fertility may be a factor too often ignored in assessing northern rural economies.

However, the evidence for an arable element in the rural economy far from denies the significance of the area for pastoral activity. It is emphasised by the great number of small enclosures at sites such as Staden. Some may have

served as 'gardening' plots and some could have been domestic. Yet the clear implication from the excavation of Staden (Makepeace 1983; 1987; 1989) is that many were cattle pens. Equally, large areas of enclosed pasture for over wintering animals could be suggested at many sites as they have been at Roystone (Hodges and Wildgoose 1980). In many ways evidence for pastoralism is harder to recover than that for arable farming (Haselgrove 1984, 17). Thus, the use of large tracts of land including plateau areas on a transhumance basis for pasturing animals is quite likely but leaves little trace. Features such as the large circular, but as yet undated, enclosures at Dirtlow on the Limestone plateau seem most likely to relate to some form of animal husbandry (Dearne forthcoming). The importance of sheep as well as cattle in the area was probably great then as now.

The conclusion to be drawn from the evidence, though as always in the rural sector it is a provisional one, is that farming was overall mixed with both pastoral and arable elements being important. Some sites may have concentrated more on one than the other, the higher settlements in the south perhaps indicating a greater predilection for pastoralism. Indeed, the suspicion may remain that for many pastoralism was the dominant partner (Hartley and Fitts 1988, 10 and 87; Makepeace 1987b, 48), but we cannot think of the area solely as a stock rearing one. Thus, the whole thrust of Hawke-Smith's (1979) modelling of the late prehistoric

settlement of the Dove-Derwent interfluvium is to emphasise the use of varied land types within a 'compound territory.' Thus mixed farming, including open grazing, pasture, arable fields and woodland activities is suggested. Indeed, it is possible that for some farmers agriculture was also combined with some role in the lead industry (see further below p.232ff).

vii) The Romano-British Settlement Pattern (Fig.8)

As we have already noted the distribution of known rural settlement is biased towards the south of the study area. There are indications that this picture is at least partly the result of less field work, more urban development and perhaps of dating problems. Fieldwork north of the Derwent headwaters has been fairly limited in comparison to the attention paid by, in particular, Butcher and Makepeace to the Peak District (and the small part of S. Yorkshire included in the study area around the R. Don headwaters). The aerial surveys in W. Yorkshire by Bob Yarwood which have located numbers of undated but possibly Romano-British sites between the Rivers Calder and Dearne represent a considerable expansion of fieldwork in the area but otherwise such activity has been limited (though one new site has been located east of Castleshaw (Start 1987/8)).

The problem is compounded by the incidence of modern urban areas. Huddersfield in particular covers a large area east of the fort at Slack and may have hidden important

evidence. Oldham also represents a large area in the north west of the study area which is no longer open to detailed fieldwork. Further, the aerial finds which may represent an increase in the known pattern of settlement south of the R. Calder might equally relate to the Iron Age or even to post-Roman settlement, and the few possible sites south of the fort at Slack (Fig.8e) are similarly not securely dated.

Yet there are some indications that settlement was more widespread, at least in some areas of the north of the study area than the distribution of definite or possible sites would suggest. As Faull and Moorhouse (1981, 153) have pointed out numbers of coin finds, many of them hoards, west of Margary 720a (Fig.8e) may indicate the presence of unrecognised settlements. These finds, as well as three altars, in fact cluster along the R. Calder and its tributaries (and indeed continue to the north of the R. Calder beyond the study area (Faull and Moorhouse 1981, Map 9)). Immediately south of the Grimescar military tiliary pottery finds probably also indicate one or more areas of activity (pers. comm. B. Yarwood), though it would be premature to assign them to civilian rather than military use.

Yet on present evidence settlement north of the headwaters of the R. Derwent must still be regarded as limited compared to areas further south, and indeed non-existent between the Calder and Derwent headwaters and between the

R. Dearne and R. Don (Figs.8e-f). The aerial finds, if Romano-British, moreover represent as much an intrusion of a settlement pattern becoming more dense east of the study area than part of any coherent settlement pattern over the north of the study area as a whole. Given the predilection for Limestone environments as settlement sites in the south of the area it seems likely that the paucity of settlement in the north of the study area is real and connected to the less favourable geology and pedology of the north with the Coal Measures of the Calder/Dearne interfluvium representing an exception again connected to geology and topography.

In the south the pattern of settlement is clearly partly dictated by the physical geography of the area. Most sites lie at the interface between higher and lower land, that is on valley slopes. However, this distribution is clearly also influenced by geology and pedology. Settlements largely avoid the interface between lower land and non-Limestone (principally Gritstone) highlands (Fisher 1985; Fig.8a-d: compare for instance the distributions either side of the lower Derwent valley). The avoidance of the Gritstone areas to the west and east is likely to be due to the presence of more acidic soils, though factors such as the growth of blanket peat could have obliterated some sites (Makepeace 1985, 80).

There are a few sites on the Gritstone (e.g. Hartshill, Whitley and other sites on the edge of the Don valley), though several of these were probably associated with quern

manufacture and so had particular reason for locating on Gritstone. This may be at least partly the reason for the number of certain and possible sites and more isolated coin and pottery finds perhaps indicating unrecognised settlements on the Gritstone areas around the more southerly Don tributaries (Fig.8d). However this is the only area of Gritstone where significant numbers of finds of material let alone sites have been made. Elsewhere on the east and west margins of the study area which are of Gritstone geology only a very thin scatter of finds occur, perhaps reflecting one or two sites near Melandra and north west of Buxton (Fig.8c) and lead smelting activity on moors east of Matlock (Fig.8b). It was rather the Limestone of the White Peak that was the attractive farming environment.

Thus, the majority of sites are found in the Hope, Dove, Manifold and Wye valleys, and on the lower, gentler landscape of the Dove/Derwent interfluvium. The greatest densities of certain settlement occur in the Wye and Dove/Manifold valleys (Fig.8a) (1 site per 717 and 874 hectares respectively).³ The Hope valley comes next (Figs.8c-d) (1 per 1,075 hectares) with other areas more sparsely settled. The middle Derwent valley (Figs.8 b and d) has figures as low as 1 per 9,065 hectares. For comparison the extensively aerially surveyed southern Salway plain has a density of 1 site per 377 hectares (e.g. Greene 1986, 126). Whilst such densities are not to be

expected in the study area with its large amount of high land there may be a hint here that further sites await discovery.

Indeed, possible Romano-British sites, numbers of which occur in the Wye, Dove/Manifold and Hope valleys and Dove/Derwent interfluvium (Figs.8 a-d), if confirmed would raise settlement densities considerably. However, few of these sites would change the basic pattern of settlement distribution except in the tributary valleys of the Derwent headwaters and around Matlock (Figs.8 b-d). But the evidence of pottery, coin, bronzework, altar and quern finds away from known sites and of isolated groups of fields both reinforces the known settlement patterns and may extend them (Figs.8 a-d).

We have noted above the few isolated finds in Gritstone areas on the east and west margins of the study area. However there are in contrast fairly dense patterns of isolated finds in the areas of the south which we have already seen have high definite and possible settlement densities. In the Hope valley attention is particularly focused on areas south west of the fort at Brough by coins and pottery finds (Fig.8c). In the Wye valley (Figs.8 a and c) pottery, though less so coin finds are scattered in areas where settlement is already known or suspected but in some cases may suggest that some expansion of it should be sought on land further

from the valley itself (?perhaps suggesting transhumance). In the Dove and Manifold valleys pottery and a few coin finds again reinforce the presently known and suspected settlement pattern (Fig.8a). Between the Wye and Dove valleys (Fig.8a) a few pottery and coin finds might indicate unlocated settlements on high land but are at least as likely to be indicative of the use of the major road from Carsington to Buxton (Margary No.71a).

It is on, and around the upland margins of, the lower land west of the R. Derwent from Stoney Middleton southwards (Figs.8 b and d) that casual finds principally extend as well as reinforce the known and possible settlement pattern. The concentration of pottery and coin finds around Eyam/Stoney Middleton and generally along Middleton Dale with a line of coin finds also leading north, conceivably indicating a trackway , is particularly notable since only two settlement sites have been noted in the area. Yet these finds may not relate to rural settlement as such but may indicate a more major settlement or a rural market site (see also Makepeace 1985; and p.238 below). More convincing as possible indicators of unlocated rural settlements are the more isolated pottery and in two cases field finds between this cluster and the R. Wye where as yet no certain or possible settlements are known.

Similar comments probably apply to the lower Wye valley

itself and to those of its tributaries, the R. Lathkill and R. Bradford. Indeed there is a notable cluster of finds at one point along the Wye valley with an altar further downstream and similar concentrations of coins, pottery and querns in lower Lathkill Dale and upper Bradford Dale. It must be likely that these concentrations represent three or more unrecognised settlements. Further south the known and probable settlement patterns are reinforced by numbers of pottery and, less so coin finds, for instance near the known sites of City Folds and Pearson's Farm, and south and south east of Rainster Rocks. Some of these probably represent unrecognised sites, though again in areas such as Rainster Rocks there might also be the possibility of rural markets to consider. However, in some places casual finds probably represent unrecognised settlements in areas where few certain or probable sites are now known. Thus, very considerable numbers of coin and particularly pottery finds both south and north west of Carsington and adjacent to and north of Closes Farm seem likely to indicate numbers of rural sites. Equally a conspicuous group of pottery finds occur south of Pearson's Farm.

A number of sites may also have existed between Margary 71a and the Carsington-Brough road where there are numbers of isolated pottery and coin finds. However, some caution is required in interpreting these finds. Not only are they

in some cases adjacent to road courses but several are on higher land and this must call attention to the possibility that they could relate to mining rather than settlement. This general area (Gratton/Elton/Winster/Grangemill) is likely to have been important for lead extraction. Even so some of the finds may relate to unlocated rural settlements especially since mining and farming could have occurred in tandem. Finally a small number of unlocated settlement sites are probably indicated by known fields and a coin hoard in an otherwise largely blank area between City Folds/Carsington and the R. Derwent.

Within the general pattern of settlement and isolated finds that may indicate settlement there are distinct concentrations and gaps. In the Hope valley there is a concentration of sites at the top of Bradwell Dale south of the fort at Brough, and again at Ladybower (Figs.8c-d). Yet other parts of the Derwent headwaters such as Ashop Dale are almost without pottery finds let alone sites. The middle Derwent from Hathersage to Rowsley (Figs.8b and d), with only two certain sites still appears comparatively sparsely settled even taking the distinct coin and pottery concentration in the Eyam/Stoney Middleton area and the other pottery and field finds south of it into account. The Wye valley (Fig.8a) presents a rather more even distribution but some clustering of settlement is seen again in the lower

Derwent and Dove/Derwent interfluvial areas (Fig.8b). There is a noticeable grouping in the area of Robin Hood's Stride and perhaps a tendency for sites to cluster in the general areas of Carsington and Rainster Rocks, as do casual finds. The distribution along the Dove valley (Fig.8a) is relatively regular (with a distinct bias to the eastern side). But the Manifold valley has one heavy concentration of settlement and utilised caves around Wetton, the rest of the valley being nearly blank.

It is entirely likely that some of the observed gaps in the distribution are the result of insufficient fieldwork or the destruction of sites. Indeed some of the concentrations of settlement seen now may in fact turn out only to be the better preserved sections of a far denser rural settlement pattern than we can map at the moment. It must also be remembered that the density of sites probably only gives a crude view of the density of settlement. Certain sites such as the Bank Top/Pilsbury complex in the Dove valley may well represent as large a rural population as several smaller sites put together. In fact the size of many settlements is difficult to gauge at present and some nearby sites presently mapped as separate may turn out to be parts of perhaps large continuous complexes of settlement. Such may be the implication of the recent additions to the Dirtlow enclosure group above the Hope valley which may in

fact be continuous as far as the site known as Pindale (Dearne forthcoming), though neither site is as yet dated.

That the present settlement density represents a minimum and almost certainly a considerable under-estimate is emphasised by the numbers of coin and pottery finds in areas without proven settlements. The same may be true of the numbers of possible Romano-British burials in the Dove/ Derwent interfluvium (Makepeace 1985, Fig.25), though at least some of these may represent the deposition of Romano-British material including coin hoards in pre-Roman burial mounds for other reasons than burial.

viii) The Dating of Rural Settlement

We have relatively limited evidence for the dating of even certain rural settlements in the study area. It has been stressed that it remains uncertain whether any or all of the settlement pattern was established in the pre-Roman period (above p.172^(f)). The absence of Iron Age pottery even on excavated sites may not always be sufficient to preclude such a possibility. However, at the moment no Romano-British site is known to have an Iron Age origin and only at Staden does it seem at all possible. Therefore we must at the moment assume that the Romano-British rural settlement pattern in the south of the area was a creation de novo. That in the north of the area, with the exception of the Don valley tributary areas, must remain almost entirely undated

as yet since only two sites have definitely associated and dated finds (Figs.8 e-f; below).

There is relatively limited evidence from definite settlement sites as to at what dates within the Roman period they were in use. The majority of sites in the north of the area are entirely undated. Of the exceptions Thornes is not closely datable but Worlow, a short distance east of Castleshaw (Fig.8e) seems to agree in date with the latter site (i.e. c.79-120) (Start 1987/8). Of the Don tributary sites one, Whitley (Fig.8d), is closely dated to the mid-second to mid-third centuries (Makepeace 1985b, 39). In the south of the study area there are considerably more definite rural sites. Yet few are closely dated. Most have produced limited amounts of pottery which are either not more closely datable than Romano-British or are poorly recorded (Derbyshire S.M.R. records).

There are some nine sites where further detail is available (Roystone, Staden, Rainster Rocks, Closes Farm, Pearson's Farm, Robin Hood's Stride/Hartshill/Carrs Wood, Chee Tor, City Folds and Hay Top). The best known are the first two (Hodges and Wildgoose 1980; Makepeace 1983, 1987, 1989). Their dating is early-second to late-third or fourth centuries and late-first and second centuries respectively. Rainster Rocks has produced material suggesting activity at least throughout the third and fourth centuries (on coin

evidence) and probably in at least part of the second century, though extending the date range back to the earliest find, a first century brooch, might be unwise without corroboration (Smithard 1911; Dool 1976). The other sites are dated mainly by surface finds though Hay Top, Hartshill/Robin Hood's Stride, and Chee Tor have material from unpublished excavations (Derbyshire S.M.R; pers. comm. C. Hart). None of them have first century material but where datings are available all but probably Chee Tor have second century finds. Closes Farm and Pearson's Farm appear to have remained in occupation until the fourth century (the former indeed has a coin of c.400) while City Folds, Robin Hood's Stride/Carrs Wood/Hartshill and perhaps Hay Top continued until the third century. Chee Tor has a more generalised later Roman date.

This limited evidence may perhaps be added to by the dating of the isolated rural finds of pottery, coins and bronzework, with the proviso that all need not relate to rural settlement. Some may alternatively relate to lead mining activity or traffic along roads. With this proviso however the evidence may be considered. Again little of the pottery is closely dated but no first century material is known (Derbyshire S.M.R.). Most of that identified at least by type is Derbyshire Ware, suggesting an emphasis on the later second and third centuries. Far more, though by no means all coin finds are dated and as well as the south of

the study area these give some indication of date to any occupation that may have occurred in the north west of the study area (though not to the area of sites found by aerial photography: compare Figs 83 and f). In this north west area the finds of both single coins and hoards date broadly to the second and third centuries with only one or two very early fourth century single finds (the latest of 305-8) and a few first century coins included in later hoards (the only single first century finds are of Nero and 14-37 A.D.).

A few dated coin finds may also give a further clue to the dating of settlement around the R. Don tributaries (Fig. 8d) (single coins or hoards of each century of the Roman period, the earliest of 80-1, the latest of 350-3). Similarly a hoard deposited in the third century and two coins of Constantine II near Melandra (Fig.8c) may hint at later Roman ?settlement activity. In the areas of the south with dense certain and possible settlement patterns indicated by sites and or casual finds (Figs.8a-d) there are some forty six dated single and hoard finds. Of these only one is first century (a single find of Vespasian in the Hope valley). There are seven single finds of, or hoards likely to have been deposited in, the second century, thirteen of the third century and twenty six of the fourth century (though five third century and three fourth century finds are notably in the Stoney Middleton/Eyam concentration: Fig.8d). The preponderance of third and fourth century finds is to be ex-

pected since coin loss nationally increases steeply after the mid-third century reflecting coinage debasement. However, it is clear that coin deposition in the area is primarily a second to fourth century phenomenon. Dated isolated finds of bronzework add little to the picture, being few and all but one second or early third century brooches. The exception is a first century Aucissa brooch in Lathkill Dale.

The evidence therefore, though it remains limited and is of varying quality, seems to suggest that there was little activity in the rural sector before the second century, supporting Hodges and Wildgoose's (1980) contention that much rural settlement in the Peak District may have represented colonisation of a virtual vacuum in the earlier second century. The evidence of caves is also in agreement with few sites likely to have seen use before c.100 and the pattern of cave usage in general having a distinct second century bias (Branigan and Dearne research in progress). The longevity of open sites is not as clearly indicated. Some such as Staden evidently did not survive into the third century yet coin finds and evidence from the better known sites indicates much continued activity in the third century and at least some in the fourth. The evidence is not as yet full enough to attempt to say whether there was a regional pattern to this possible decline in rural settlement, and

indeed its very existence relies on only a small number of sites. However the sites with clear or probable fourth century evidence are mainly in the extreme south of the area (Rainster Rocks, ?Roystone, Closes Farm and Pearson's Farm), although fourth century coin loss appears to be more widespread.

ix) Stimulation in the Rural Economy?

Perhaps the key question in examining the nature of the economy of the Roman south Pennines is whether the rural economy was in any way stimulated by the concomitants of the Roman conquest. Did the siting of garrisons in the area, growth of military vici (and in two cases of towns), imposition of taxation and development of a lead industry result in an expansion of settlement? Did the rural sector react only by shouldering the additional burdens placed upon them or did they become part of a profitable market economy? It is clear that we cannot answer these questions at all fully as yet, for the answers lie in the excavation of a representative sample of rural sites. Their agricultural regimens, occupation dates and histories of expansion or inertia are perforce still too much the realm of speculation and dubious generalisation. Assertions that military and urban centres and taxation did stimulate the economy are too often made without such evidence (e.g. Hartley and Fitts 1988, 70f).

There does not at the moment appear to have been any significant late pre-Roman Iron Age activity in the area and the evidence is for the establishment of much of the settlement pattern in the south and east of the area in the second century. Sites such as Roystone and Wharnecliffe were earlier second century foundations and, although only a handful of other sites are yet well enough known to date reliably the evidence that we have suggests that they are part of a wider pattern. Certainly many sites in the south were in use in the Roman period and many if not most had arable elements. The establishment of this pattern may be potential evidence for the existence of a stimulus from military and urban foundations, taxation or mining. However, the evidence needs to be examined in more detail if this is to be substantiated.

a) Settlement Distribution

There may be hints in the distribution of rural settlement that urban, military and mining communities did stimulate the rural economy. Although the Wye valley, with its high percentage of attractive valley slope land, would be expected to have a relatively dense population, it is quite possible that the presence of Buxton contributed to the density of sites and possible sites. Perhaps the concentration of sites, possible sites and finds south of the fort at Brough is even more suggestive of a stimulus. Moreover the presence of an increasing number of known and suspected sites in the tributary

valleys of the R. Derwent on damper, heavier Limestone Shale soils (Figs.8c-d) may be significant.

A clustering of settlement around Carsington may also be significant, it being a probable centre of the lead industry. There are four known sites just north of it (Fig.8b) and at least one must be suspected just south of this cluster. To the north west fringing a tongue of higher land there are up to seven sites including Roystone Grange and casual finds probably suggest that there were others. Moreover to the south and south west casual finds probably suggest a number of other settlements as yet unrecognised. The possibility that sites such as Roystone were brought into existence in one way or another as a response to the needs of this industry is an attractive one. Indeed, the nearby site of Rainster Rocks (Makepeace 1985, 139) could also fit into such a pattern.

The site, strikingly set around a group of rock pillars not far from the Buxton-Carsington-Derby road (Fig.8b), includes house sites and field systems perhaps with elementary 'roads' within the settlement. It has yielded an assemblage of coins, pottery and metalwork of unusual size, variety and Romanisation for a rural site (Smithard 1910; Lane 1973; Dool 1976). These finds, mainly by metal detector and not excavation, appear at variance with the nature of the site, for little architectural refinement seems to be present.

Hodges and Wildgoose's (1980, 50) suggestion that the site represents a rural market connected to the supplying of the lead industry is therefore attractive. The question of the connection between lead and the rural sector is considered in more detail below (Chapter 9, p.232ff).

However similar possible correlations are not seen in the hinterland of Melandra (Fig.8c) where there is only one settlement known and the few coin finds hint at dates for any sites that existed later than the usage of the fort and vicus. The same is true of Castleshaw (Fig.8e) though the one known site does agree well in date with the fort(let). The picture is less clear cut for the fort at Slack. The recent undated aerially located sites are all too far east to be considered as deliberately influenced by it (Figs.8e-f). However a few possible sites and perhaps others indicated by coin finds do occur north, east, and south east of the fort (with others north of the R. Calder beyond the study area), though again often at some distance. Perhaps the strongest evidence for military stimulation in this region is in fact the possible settlements south of the Grimscar tilery (above p.105).

b) Coin Patterns

In contrast to the rough stone construction of most rural sites considerable numbers of coins are now known away from

major sites (Figs.8 a-d). Concentrations occur in the Eyam/Stoney Middleton and, broadly, Carsington areas, perhaps indicating the existence of rural markets and or reflecting the existence of rural sites with monied economies. Indeed some coin hoards (at Oker Hill, Lombards Green, ?and Eyam Dale) may be associated with settlements and others of fourth century date hidden in burial mounds (Eaddon Fields, Minning Low, Steep Low and Saints Low) (Makepeace 1985, 99) may indicate the continued use and hoarding of coinage by, presumably the rural population. The best evidence that we have for the participation of the rural sector in a monied economy is the presence of coins on known rural settlement sites. As yet it is notable that such evidence is principally restricted to the south east of the study area, and particularly the Carsington area (sites including Roystone, Rainster Rocks, Closes Farm and Robin Hood's Stride). Further north coins seem at the moment to be less often associated with sites, though our evidence is as yet highly limited. Even with this proviso though it is notable that the best known excavated site further north, Staden has produced no coins.

The detailed pattern of coin loss is also interesting. Clusters of coin finds are to be seen in the general environs of Slack (Fig.8e), Brough (Figs.8c-d) (which in fact may have more coins in its environs than shown because of poorly recorded metal detector finds (pers. comm. Wendy Huddle)

which cannot be mapped), and Carsington (Fig.8b). Although the same cannot be said of Melandra, Castleshaw or Buxton and there are other coin find concentrations (Lathkill/Bradford Dales and most notably Eyam/Stoney Middleton) this may be significant. Indeed the general Carsington area we have already noted also has known sites that have yielded coins (at least twenty eight at Rainster Rocks).

Yet the chronological pattern of coin loss may throw some doubt on suggestions that they indicate stimulation of a monetised economy in the rural sphere by urban and military sites. Of the twenty dated coin finds on Fig.8e and so broadly in the hinterland of Slack only seven could have been deposited before the fort closed c.140/60 and none of the three finds around Melandra could have been deposited before it closed. Near Brough all the coins could have been deposited during its long occupation, though two finds are undated, and the same is true of Carsington though whether it was still an urban centre in the later Roman period when at least some of the coins were deposited (e.g. those from Rainster Rocks which are all third and fourth century) could be doubted (above p.98f).

c) The Pattern of Wealth

Though we are still dependant on casual finds and a very few sites with significant surface or excavated material,

the wealth of rural settlements in some areas is beginning to become clearer. Particularly in the south east of the study area south of the R. Wye (Fig.8b) evidence is accumulating for a material wealth greater than that suggested by the form of settlements (e.g. Makepeace 1985, 100). We have already noted the pattern of coin loss in the vicinity of Carsington in particular and the rich assemblage of metalwork from Rainster Rocks (Dool 1976). To this we may add the finds from the settlement grouping (?village) in the Robin Hood's Stride area which include coins, brooches, a bronze strainer, repousee disc, enamelled stud, imitation samian ware, colour coated ware and a very fine millefiori glass bowl (Derbyshire S.M.R; Price 1985; pers. comm. C. Hart: the Hartshill finds are in Sheffield Museum). Roystone Grange has produced coins, bronze brooches and pins (pers. comm. C. Hart) while City Folds and Pearson's Farm have samian and the latter colour coated pottery and Closes Farm glass and even tesserae (Derbyshire S.M.R.). The majority of isolated fineware and bronzework finds (though both are few even in total) also occur in this area (and the lower Dove/Manifold valleys) (Figs.8 a-d).

In comparison other parts of the south of the study area have rather less finds indicating material wealth. The rich assemblages from caves such as Poole's Cavern, Thirst House

and Thor's Cave cannot be safely included in this evidence since the former two at least may have been workshops serving a market at Buxton. This leaves the coin concentration at Eyam/Stoney Middleton, which also includes such items as a pair of silvered armlets; some fineware and a brooch from Hay Top; fineware from The Burrs and Demons Dale (Derbyshire S.M.R.); the finds from Staden (some fineware, three or four brooches, a ring and a bronze sheet fragment); and a very few isolated fineware and bronzework finds. Whilst this picture may be partly due to fieldwork variations, the very few excavations in the south east being rather better known than those elsewhere, it may well be a real pattern.

Nowhere further north can similar discussion of patterns of wealth be attempted for, apart from the isolated coin finds discussed above there is no evidence to go on. The only published excavation, at Whitley (Makepeace 1985b) produced little to indicate any wealth but it would be wrong to extrapolate this evidence very far. However, at the moment the pattern of wealth in the study area would seem to be concentrated in the south and particularly the south east.

d) The North/South Divide and Vicinal collapse

A piece of circumstantial evidence in favour of military and or urban stimulation of the rural sector is the disparity between the densities of sites in the south and north of the

study area. The presence of far more major sites in the south, some of which had far longer lives than any in the north, as well as the lead mining industry provides a possible explanation for this. The settlement pattern in the south could well have been created by the demands of urban and mining communities for food, demands little present in the north. We may also note again the possible implication of Derbyshire ware, that agricultural produce was being exported from the south of the area (see further below p.242f).

Yet there is also some important circumstantial evidence against large scale stimulation of the rural economy. If militarily based vici such as Brough were having an effect on the rural economy it was clearly not sufficient to bring about a situation where they could stand alone without an army presence (above p.79). There may be hints that there were elements other than the military within the economy of a military vicus (above p.80ff). It is also possible that rural markets existed which represented a more enduring and perhaps socially embedded mechanism for exchange. Yet, it is still difficult to accept that vici were disseminating a monetized economy and encouraging increased agricultural production with any success when they collapse as soon as the garrison leaves. Nor can it be argued that the process had not had sufficient time to develop by the time the military left. That would be all very well at Melandra, but not at

Brough where the vicus closed down in the ?late third century while there was still a garrison present (Dearne forthcoming b). It is anyway not the late first and early second centuries that are emphasised by rural site dating but broadly the whole of the second, third and perhaps fourth centuries. During much of this time only one fort, Brough was in existence. Any rural decline was rather on present evidence in the third and fourth centuries when there was no change in the military pattern. This problem is not unique to the study area and has been discussed in detail for Wales by Davies (1984, 107ff).

Similarly, we have noted possible settlement clusters around major sites. But it is curious if the major sites were acting as a stimulus to the rural economy that rural sites do not cluster along Roman roads (Figs.8a-d). In fact sites seem almost to avoid road lines. Only along Margary 71a and the unproven course of the Brough-Carsington road is there any real proximity of settlement to roads. However, this could be due to the utilisation of highland for many road courses.

e) Conclusion

It would be wrong at the present time to try and draw firm conclusions about the degree to which urban, military

and mining developments changed or created the rural economy of the area. The existence or not of an Iron Age settlement pattern remains problematic and the Romano-British evidence itself is still highly limited. More direct evidence from excavated rural sites must be forthcoming before reliable judgements can be made.

At the moment though the picture appears to be one firstly of very little stimulation in the north of the study area. The recent aerial discoveries, if Romano-British, distinctly avoid the Slack fort and, though sites probably remain to be found or have been obliterated nearer to it the dating of isolated coin finds may suggest that they were either not contemporaneous with the military presence or continued unabated when it finished. No case can be made out for significant stimulation from the forts at Melandra or Castleshaw either. In the latter case a single settlement does appear to have been in existence at exactly the same period as the fort suggesting that it was in some way dependant on it, but this hardly constitutes significant stimulation of the rural environment.

For the south there are more signs of stimulation, though it must remain questionable as to whether that provided by military presences and by military vici ever reached a particularly high level. Rather the most likely candidate for a major economic stimulus seems to be the lead industry

(the nature of the connection with which is considered in more detail below: Chapter 9, p.232ff). This is indicated particularly by the apparent wealth of the south east of the study area (probably the main area of the industry), the concentration of settlement and coinage (and so perhaps a monetised economy) in the Carsington region (probably the centre of the industry) and perhaps by the relative longevity of the settlements in the area.

Brough, the only military site occupied for much of the Roman period may have occasioned some stimulation of rural activity and in this connection the presence of known and possible sites on the Limestone Shale of the Derwent tributaries and the cluster of sites and finds south of the fort at Brough are likely to be significant. Similarly Buxton probably represented an urban and civil stimulus to the relatively dense pattern of settlement in the Wye valley. However, no such stimulus is immediately obvious for the also apparently well populated Manifold and Dove valleys and may warn us against automatically assigning Wye valley settlement to Buxton's influence.

But Buxton and particularly Brough would at the moment seem to be less significant factors than the lead mining industry, probably centred at Carsington. This would seem to reinforce the suggestion made by Hodges and Wildgoose

(1980) that much of the settlement pattern including sites such as Roystone was established de novo in the earlier second century in connection with the lead industry. However, their further contention (1980, 52) that the existence of an aisled house at Roystone specifically indicates immigration from southern Coritanian territory may be more questionable. A second aisled house is known at Wharnecliffe (Makepeace 1985b) and would on this scenario indicate immigration to the Don valley as well. Moreover, it is clear that, though aisled houses are particularly known from Coritanian territory their distribution in Britain is in fact much wider and their significance may be as much for social organisation as vernacular parochialism (Millett 1990, 199ff; Hingley 1989, 41).

NOTES

1. The plough tip from Rainster Rocks and reaping or pruning hook from Hopton (both in Sheffield Museum) are about the only relevant items.
2. Tesseræ from Closes Farm near Carsington might also suggest another possibility but the nature of this site remains uncertain since it has a V-shaped ditch.
3. The figures for settlement density have been calculated from the distribution maps in Makepeace (1985, Figs. 29-34). The amount of desirable valley slope land is different in each case and the figures therefore represent raw data. They do not represent the incidence of utilisation of worthwhile sites but of land irrespective of quality. They must therefore be regarded as only crude guides to the pressure on land. However, insufficient is yet known about the resource areas required by individual settlements to attempt more refinement.

Chapter 8: The South Pennine Lead and Silver Extraction
Industries in the Context of British
Production: the Direct and Comparative
Evidence and some Implications

i) Introduction

Of the limited number of 'industries' that can be attributed to the Roman south Pennines lead extraction (which may have included the production of silver) is by far and away the most important. The evidence for the industry in the study area is limited. Our knowledge of it is principally derived from the lead pigs or inscribed blocks that it produced, supplemented by a little literary and archaeological information. This is also the situation in the other areas of Britain which were exploited for lead and silver by the Romans. However, the corpus of British lead pigs known to us, now numbering at least seventy-three, allows inferences to be made regarding a number of aspects of the industry nationally.

Whilst valid conclusions regarding certain aspects of the industry have been drawn from studies of only a few pigs (e.g. Whittick 1982) it is not possible to recover the full potential information from them without considering each pig in its context within the national corpus. Similarly, it is necessary to consider not just individual aspects of the corpus such as their silver contents or distribution but to compare these aspects which may together yield further

information (e.g. Appendix 3). Most importantly the full significance of the Derbyshire evidence, both from its pigs and from archaeology, cannot be assessed without a thorough examination of the evidence from other areas of the country. The latter provides not only the context for the Derbyshire industry, but the Mendips in particular may have served as its model and training ground.

The broad outlines of the development and something of the administration of the industry have been established from the pigs (e.g. Davies, 1935, 140ff; Frere 1987, 276ff; Salway 1984, 633ff). However, much of the literature surrounding them contains antiquarian errors, some perpetuated in modern works. Moreover the antiquarian works are diverse, often relatively obscure and rarely deal with more than one or two items each. Therefore, it has been found necessary to compile a new catalogue of these pigs, and associated items, extensively checked against the literature and in many cases against the pigs themselves (Appendix 1).

Evidence other than that of the pigs is limited. A very little literary evidence relates to the role of British production within the empire and the empire wide trends in administration. A larger but perhaps less directly applicable amount of literature, along with some archaeological evidence, has a bearing on the questions of technology and labour supply. However, with the exception of the question

of military involvement in the industry, the regional archaeological surveys presented indicate how little non-epigraphic evidence is available from Britain. It is the pig evidence that is foremost and it is considered under a number of headings (chronology and organisation; archaeological context and size of production; distribution and transport; and desilverisation). Other less directly relevant matters where pigs provide information (detailed epigraphic matters and weight standards) are considered in Appendix 2. Discussion of the important but hypothetical evidence for the economic geography of lead supply in Britain is reserved for Appendix 3. Throughout references to numbered lead pigs are to Appendix 1, following the form outlined on p.407.

Although much can be said of the British lead and silver industry comparable industries in the Roman period and in the Medieval and early modern periods are better documented. In particular the epigraphic evidence from Vipasca in Roman Spain represents the most important single source for mining administration in the Roman world. The evidence from post-Roman Derbyshire in the form of its Laws and Customs also has some relevance to the present study and the well-documented industries of colonial south America provide interesting comparative material on some points. This comparative evidence and its applicability to the

present study will be considered at the end of the chapter.

ii) Lead and Silver in the Roman Empire

Lead and silver (frequently found together) were very important to the Romans. Silver's chief use was as coinage and bullion, though it was also important to the jewellery, high quality table-ware and other decorative industries. Lead was of lesser intrinsic value but was widely used and important. Perhaps its best known use was in water supply systems (e.g. the 'Agricola' water pipes Nos.ADD 1, 13-15) and to line baths (e.g. Cunliffe 1971, 45)¹. However, a number of other uses included the sheathing of the hulls of boats (Greene 1986, 21; Parker 1974, 47), the making of weights (Duncan-Jones 1982, Appendix 18), and of coffins (Toller 1977) where its malleability allowed it to be finely decorated (e.g. Toby 1974).

Lead was added to copper along with other metals to produce a range of alloys with many uses including statuary (Craddock 1988 and bibliography therein) and to tin to produce both pewter and solder (Hughes 1988). It was also used in the form of lead sheeting to make vessels such as the Ireby vat (Guy 1981). Many other objects were wholly or partly made of lead, particularly where weight or stability were important, for instance sling-shot (Greep 1987). Other minor uses included pottery repair clamps (e.g. Allason-Jones and Miket 1984, 333), pottery glazes

(Swann 1978, 10), glasses and enamels (Nriagu 1983, 232ff), seals (Richmond 1936) and lamp (holders) (e.g. Dearne in Bishop et al forthcoming). Lead was also important in metallurgical processes such as the recovery of silver from copper coinage as suggested at Silchester (Tylecote 1986, 60).

This is a fairly extensive list, but by no means comprehensive, and perhaps initially suggests that very great supplies of lead were required. Yet quantification of the empire's lead needs is impossible. Clearly with the importance of both private and public baths to Roman culture, let alone all the other uses that it was put to, large quantities of lead were in use. However, even if they could be quantified, we have no way of telling what proportion of it was fresh from a mine and what proportion had been recycled from scrap (as the 'pigs' Nos.ADD 1, 5-10 may have been). Indeed, it may be that as time went on the amount of recycled lead increased, reducing the demand for freshly mined lead.

iii) The Literary Evidence and Britain's Role in Imperial Lead and Silver Production

British lead and silver, let alone its mining, rarely appears in ancient literature. The only reference to lead is in Pliny (Nat.Hist. xxxiv, 164):

'Black lead (i.e. lead rather than tin) is extracted with much greater difficulty in Spain and throughout Gaul; but in Britain it is found in the upper layer of soil and in such quantity that a law was passed without protest, prohibiting the extraction of more than a fixed amount.'

Silver is little better represented in the literature. Although two references imply that British silver was known to the Romans before the conquest only a single brief mention in Tacitus seems to confirm that it was subsequently worked.

Strabo's(Geography IV, 5, 2) much quoted list of pre-conquest exports includes silver. Whether these were raw silver exports implying the working of the Mendip lead field (below p.281) or silver coin exports (Salway 1984, 39), there does seem to have been an expectation at Rome that Britain would produce silver once conquered. Thus, Cicero (Ad Atticum iv 17), in Frere's(1987, 257) words "contradicting what sound like earlier anticipations," wrote in 54 B.C:

'The result of the war against Britain is eagerly awaited ... It is also now ascertained that there isn't a grain of silver on the island ... '

This was clearly a premature statement, for the war in question was Caesar's abortive expedition which could not have reached a potential silver production area anyway

(Salway 1984, 39; Frere 1987, 257). Yet, the only reference that can be taken to imply post-conquest silver working is Tacitus (Agricola 12):

'Britain yields gold, silver and other metals, to make it worth conquering.'

This reference, coming in a context after a generally derogatory description of Britain, suggests that its metallic wealth was the single most important 'prize of victory'. This is problematic. At the period with which Tacitus' work deals, let alone at the time at which he was writing, c.98, argentiferous ores in the Mendips and perhaps Flintshire were being exploited (below p.227ff). Therefore this must be a statement of the prizes actually won not expected. But this is at variance with other evidence which tends to minimise British silver production (below). Moreover, it is the only reference in classical literature after the conquest to British silver.

How great a part then did the British lead fields play in the supplying of lead and silver to the Roman empire? This is not a question that can be answered quantitatively for, as pointed out below (p.250), we do not even have the crude evidence of the amount of slag produced that is available at some Spanish sites. The evidence that we do have relates essentially to Britain's importance relative to other areas and is primarily literary. Little work has

been done on aspects such as the relative numbers of lead pigs extant from Britain and other areas of the empire.

To take lead first, it is clear that a number of areas of the empire produced lead, either as a by-product of silver mining or as a product in its own right (for a detailed survey of imperial mining see Davies 1935). Probably the most important production areas before the conquest of Britain were in Spain and Portugal (Davies 1935, 94ff; Van Nostrand 1937, 160). Though other areas such as Gaul were important as well (Davies 1935, 76; for a corpus of the distinctive Gaulish ingots see Laubenheimer-Leenhardt 1973). Much work has been done on lead, and more so on copper and silver, mining particularly in Iberia (e.g. Rickard 1928; Jones 1980; Checkland 1967; Allan 1970; Blazquez 1984; Rothenberg and Blanco-Freijeiro 1981; Edmonson 1987). However, many important points including the scale of production, especially given the long pre-Roman and indeed post-Roman history of many sites, and the dating of contractions and expansions in the industries, remain matters of debate.

This is important for it is the apparent competition that the British lead fields represented, particularly to Spanish and Gaulish production, as implied by the law noted by Pliny (above), that suggests that Britain was a major lead producer at least as important as Spain. This law

'prohibiting the extraction of more than a fixed amount' noted by Pliny is problematic in itself. We do not know how much the fixed amount was, whether the law was enforced, nor how long it was in existence for. Although it is perhaps likely that the law was enacted soon after the beginning of the British industry, and so c.60-70, and Salway (1984, 635) has suggested that it may have been lifted by Hadrian, there is no way to gauge its effects on the British industry.

However, there are some archaeological indications that despite the law British production did indeed pose a serious threat to Spanish production. Flavian pigs from Spain are from worn-out moulds (Parker forthcoming) and it may be that an imperial takeover prior to the closure of mines was in progress (Parker 1974, 149). Indeed, many of the pigs found in Mediterranean wrecks of this and later dates (e.g. Nos.ADD 2, 6-9) may be British not Spanish (Parker forthcoming; and footnotes to Nos.ADD 2, 6-9). If there was a decline in Spanish mining it was perhaps a gradual one and we have insufficient evidence at present to accurately assess it. Thus, although some would suggest a Flavian date for it (e.g. Nriagu 1983, 122) Jones' (1980, 159) work at Corta Lago suggested a decline c.160-70 and silver mining at least continued until the fifth century (Rothenberg and Blanco-Freiheiro 1981, 174). Nor is it at all clear whether the decline in lead production in Spain should be entirely

attributed to British competition.

Even were this equation to be accepted and Britain regarded as the cause of a Spanish decline in and after the Flavian period a further question would occur. How long did British production remain important in the imperial market? There are reasons for suggesting that less later British pigs are likely to have entered the archaeological record than earlier ones (below p.255). Although those possibly of British origin in wrecks noted above date as late as 193-211, it is clear that the pig evidence for British lead production declines sharply after the Vespasianic period. Nor is there any appreciable sign of a second or third century resurgence. Even though the disturbances of the Moors in Spain in the third century (Davies 1935, 94ff) must have disrupted any lead extraction still continuing there. A fourth century increase in British production may be more likely (e.g. Frere 1987, 278) but the evidence for it is slim. Indeed, some decline in the British industry is perhaps to be expected since the deposits, initially worked by surface methods, would become more expensive to work as lower and lower levels had to be mined. Some discouragement may also have attached to the probably disappointing silver yields, which may have decreased with depth (below p.223). Moreover, lead mining throughout the empire may eventually have been affected by the re-use of old lead as suggested

above (p.216).

The importance of British lead to the empire as a whole must remain uncertain to an extent. Though it was clearly exported to the continent (below p.256) and has been suggested to have been competitive with both Spanish and Gaulish production there (e.g. Bayard and Massey 1983, 154) we still have little more than hints that it in fact displaced Spain as the most significant producer. Yet in the absence of contradictory evidence Pliny's implication that Britain became at least one of the most important producing areas for lead must be accepted. For how long this situation continued we cannot say but much light could probably be thrown on the subject by a study of all the extant pigs from the empire. This would likely reveal something of the relative production figures for different regions at different times.³

British silver is far less likely to have been of significance in an imperial context. In contrast to Pliny's (Nat. Hist. xxxiii 96) assertion that Spanish silver was the best (presumably the purest) and so most worked in the empire, he makes no reference to British silver. It is perhaps significant as well that the law prohibiting the extraction of more than a certain amount of lead from Britain (above) says nothing of silver. It is not certain how rich in silver the ores worked by the Romans were. Although British lead ores

are generally low in silver (Tylecote 1986, 54), there is a great variation even between veins in the same mine (Tylecote 1986, 69). Therefore it may be that the ores worked by the Romans were somewhat richer in silver than those available today.

This is particularly likely because the Romans would, at least initially, have been working the upper parts of the veins, and there is a tendency for lead to 'wash out' of the top of veins. Thus, the upper levels may become proportionally richer in silver (Davies 1935, 95; Tylecote 1986, 54; the same happens with copper-silver ores, Rickard 1928, 132). Although cupellation, the only silver extraction method certainly known to the Romans (Tylecote 1986, 54ff), was fairly effectively practiced it is difficult to calculate the scale on which silver was produced (see further below p.261ff). However, silver production on a significant scale seems unlikely to have been economic outside the Mendips and Flintshire. Even here it could not have competed with continental sources (Frere 1987, 278). The analysis of lead pigs (below p.261ff) and the reference in Tacitus (above) indicate that some silver was produced. It was perhaps cast in the form of 'double axe' ingots (Painter 1972), though none can be assigned to a production area. However, that at least one of these ingots was imported from Gaul (Br. 17 (1986), 443f No.55) must question whether Britain was even self-sufficient in silver.

iv) Imperial Mining Administration

The legal position with regard to the ownership of subsoil mineral rights in the provinces under the Roman empire is somewhat obscure. The Roman state took over in various ways the ownership of the ground under which many important mineral deposits lay (Davies 1935, 3). Whether the mineral rights on privately held land belonged to the state is not clear. But the provisions of the Aljustrel tablets (below p.292ff) and the development of a system of royalty payments under the later empire (Davies 1935, 4) probably imply that they did. Though how soon or effectively such laws were enforced in newly acquired areas must remain uncertain.

The extent of imperial ownership and the details of how state-owned mines were exploited are also problematic. Edmondson (1987, 37) has recently argued that, whilst gold mines were probably all under imperial control by the Augustan period, silver and other mines may have remained in private hands. However, some mines such as the Vipasca copper-silver mines were probably imperially owned as part of imperial estates. Whether this was the case or whether, as for instance Rickard (1928, 129) believed, both gold and silver mines were all in imperial hands, it is likely that at least some baser metal mines were privately held at the opening of the imperial period. From the time of Tiberius

on there seems to have been an empire-wide trend towards bringing all mining under direct imperial or state control and ownership (Van Nostrand 1937, 166). But it was perhaps as late as the Hadrianic period that this was fully achieved.

In the republican and very early imperial periods state-owned mines may have been extensively 'farmed out' to publicani, the large companies who also farmed taxes for the state, (Plutarch Cato Minor xvi). Or they may have been given to municipia to run (perhaps implied by Suetonius Tiberius 49). However, Richardson (1976, 139ff) has recently argued that the actual evidence for this system, at least in the second century B.C., is very limited. Rather a variety of large and small lessees may have been involved. Whether this was also the case for non-precious metal mines in the early empire is uncertain. However, the evidence of inscriptions on Claudian tin ingots from the Port-Vendres II wreck, perhaps supported by the lead ingots from the Ses Salines wreck, may suggest that at least some mines were privately owned. The production though may have been sold to, or through, the imperial authorities (Edmondson 1987, 38f).

Associated with the moves under Tiberius and later emperors to bring mining under state control was a re-organisation of the administrative framework for the working of imperial mines. This is perhaps to be ascribed to Vespasian (Rickard 1928, 136) but was certainly in place by

the time of Hadrian (Van Nostrand 1937, 167). This system was based on Procuratores metallorum, who were concerned principally with the financial administration of the mines, and were assisted by tabularii and commentarienses (Davies 1935, 9f). The procuratores directly ran certain large mines, perhaps particularly where slave or criminal labour was used, such as Rio Tinto in Spain. But in many cases they let out mining concessions to conductores⁴. This latter system may have derived from practices developed on imperial agricultural estates (Davies 1935, 11). But Edmondson (1987, 37) has warned against drawing too many parallels from the main piece of evidence for this system, the Aljustrel tablets (discussed in more detail below p.292ff), since the area of Aljustrel may itself have been an imperial estate.

No Procurator metallorum is known from Britain. However, a number, such as the Proc.Metall.Alboc. from the Esla basin in Spain (C.I.L. ii 2598; Davies 1935, 9), are found in other provinces. They appear to have been equites or freedmen (and in the fourth century perhaps decurions (Edmondson 1987, 68)) and to have been separate from technical staff, who rarely appear in our sources. They were perhaps mainly natives (Davies 1935, 9f). The large conductores known appear to be men of social standing and Davies (1935, 11f) believed that the presence of private names on Derbyshire lead pigs indicated that it represented

an exception amongst lead mines, being worked by conductores due to its low silver ores. However, it is now clear that if this was the case then other lead fields in Britain were also considered similarly since private names appear on their pigs too.

v) The Chronological and Organisational Evidence of the British Lead Pigs

The most important evidence for lead mining in Britain comes from the pigs, or cast blocks, of lead. British pigs are invariably in the form of blocks with a truncated triangular cross section (Fig.10), though some are more regular than others. The majority carry a cast inscription (usually but not invariably enpanelled) in one, or after 164 two, lines on the smaller top face (the bottom as cast). This may have been transferred to the front of the pigs in or before Severan times if Appendix 1 Nos.ADD 2, 2-3 are British. The base (top as cast) is unmarked. The sloping sides, and less often the ends, also carry various marks, in some cases a one line cast inscription, and or various stamped marks. A minority of pigs are without cast inscriptions, and in some cases carry no marks at all. In weight the pigs vary from some 50 lbs. (22.7 kg) to 223 lbs. (101.2 kg) but principally cluster between 150 and 200 lbs. (68.04 - 90.72 kg) (Fig.11). The significance of the weights is considered in Appendix 2. The dimensions of the pigs vary considerably, both absolutely and in their ratios, but typically are in the regions base 16 x 56 cm; top 8 x

48 cm; height 10 cm.

The evidence that the inscriptions on these lead pigs provide on the chronology and organisation of the industry is, particularly given the paucity of the available archaeological information from production sites (below p.280ff), of central importance and will be discussed in detail. However, detailed examination of the elements of the inscriptions, such as the identification of place names, is reserved for Appendix 2, to which reference is made where appropriate. The chronological evidence will be considered first for each production area in turn, and then the evidence for the organisation of the industry.

a) The Mendips

There are at least twenty-six lead pigs known which originated in the Mendips. The earliest certain date for extraction here, and indeed nationally, is 49, clearly indicated on pig No.1. Whittick (1982, 113ff) has put forward cogent arguments for accepting Leland's (1544) original description of this item as a 'trophy', essentially an inscription on lead rather than a cast block, and rejecting later assumptions that it was in fact a pig. He argues that the inscription resembles propagandist coin issues more than other pig inscriptions. It may also be observed that the early mining seems to have been supervised by Legio II (below), yet there is no legionary reference on

pig No.1. Thus, it is possible that pig No.1 could pre-date the beginning of intensive mining in the Mendips by the Romans. However, it is unlikely to pre-date it greatly since once found the Romans would have been keen to exploit the lead deposits.

The first certain pig, as opposed to 'trophy,' is probably No.2. However, it cannot be more exactly dated than Claudio-Neronian. As Whittick (1982, 116f) points out its main cast inscription does not contain a reference to Claudius' son Britannicus (therefore indicating a date of 49) as some have suggested. Rather L(egio) II has been constantly misread in FIL or IMP leading to the misinterpretation of the preceding word BRITANNIC(a) (see further Appendix 1, note 10). Nor can the pig be dated to 49, as Webster (1952/3 note 12) and others would argue, by the stamped inscription read by Webster as VETP. Whittick (1982, 117) cites a number of arguments against an interpretation as a reference to the consulship of Veranius and Pompeius (i.e. 49). Besides which the stamp is in fact clearly V.ETPL.C (Whittick 1982 plate VB; Appendix 1, note 11). The pig is though probably earlier than the Neronian pig No.3 since it carries a rather fuller abbreviation of Britannica (BRITANNIC as opposed to BRITAN), a phrase which becomes increasingly abbreviated as British lead becomes better known (Whittick 1982, 117).

One other Neronian pig is known, No.4, of 60. It is probably to be regarded as later than No.3 since, in contrast to Nos.2 and 3 which have references to Legio II, it bears the name of a private individual in common with most Vespasianic pigs. The large group of Vespasianic pigs (Nos.5-14) include only one specifically dated example, No.14 which is dated to 79. There may be reason to suggest that the other nine pigs date before 71 since there is no reference to Titus (Appendix 1, note 30), but it would be unwise to be dogmatic here since pig No.14 also fails to carry such a reference. No other criteria are available from which to construct an internal chronology for these pigs.

The Hadrianic period is represented by one pig (No.15) and perhaps by a second rather dubious one (No.15A). There is then a gap of a hundred years to three pigs (Nos.16-18) of A.Pius, followed by four of M. Aurelius and Verus (Nos. 19-22). Whether there is any significance to the gap in the sequence must remain uncertain, though it could indicate a decline in the industry for which there may be a little archaeological support (below p.281).

No further datable pigs may be certainly attributed to the Mendips. A series of uninscribed pigs (Nos.23-6) from the area are probably to be regarded as Roman and might on the basis of the parallel stratified finds from Derbyshire

(Nos.54-5) be suggested to be late Roman. However this must remain speculative. Similarly two pigs later than those certainly from the Mendips (Nos.ADD 2, 2 and 3 of S. Severus) may well have a British origin and, since it has by far the latest inscribed pigs, must be more likely to come from the Mendips than other areas. But neither presumption has yet been proven. Especially in view of these possibilities the date at which the Mendip field ceased production must remain uncertain.

b) Flintshire

Flintshire may well have been the second of the main lead extraction areas in Britain to have been opened up by the Romans. However, there may have been some working of deposits in S. Wales, from which we have no true pigs, conceivably at an early date (below p.281f). We have seven Flintshire pigs. Extraction by 74 is proven by two pigs (Nos.57-8) but Whittick (1982, 120) has argued that a pig from Carmel (No.56) ought to be dated to the mid-60s. Certainly there seems little basis for J.R.S. (xli (1951), 142)'s second century attribution of this pig (Appendix 1, note 172). There seem to be two main reasons for suggesting an early date for it. Firstly the inscription carries no imperial reference, just a private name unlike all the other Flintshire pigs. This could be taken to suggest exploitation by private prospectors prior to the establishment of any

imperial machinery in the area. Whittick (1982, 120) argues that the most likely date would be in the mid-60s, when there was a lull in campaigning in the area but before its final absorption by the Roman authorities.

Webster (1952/3, 5-7) has argued that exploitation before military control of the area would be unlikely. But he admits that Tacitus (Annales xii, 32) may record reconnaissance of the area under Scapula which could have led to discovery of the lead deposits. The second argument in favour of an early date is that the private name cast on to pig No.56 is C.NIPI.ASCANI. In view of the rarity of both Nipius and Ascanius (J.R.S. xli (1951), 142) it seems very likely that he is identical to the C. Nipius Ascanius recorded in the Mendips in the early 60s (pig No.4). This makes a second century date questionable and suggests that pig 56 was cast by someone with previous experience in lead mining who would not need military experts to learn from. As to the exact date of the pig we have only the two references to Ascanius to go on for he does not appear on later pigs in the Mendips. Though this is too small a corpus to use as negative evidence. Private individuals continued to be associated with the industry in the Mendips up until at least late Vespasianic times (below p.244f) but subsequently probably moved north into other extraction areas (below p.246ff). Whether Ascanius represents one of the first of these to move to other fields must remain uncertain

but the balance of the evidence is probably in favour of a date before 74 for pig No.56.

Of the later imperially inscribed pigs we have a relatively short run, consisting of the two of 74, two others of 76 (Nos.59-60) and a group dating to 76 and to the reign of Domitian (Nos.61-62). No later pigs are known, though one (No.63) cannot be fully read (Appendix 1, note 206).

c) Shropshire

Only four pigs (Nos.68-71) come from Shropshire and all represent the Hadrianic period. It is perhaps likely that mining began at an earlier date but the pigs provide no evidence on the point.

d) Derbyshire

Only one of the twenty-eight Derbyshire pigs gives us a direct date and the assessment of the chronology of this important extraction industry is dependent mainly on epigraphic parallels, principally from the Mendips. The dated pig (No.45) is Hadrianic and there seem good grounds on which to suggest that all but two of the other inscribed pigs are earlier.

Cockerton (1959, 94) has rightly pointed out that the terms *Britannica* and *Ex Argentariis* (see also below p.494ff),

in their various abbreviations, disappear in the Mendips by 117. Further this seems to coincide with the disappearance of private and society names in the Mendips (below p.239). Indeed, it is notable that the only pre-Vespasianic occurrence of Ex Argentariis is on the only pre-Vespasianic pig with a private name (No.4). Moreover, Britannica and Ex Argentariis are absent from Flintshire, Shropshire and Yorkshire pigs where private names are not recorded except for pig No.54 (above p.231 f). Thus, it seems that there may be a correlation between the presence of these elements of inscriptions and the presence of private or society names.

The important question is can this correspondence be used to date Derbyshire pigs? It can perhaps be objected that the Derbyshire inscriptions are not sufficiently similar to those from the Mendips for this to be possible. Certainly the private names in Derbyshire are cast not stamped and imperial references are not present. This, and the third variation of private name cast without any other inscription (No.56), may suggest that there were different variations on a theme in the pre-Hadrianic exploitation of British lead resources. But the basic correlation remains. Britannica and Ex Argentariis disappear at the same time as private and society names. The implication is that they were both part of a system operated in pre-Hadrianic times, and quite possibly by the same individuals in both areas

(below). Therefore, it is contended that pigs 27-44 should be dated to some time before a general change in the structure of the industry in or before Hadrianic times.

There is some further supporting evidence that may allow us to refine the dating a little. Firstly it seems unlikely that any of the pigs are pre-Vespasianic since the contractions of Britannica and Ex Argentariis found in Derbyshire (BRIT.BR; EX ARG) are generally shorter than those found on the Neronian pigs from the Mendips (BRITANNIC, BRITAN, BRIT; EX ARGENT). Extraction before 69 ought to be unlikely anyway given the political situation. Although the possibility of extraction before full military conquest in Flintshire (above p.231f) should warn us not to be dogmatic regarding early prospecting.

Secondly, pigs 37-41 carry the name TI.CL.TR which it is tempting to identify with the TI.CL.TRIF of Mendip pigs 5-7 which are Vespasianic and perhaps before 71 (above p.230). Although such an identification is not certain it must be regarded as relatively likely. If it is accepted then pigs 37-41 ought to date from before about 110 even if the individual in question was only twenty when he worked in the Mendips. Thirdly, the change in the organisation of the lead extraction industry represented by the omission of private names on pigs can perhaps be seen to occur in the Mendips in late Vespasianic times, perhaps gradually (below

p.245). Yet in Flintshire any reorganisation was in place by 74 (below p.245), and it seems likely that we should be looking for a broad period in which the different production areas were brought into line. Thus, it seems entirely possible that men such as TI.CL.TRIF were displaced from the Mendips in late Vespasianic times, moved north and continued to work in Derbyshire for many years before the imperial rationalisation reached it.

Constructing any chronology within this pre-Hadrianic group is difficult and must remain largely hypothetical. However, three recurring terms with various abbreviations, Britannica, Lutudarensis and Sociorum Lutudarensium, may allow an attempt to be made. The premise that such terms would tend to become more abbreviated over time as they became more widely understood is probably far more valid for the likely more obscure second and third terms than for Britannica. The latter was probably already reasonably well-known and is never longer than BRIT. Its abbreviation probably has more to do with considerations of the space available in moulds than with intelligibility. The hypothetical sequence would be Nos.27-8; 42-4; 29-34 and 35-6 (the two inscriptions involved here having been found in a single hoard); and 37-41.

The two most difficult inscribed Derbyshire pigs are Nos.47 and 48. There seem to be epigraphic reasons to date

these pigs early, and equally good ones to suggest that they ought to be nearer in date to the Hadrianic than any other pigs. The arguments for an early attribution are that the forms of Lutudarensis (LYTVDARES, LVTVD) are fairly full (necessitating considerable conflating of the letters) and that private names are present. The arguments for a later attribution are that Britannica and Ex Argentariis are not present and that the phrase Metalli, paralleled only on the Hadrianic pig No.45, occurs. There does not seem to be any way to resolve this conflict of evidence and these two pigs must remain undated.

Two further, but uninscribed, pigs from Derbyshire may be dated to the fourth century (Nos.54-5) since they were found in a stratified context (Branigan, Housley and Housley 1986). On this parallel it might be suggested that pigs 49-53, also uninscribed except for a ?weight mark on one, are also later Roman. However, the presence of the weight mark and the general implications of the weights of uninscribed pigs (below p.510ff) warn against automatic late attributions of uninscribed pigs.

e) Yorkshire

The two earliest of the four Yorkshire pigs (Nos.64 and 65) are dated to 81. A poorly recorded pig (No.66) seems to have been Trajanic, while an equally badly recorded find

can only be restored to indicate a Hadrianic date (No.67). Nothing else is known of the chronology of the Yorkshire industry.

f) Organisation

A surprising amount about the organisation of the British lead industry, at least in the pre-Hadrianic period, can be deduced from the inscribed pigs. Initially it is clear from pigs 2 and 3 that mining in the Mendips was in some way under the control of Legio II. Exactly what role they played is unknown. However, it is perhaps most likely to have been supervisory and technical as it probably was elsewhere in the empire (Davies 1935, 15). Military involvement elsewhere in Britain is not indicated by pig inscriptions. The supposed reference to Legio XX on a Shropshire pig has now been shown to be spurious (Appendix 1, notes 225 and 228). Davies' (1935, 15 note 5) speculations regarding C.I.L. xiii 2612 a-b, C.I.L. vii 1218 and 1209, 6 (which he suggested contained references to Legio VI at York) and pig No.72 (which he suggested included part of the same stamp) cannot be maintained. The inscription in question could easily be rendered as a name (LV(cius) I(?) CVC(?)) (cf. Appendix 1, note 242; Webster 1952/3, 12f). The inscription on pig No. ADD 2, 4 is a more likely candidate for evidence of the involvement of Legio XX in lead mining. But the pig is not certainly British, is undated and could

as easily record the supply of lead from Legio I Minerva to Legio XX. On the two pigs of ?resmelted scrap lead from Wales stamped by Legio II see below (p.282).

The involvement of Legio II in the Mendips seems to have ceased by 60 to judge from pig No.4. This pig is the first of a series of otherwise Vespasianic ones characterised by the presence of private and or society names and inscriptions including the elements Britannica, Ex Argentariis and Veb(?). All disappear simultaneously in or by Hadrianic times, though there are a few Vespasianic pigs which do not carry these elements. It is suggested here that these privately marked pigs represent an extraction system in force c.60 until ?late Vespasianic times in the Mendips (on the dating see further below).

It seems likely that pig No.4 represents an early stage in the development of this system for the arrangement of its inscription is transitional between the earlier legionary pigs and the main run of Vespasianic pigs. Its main cast inscription is similar to earlier pigs except for the omission of a legionary reference. But the phrase EX ARGENT (ariis) appears, incised not cast as on later pigs, as well as a private name, C N[I] PI ASCA [NI]. The Vespasianic pigs show a development from this. EX ARG (entariis), along with BRIT (annica) which has been transferred from the main cast inscription, and a new element,

VEB (?) now appear in a separate cast inscription on the side of the pig. A private or society name often appears, but continues to be stamped not cast. The reading of this side cast legend is discussed in detail in Appendix 2 (p.494ff) where it is concluded that it should be read '(from the) British (lead-) silver works (at) VEB (???) ' VEB (???) being an as yet unidentified place or area name (below p.501f).

Thus, in the developed form of the system we have a number of elements to consider. Firstly there is the main cast inscription with a plain imperial reference. Secondly we have the side cast inscription telling us that the pig comes from a named lead-silver works. Thirdly we have stamped references on some of the pigs to private individuals and to a society. What sort of system does this reflect? Clearly there is some imperial involvement. The main cast inscription is not just a form of dating, for, with the exception of No.14, the pigs in fact carry a less specifically datable reference than earlier pigs. Equally clearly though named individuals and societies are involved in at least some of the examples. The key question is what function were they fulfilling?

There are a number of possibilities: that they were imperial servants of one form or another ; that they were private individuals involved in the processing of the lead

alone ; that they were private individuals involved in the actual extraction (?and the processing) of the lead; or that they were private individuals involved after the smelting process. There are a number of objections to such individuals being imperial servants. If these men were imperial administrators, perhaps checking production, we should surely expect them to state their title and to mark every pig (which is certainly not the case). Indeed, a simple name seems insufficient as a checking mark. Moreover, at least one of them, C. Nipius Ascanius, later appears in a different region producing pigs with his name standing alone on them (pig No.56), as may a second, Tiberius Claudius Trif (?o) (pig Nos.37-41). These are likely to be pigs actually produced by the signatories, implying a far more practical skill than that of an administrator.

Suggesting that they were involved only in the processing of the lead, that is that they were smelter operators rather than miners, is also problematic. In these circumstances we should surely expect the names to be cast not stamped. The fourth suggestion, that they were involved after the smelting process and therefore merchants or middle men of some description, is more likely. Here we would expect stamps not cast names. But again it hardly seems to agree with the evidence for Ascanius' and Trif's(?o) later activities. In the case of the pigs stamped by a society, the SOC (iorum) NOVEG (??) (on the same see below p.506),

(Nos.9, 10 and 14) this is less certain. Particularly since a probable individual's name also appears on No.14, there must be a possibility that the society acted as a marketing agency rather than as a grouping of extractors , though the parallel evidence for the Sociorum Lutudarensium in Derbyshire (below p.247) may argue against this.

The remaining suggestion for the role fulfilled by these individuals and the society is that of actual miners, conceivably involved in the processing of ore as well. This certainly seems to be the most obvious and likely of the options. If this is indeed so we need to establish their relationship to the imperial authorities and to the lead-silver works at VEB (???) .

For the first we have little evidence but the options seem to be limited to two , that they leased the mines from the imperial authorities or that they worked them for the imperial authorities on contract. Parallel evidence from Vipasca in Spain (below p.292 ff) must sway us towards the first option though certainty is impossible. The only other evidence from the pigs that might shed light on the matter are the IMP stamps on two pigs (below p.504f) , but the interpretation of these must remain conjectural. The relationship of the individuals and society to the lead-silver works is perhaps easier to gauge. It is argued in Appendix 2 (p.497f) that the term Ex Argenteriis which we

are interpreting as 'the (lead-) silver works' originally denoted in the Mendips a processing centre where de-silverisation took place. But later in Derbyshire was used to mean just a lead processing centre. Whether there was one processing centre in the Mendips at VEB (???), or whether there were a number in an area called VEB (???) is unknown. What does seem likely is that all production passed through it/them. Such is the implication of the ubiquity of the phrase BRIT EX ARG VEB which only fails to appear in full on the Neronian pig and two other fully recorded examples (one at least of which it is argued below represents the end of the extraction system using private miners). It is also implied by the fact that names are struck onto the pigs after casting. If each miner had cast his lead when and where he wished there would have been no need to identify each's products. Equally, if it was at this/these smelting site(s) that the silver was removed from the lead, quite possibly to flow into the imperial coffers, all production must have passed through it/them.

Indeed, it is extremely tempting to see the smelter(s) of VEB (???) as imperial or imperially licensed. Not only would this have ensured the procuring of any silver for the emperor but it would also have been a convenient way of checking the lessees production and assessing any rent or other due that he claimed if it was based on production. Thus, the possible picture that emerges of the extraction

system in the Mendips in the Vespasianic period is one of private lessees working the mines. Then bringing their ore, probably already dressed, to one or more central imperial smelter(s) where it was desilvered, cast into pigs and marked to show who it belonged to. Imperial officials probably noted the productivity of each lessee at the same time to assess any payment due to the emperor.

Two or three pigs complicate this scenario, but may help to date the demise of the system. Pig No.12 carries only an imperial reference to Vespasian (the same is true of No.13 as far as it is known but the pig is incomplete and BRIT EX ARG VEB could originally have been present; Appendix 1, note 66). No.14 carries a main inscription, specifically dated to 79, combining imperial elements and part of the usual side inscription, as well as stamped private and society names. No.12 could represent a complication to the system outlined above, that of imperial extraction existing along side exploitation by lessees. However, it seems equally possible that taken together Nos.12 and 14 in fact represent the end of the private lessee system.

It is clear from pig No.15 (and perhaps 15A) that by some point in the reign of Hadrian a distinct change had occurred in the organisation of the Mendip industry. Hadrian's name stands alone on the pig and elements such as

BRIT, EX ARG, and VEB have disappeared. The implication must be that far tighter imperial control is being exercised. Pig No.14 seems to represent a transition between this and the private lessee system. The main cast inscription gives the impression that it is an unsuccessful attempt to conflate the earlier cast inscriptions. If the whole side inscription was intended to now appear with the emperor's name the mould maker clearly left insufficient space for it. Mainly because we now find a specific date reference appearing as well. Yet it is equally possible that the element VEB was no longer considered necessary. This would change the whole tenor of the inscription. The British lead-silver works are now being specifically linked to the emperor.

If this is the case it would appear that an increase in imperial control was being phased in c.79. Pig No.12 might represent the completion of this. However it can hardly be more than a few months later than No.14 since Vespasian died in 79. It may be more likely that the gradual process came to fruition earlier in some sectors of the Mendip industry than others.

We have pig evidence for the activities of private individuals in two other areas of Britain. At some time after 60 but before 74, and quite possibly in the mid-60s (above p.231f), C. Nipius Ascanius probably moved from the Mendips to Flintshire from where we have a pig with his name

standing as the only inscription (No.56). He must be regarded as a prospector if he was working in the mid-60s, producing lead without the involvement of the imperial authorities. Whether a lessee system ever developed once the imperial authorities had taken control of Flintshire we are unable to say. But if it did it is not being referred to by the time of the next extant pigs, Nos.57-8 of 74.

In Derbyshire we have already seen (above p.234ff) that the terminology at least of the Mendip system was inherited. Tiberius Claudius Trif (?o) who had previously worked in the Mendips may have moved to Derbyshire. In fact it is tempting to see a steady flow of men with experience in the Mendips moving north to exploit new deposits. Some of them were perhaps displaced by the trend towards closer imperial control in the Mendips in the ?late Vespasianic period. However, the details of the pre-Hadrianic extraction system in Derbyshire seem likely to have differed from that in the Mendips.

The most important difference between the Derbyshire and Mendip pigs is that the former do not carry imperial references. Davies (1935, 12) felt that the Derbyshire ores were too poor in silver for the government to work directly and that they were worked on leases. Yet this conclusion was based partly on a belief that all other areas were under military control, a belief that cannot be supported (above

p.238; below p.276 ff). Indeed, an imperial leasing arrangement is exactly what we have suggested for the Mendips where there are imperial names on the pigs. Final proof is lacking but the presumption must be that the Derbyshire field was not directly under the control of the government until some point in or relatively shortly before the reign of Hadrian. This is not to say that the government took no interest in it. There may have been dues payable especially if any silver was produced, but on present evidence imperial control as such is not indicated.

The detailed implications of the inscriptions on the pigs bearing private and society names from Derbyshire are discussed in Appendix 2 (p.498). But the general import in all cases is clear. The lead comes from Lutidarum (on the name see below 286 f and p.500), which may be a place, an area, or perhaps in some instances also the name of a mine, and from a lead works. Whether we are talking of one lead works or several is not clear. But that one society and two different individuals had their names cast on to the pigs may argue that there were at least three privately operated sites. It is possible that none of these private/society names represent actual extractors, but rather smelt operators (who might for example buy miners' ore, smelt it and then sell the pigs). A third option that they were merchants buying the lead seems unlikely in view of the fact

that the names are cast not struck.

We know little of the private individuals who stamped or cast pigs, and probably made up the societies that did the same, in the pre-Hadrianic period. C. Nipius Ascanius who appears in the Mendips and Flintshire could have been of Italian origin (Webster 1979, 149). He is likely to have been from a family whose only other known representatives were an imperial procurator at Rome and an equestrian officer (Birley 1980, 149f). Tiberius Claudius Trif (?o) (or Triforus or similar) was probably a citizen given the franchise by Claudius or Nero, though he could have been an imperial freedman (Birley 1980, 149f). Of the names only known from Derbyshire C. Iulius Protius may have been the libertus of a family enfranchised under Caesar or Augustus, L. Aruconius Verecundus may have some connection with Ariconium (Weston-under-Penyard), and P. Rubrius Abascantus must remain an obscure name (Birley 1980, 149f). There is little pattern to discern here, either in origin or social status and no conclusions can be reached on matters such as whether these men were working for themselves or as freedmen or agents for the more wealthy.

The organisation of the lead extraction industry in Britain after the cessation of the privately stamped and cast pigs is somewhat more obscure. Clearly there was some general tightening of imperial control. In Derbyshire

perhaps the imposition of that control for the first time. This is reflected by Hadrianic pigs in all areas which bear the imperial name alone. In Flintshire the change had evidently happened under Vespasian by 74, if indeed there had ever been a system using private individuals before. In the Mendips we have seen that the change probably came in late Vespasianic times. Here there may be some confirmation in the pig of Nerva (No.73) which has only an imperial name and is most likely to come from the Mendips. But in Derbyshire it may have come later. In Yorkshire and Shropshire, if there had ever been systems as in the Mendips and Derbyshire, the change appears to have occurred in or by 81 and the Hadrianic period respectively.

The nature of the extraction system under Hadrian, and in the Mendips at least under subsequent emperors until 164-9 or later, must remain speculative. Whilst some comparative evidence that may pertain to the Hadrianic period, but perhaps under different conditions, will be discussed later (below p.292 ff) the pigs themselves yield almost no information. It is entirely possible that some system using private lessees and or contractors continued in operation, it being only the arrangements for smelting and checking production that changed, perhaps becoming more centralised in imperial hands. Yet it is also possible that the entire mining process was now in the hands of imperial

officials, presumably employing contracted labour. But there is no evidence for the involvement of the military in lead mining at this date (below p.276ff) and that for the use of convict labour is similarly limited (below p.275f).

Only two pigs certainly represent lead extraction in later Roman Britain, the uninscribed pigs (Nos.54 and 55) from a fourth century context at Carsington in Derbyshire. Whether other uninscribed pigs from Derbyshire and the Mendips are also of a late date is uncertain (above p.230ff). Little can be said of a sample of two pigs. However the fact that there are no late inscribed pigs tends to suggest that the industry had either declined or ceased to produce inscribed products. If the latter was the case it is probably likely that they represent an industry less organised than in earlier times and perhaps now entirely in private hands. Parallel evidence from Spain would support this (Edmondson 1987, 48).

vi) The Archaeological Context of Pig Finds and the Size of British Production

One of the most important questions for the British lead industry is what was the scale of production? On this point, as so many others, we have virtually no evidence except for the pigs. Only one certainly Roman mine is known (below p.281f) and no work has been done on quantifying the amount of slag at mining centres. Indeed, this is rarely

possible.⁵ At Charterhouse in the Mendips much of the slag has been resmelted in recent times (Gough 1967, 35). At the more promising site of Green Ore work has been limited (Ashworth 1970). In Derbyshire no certain processing site of any size is known and the best candidates, Carsington and Rainster Rocks, are disturbed and little investigated (Branigan 1985, 41). The possibly important site at Linley Hall in Shropshire may hold more potential but again work has been limited (Webster 1975a, 100ff). As it has at Pentre in Flintshire (O'Leary 1989). Thus, the sort of quantification possible at Rio Tinto in Spain (Rickard 1928) is not open to us. Though even if it was its validity would perhaps have to be questioned since it is not established whether ore was processed at a few central sites or at many smaller ones in Britain.

The pigs of known area origin give us our only indication of the relative outputs of the British production areas, though deductions from these must remain cautious since we have no way of knowing whether they present a representative sample. Indeed, the time span of the Mendip pigs for instance is far greater than that of any other area and their numbers could indicate not greater levels of production but simply production over a longer period. Thus, if we were to compare the Mendips and Shropshire in the Hadrianic period, Shropshire would appear to be the more

productive with four pigs to the Mendips' one or two. There may also have been factors in the rates of loss of pigs that varied from area to area. These qualifications having been stated it does seem that the Mendips and Derbyshire should be regarded as the most important areas. There are at least twenty-five Mendip pigs and at least twenty-eight from Derbyshire. Yorkshire and Shropshire have four each, suggesting that they were relatively unimportant. There are nine entries for Flintshire, but two of them (Nos.61 and 62) represent between them a number of pigs, perhaps raising the Flintshire pig total into the upper twenties. It seems likely that this exceptional find unduly distorts the picture and that Flintshire should actually be ranked below the Mendips and Derbyshire but above Yorkshire and Shropshire.

The reliability of the sample of lead pigs brings us to the question of how they entered the archaeological record, bearing in mind that they are large, heavy and unwieldy objects. The vast majority are single finds (some forty-seven) and a total of thirty-eight of the pigs come from the vicinity of production areas (Fig.13). There are ten multiple finds, all except the large Flintshire find (Nos.61 and 62) of two or four pigs, and seven of them from outside production areas. One possible conclusion to be drawn from the multiple finds is that pigs were often moved

in groups of two (? in mule panniers) or four (? on carts).

Only two certain pigs (Nos.30 and 73) appear to be part used, as opposed to simply damaged or incomplete castings, and therefore probably 'at destination'. Most losses are therefore probably to be attributed to events at the time of production or during subsequent storage and transport. A few are likely to have been lost by accident. The pig from the Roodee, Chester (No.58) might have been lost while being loaded on to or off a boat (Appendix 1, note 185). As may the two pigs from the R. Frome at Bristol (Nos.16 and 17), and No.3 from the harbour at St. Valery in France. The majority though seem likely to have been either deliberately concealed and not recovered or to have been stored at production centres and never sold. The pair from Carsington (Nos.54 and 55) and the four from Green Ore (Nos.5-8) were in pits (Branigan, Housley and Housley 1986; Palmer and Ashworth 1956/7) which suggests deliberate concealment. Similarly the several finds from Charterhouse may suggest unsold or misplaced stocks.

It is regrettable that very few pigs have been excavated from known contexts for the circumstances in which most entered the archaeological record must be debatable. For most the choice seems to be between unrecovered thefts and unrecovered concealments in times of trouble or accident

(such as a cartier hiding his load if his cart broke down and he had to fetch help). In either case it seems likely that the pigs that we have records of are only a very small percentage of the total production. Theft cannot have been easy and concealed pigs ought to have been relatively easy to relocate.

One piece of evidence may argue that the majority of losses were thefts. It is argued in Appendix 2 (p.510 ff) that certain broad weight standards were in use in the Roman period, but that in the Mendips at least there was a tendency through time for pigs to get heavier. Although this might be due to increases in the size or efficiency of furnaces it also seems possible that it was a measure to stop pilfering. It might indeed be a factor in the apparent dearth of post-Hadrianic, and in the Mendips post-Aurelian, pigs. Indeed, the lack of Hadrianic finds from the Mendips and Derbyshire compared to the numbers of earlier pigs, and to the number from Shropshire as we have already noted, is in itself interesting. One wonders whether the tightening of imperial control over the mining areas in or by Hadrianic times (above p.244 ff) may not have extended to the safety of pigs being transported, especially if Frere (1987, 278) is right to link it with a military need for lead.

Whatever the exact circumstances surrounding the deposition of British lead pigs it is clear that the greatest

losses occurred in the Vespasianic period, or at least before the accession of Hadrian. Most multiple finds are from this period as well and in Derbyshire there is some evidence that the loss or theft of pigs at this time may have been common. Pig Nos.29 and 30, though both found at different places come from the same mould as Nos.31-3 which were found in a hoard. Similarly No.35 from the same hoard but a different mould may have been cast in the same mould as the separately found No.36. Unless there were relatively few moulds in use this tends to suggest that loss at the time was occurring repeatedly, presumably due to theft. Yet, we are unable to say what percentage of production the known lead pigs represent, or whether the greater number of finds in Vespasianic times represents a peak in extraction. Circumstantial evidence such as the distribution of late Roman lead coffins and ossuria around the richer major towns and the south and east of Britain (Toller 1977, maps 1 and 6) suggest the continuing value of lead in the Roman world. But the level of British production at any period remains unknown.

vii) The Distribution of Pig Finds and the Implications for Transport

We have touched above on the question of the transport of lead pigs within Britain. The distribution of the known finds (Fig.13) is quite informative regarding the methods

and routes in use. Further it allows something to be said of the economics of lead supply within Britain. It will be best to look at the distribution of the pigs from each production area in turn.

a) The Mendips

The vast majority of Mendip pigs have been found at or near the probable main production and or processing sites of Charterhouse, Priddy and Green Ore. Pig No.1, which may not be a true pig, may have come from there or from a little further away (Appendix 1, note 2), as did pig No.20. Two or three pigs suggest usage of the lead in the relatively local area, No.14 from Cirencester (Corinium) and Nos.15 and 15A from Bath (Aquae Sulis). This leaves six pigs. Nos.4, 9 and 10 probably indicate an important transport route east from the Mendips through Old Sarum (Sorviodunum) to the port of Bitterne (Clausentium) on the Itchen estuary (which flows into Southampton water). Whether the whole route was by road through Winchester (Venta), or partly by water, using the R. Test or the R. Itchen is unknown.

Pig No.3 indicates that at least part of the Mendip production was exported, probably from Bitterne, for it comes from the old harbour of St. Valery sur Somme in France. The Bristol pigs (Nos.16 and 17) might indicate another

export route to the west. But this would make sense only if they were destined for Wales (which had its own lead deposits in the north, central and southern parts) or for N.W. England. Perhaps more likely is that they were being shipped down the R. Frome (presumably having come by road at least as far as the R. Chew) either to a villa in the area or to a town such as Sea Mills (Abona).

b) Derbyshire

Again the majority of the pigs come from the production areas (Wirksworth, Matlock, Carsington etc., and Bradwell and Castleton). Three pigs lie just outside the production areas near to Roman roads. Nos.27 and 28 are from Yeavely between Derby (Derwentio) and Rocester and seem likely to have been destined for the latter site or another site to its west or south west. Perhaps the ?quasi-military site of Holditch where there is some lead working evidence (Charlton 1961). Pig No.29 from Hexgrave Park between Chesterfield and Derby was probably more likely destined north than south since the production centres lay to its west but were probably mainly accessed from further south.

Nine Derbyshire pigs are known from the vicinity of the major port at Brough-on-Humber (Petuaria) and other parts of the Humber estuary (Nos.30-36 and 42-3). Although

one (No.30) is probably part used and 'at destination' (above p.253) this group seems to imply a principal destination for Derbyshire lead and probably its subsequent export or sea borne distribution. At least part of the route to Petuaria was probably by river, as recognised by Dool and Hughes (1976). If not a detour via Lincoln would seem to have been necessary. The most likely route is probably south by road from the lead fields to Derby and thence to the possible trans-shipment point at Sawley on the R. Trent (above p.72), along that river and then onto the R. Humber.

However, other, exclusively road transport, routes are implied by the presence of pig No.44 at Churchover (Tripontium). It had presumably arrived via Derby and Leicester (Ratae). This leaves four pigs (Nos.38-41) from the initially unexpected site of Pulborough in Sussex. They seem likely to have arrived at their destination, or be destined for nearby Chichester (Noviomagnus), via the sea from Petuaria. Either to London (Londinium) and thence by road or directly to the south coast and up the R. Arun. Although in either case much of their journey would have been by sea, and therefore far cheaper than if it had been by land (Chapter 5, p.76ff), this seems to be a most curious place to find Derbyshire pigs. The Mendips are less than a hundred miles away and the probable Mendip lead port of

Bitterne only just over forty miles away even by road.

Clearly this phenomenon requires some explanation. It is possible that this explanation is not one of economics. Whoever the lead was destined for might have connections with the Derbyshire industry, even be an investor in it. If the Pulborough pigs were the only evidence for lead from other than the Mendips in the area this would be sufficient. However, it is not for analyses of lead objects from the general area indicate the presence of non-Mendip lead elsewhere (see further Appendix 3 for the details and where the question of the economic geography of British lead supply is dealt with in more detail).

Four possible economic explanations present themselves. Firstly, that Derbyshire lead was much cheaper to extract than that of the Mendips. This seems unlikely for both areas are likely to have worked surface deposits in similar ways. Secondly, that Mendip lead was reserved exclusively for export. Yet we have already seen that it was being sent to Bath and Cirencester. Thirdly, that the Derbyshire lead had arrived either as part of a more expensive cargo, or as ballast in an empty vessel, from northern England and had thereby been transported far cheaper than if it had come on its own. This must be a possibility, and could have happened repeatedly. Yet it is difficult to cite a high value cargo that would be carried from Northern England even to London, though the ballast idea is more attractive. The fourth

possible explanation is perhaps the most interesting, that Mendip lead having been desilvered became excessively expensive. It is argued below (p.261ff) that Mendip lead was usually desilvered but Derbyshire lead was not, and the desilverisation process may have tripled extraction costs. Especially if the emperor claimed the silver produced, and given that Mendip silver yields were not probably very high, this may have made Mendip lead so expensive that unde-silvered lead from Derbyshire could compete in price with it 'on its doorstep'.

c) Yorkshire

All four Yorkshire pigs come from the probable production areas some perhaps on road lines (Raistrick 1934, 217). It seems likely that the two large centres nearby, York (Eburacum) and Aldborough (Isurium), provided a market for Yorkshire lead. It may have been exported through Petuaria if production was ever high enough to justify this. But there is no evidence on either point.

d) Flintshire

In Flintshire only pig No.54 comes from the production area itself, but pigs 57, 58 and 63 indicate that nearby Chester (Deva) must have been a major market for the lead. Indeed, there can be little doubt that the inscribed 'Agricola' water pipes from there (Nos.ADD 1, 13-15) are of Flintshire lead. Lead transport from Flintshire to Chester

was probably along the river Dee. The largest find of Roman lead pigs in Britain (Nos.61 and 62), though badly recorded, comes from the Cheshire coast near Halton Castle or Runcorn. Exactly what this indicates about the transport of Flintshire lead cannot be certain but it must be suspected that they were being moved north by sea.

Two Flintshire pigs (Nos.59 and 60) from Hints Common between Wall (Letocetum) and Mancetter (Manduessedum) indicate road transport to more distant parts of the country than Chester. Their presence only twenty-five miles from Churchover (Derbyshire pig No.44 above) suggests that Flintshire and Derbyshire lead moved by road may have been able to compete in price in the central Midlands (see further Appendix 3, p.517ff).

e) Shropshire

The four known Shropshire pigs all lie in or near the production area. It may perhaps be suspected that little production passed out of the area and that Wroxeter (Viroconium) provided its main market.

viii The Desilverisation of British Lead

It is argued in Appendix 2 (p.496f) that the phrase Ex Argentariis cast onto some British lead pigs, although its original suitability may have been the result of silver extraction, cannot be taken as proof that a particular pig has

6
been desilvered. However, we are principally reliant on lead pigs in assessing the extent of desilverisation in the British lead fields. As noted above (p.223), though usually regarded as low in silver, there cannot be absolute certainty about the argentiferousness of the deposits worked by the Romans. There is some evidence for cupellation, the only method certainly known to the Romans of removing silver from lead and copper (for details of the process see Tylecote 1986, 54ff), in Roman Britain. At Silchester it was probably used to remove silver from copper coinage and there is some evidence for its use at Wroxeter (Tylecote 1986, 60) and at Green Ore, one of the probable lead processing sites in the Mendips (Ashworth 1970).

There can be little doubt that any desilverisation was carried out before lead pigs were cast and therefore they should provide a guide to the extent of cupellation. Those low in silver having been desilvered, those higher in silver not having been. However, a number of factors complicate this situation. Firstly and most importantly we need to define what we mean by low and high silver contents. Our evidence on this point is partly circular, being largely derived from the analyses of the pigs themselves but appears to form a coherent picture agreeing with what external evidence, in the form of analyses of the raw ore, we have.

The strongest evidence comes from the Mendips where we

have three pigs whose much higher silver contents than for the rest of the area's pigs are anomalous (Fig.14). Analyses of Mendip ore indicate that these three pigs (Nos.2, 3 and 6) may be cast from undesilvered lead, but that the silver contents of the rest of the pigs are unacceptably low for this to be the case. Even the lowest silver content for the galena (as opposed to 'stalagmite' ore) recovered from Green Ore is 0.003% (Ashworth 1970, Appendix 2), while Davies' (1935, 148 note 7) far too conservative estimate for silver contents from the area is 0.01%. It therefore seems highly likely that all the analysed Mendip pigs except for Nos.2, 3 and 6 have been desilvered. This is supported by the homogeneity of their silver contents. The correlation with the similarly homogeneous group of Flintshire pigs (Fig.14) reinforces the argument that they represent the lower silver values to be expected from Roman cupellation. This lower value seems to be 0-0.005%, or perhaps a little less, the efficiency of the process probably varying within these limits. For our purposes a silver content much above this range will be high, that is it will indicate that the lead has not been desilvered.

A second problem is in knowing what these relatively high silver contents actually mean. Although they indicate that the lead has not been cupelled is this because the ore was thought to contain too little silver to be worth de-

silvering? Tylecote (1986, 61) followed Gowland (1901, 359) in suggesting that cupellation was only thought worthwhile where there was 0.06% or more silver in the ore. This is certainly a reasonable figure, and may receive a little confirmation from the fact that pig No.6, whose silver content lies just below this figure, has not been desilvered. Though there are also arguments in favour of its non-cupellation being an accident. The silver levels of pigs 2 and 3 are also lower than 0.06% but their non-desilverisation may reflect organisational factors rather than their being below the cupellation threshold (see further below).

The third problem is that the silver content of some ores was so low that there is a danger that naturally low contents could be misinterpreted as the result of cupellation. This problem mainly affects Derbyshire where silver contents are low but variable and we shall see below that it precludes absolute certainty about desilverisation policy in the area.

Bearing in mind the points discussed above a number of conclusions may be drawn from Fig.14. Firstly, as already alluded to, it is clear that Mendip pigs 2 and 3, the earliest analysed pigs and the only legionary marked ones, have not been desilvered. Whilst we have noted that it is difficult to be certain exactly what level of silver content was regarded as economic to remove, both pigs lie below the probable figure for this, 0.06%. It is possible therefore

that cupellation occurred under legionary control, or at least would have if sufficiently rich ore had been encountered. But it is also possible that it was only with the advent of non-legionary extraction that desilverisation became standard. This may be supported by the introduction at the time of the phrase *Ex Argentariis* (Appendix 2, p.497).

It is clear that after legionary control had ceased desilverisation was regularly practised in the Mendips up until at least 139-61, the date of the latest pig for which we have an analysis. The homogeneity of the silver contents for all but one of the analysed pigs leave little doubt about this. The exception, pig No.6, is curious in that it was found with three other pigs (Nos.5, 7 and 8) which had all been desilvered. All bore virtually identical inscriptions to No.6, and they come from Green Ore, where we have already noted that there is evidence for cupellation. It is difficult to say whether this pig represents an accident where the lead was cast before being desilvered or whether its silver content was felt to be too low to make cupellation worthwhile. However, the fact that it is unique amongst the post-legionary Mendip pigs may support the former.

In Flintshire, as Whittick and Smythe (1935) noted, all the analysed pigs seem to have been desilvered, for their silver contents are all much the same as for the desilvered Mendip ones. The desilvered Flintshire pigs include No.56,

the private and ?early pig. It may suggest that C. Nipius Ascanius, who had earlier worked in the Mendips and whose name appears on the first desilvered pig there (No.4), had brought not just mining and smelting skills but also those of cupellation to Flintshire. Although our sample of Flintshire pigs is not as great as for the Mendips the fact that they, and the 'Agricola' water pipe (No. ADD 1, 13), have all been desilvered must suggest that cupellation was regularly practiced in the area.

For Shropshire it seems unlikely that desilverisation was practiced but rather than the analyses we have reflect uneconomic silver contents between 0.005% and 0.01%. The single analysed Yorkshire pig seems unlikely to have been desilvered. Although any certainty is impossible with a sample of only one pig, it must be unlikely that cupellation was a feature of Yorkshire production.

As has already been mentioned Derbyshire presents our greatest problem where desilverisation is concerned. Some of its pigs (e.g. No.31) have clearly not been cupelled, and the majority seem likely to have naturally low silver contents. However, four (Nos.38, 47, 48 and 52) have silver contents that do fall into the desilverisation efficiency range (Fig.14). It is possible that they may represent sporadic desilverisation of ores richer in silver than the norm. Thus, the ore body at the Ball Eye mine, Bonsall

provided uniquely high-silver lead in more recent times (Ford and Rieuwerts 1983, 15). Yet the very variability of Derbyshire ores provides an alternative explanation for the presence of these four pigs in the cupellation efficiency range. It is possible therefore that no Derbyshire lead was ever desilvered, and certainly regular desilverion appears to be unlikely. However the possibility that some cupellation occurred cannot be entirely dismissed.

The yields of silver in the two areas certainly desilvering their lead, the Mendips and Flintshire, are difficult to calculate. The highest silver content for ore certainly extracted in Roman times is that of pig No.6, 0.05%. Yet, we have already seen that this may have been relatively poor in silver. If No.6 had been cupelled it would have yielded between 0.05 and 0.045% silver. In the case of this pig's weight (85 kg) this would mean 0.0425-0.03825 kg of silver, and by extrapolation a yield of 508-457.2 gramme per ton (17.92-16.13 oz per ton). This is not even a figure for the yield per mined ton since a good deal of the weight of mined ore consists of rock and other impurities. Tylecote(1986, 61) has calculated that cupellation would triple the cost of extracting lead. That is for desilverisation to be economic silver to twice the value of the lead produced would have to be extracted. However, it is clear that the cost continued to be thought worthwhile and the potential significance of silver pro-

duction, at least in the Mendips, should not be ignored. If silver contents even of the order of that of pig No.6 were regularly met with they certainly seem to be within the range felt to be worth mining in other parts of the empire. Ores containing up to 0.028% silver, which today would be considered high grade, are known to have been neglected at Minas de Mouros (Davies 1935, 5). However, Frere (1987, 278) feels that British silver contents could not compete with continental sources.

Some further implications of the identification of desilvered and untreated lead, in combination with the known distribution of lead pigs, for the economic geography of lead supply in Roman Britain are discussed in Appendix 3.

ix) Technology and Labour Supply in Romano-British Lead Mining

We have very little evidence from Britain for the techniques used in lead and silver extraction and processing, and none at all for the source or nature of the workforce. Although a few possible Roman mines are noted below (p.280ff) only one can be attributed to the period with any confidence. Such underground workings are anyway likely to be exceptional. For the presumption from Pliny (Nat.Hist., xxxiv, 164) and from the nature of British lead deposits, which have significant ground level outcrops (e.g. Ford and Reiuwerts 1983, 9ff), must be that most workings were by shallow trench or

pit if not open cast. Such workings are unlikely to be datable even if not obliterated by later activity. No properly authenticated mining tools from Britain have been published.⁸

One good candidate for a lead smelting or roasting hearth of the Roman period in Britain has been excavated and published (Parker and Willies 1979, No.70; Brassington and Webster 1988; the hearth was lifted and is in the Mining Museum at Matlock). This hearth comes from Lumb Brook near Duffield in Derbyshire, somewhat south of the main mining area as suggested by the distribution of lead pigs. It consisted of a slab floored rectangular trench formed of Gritstone blocks only 26 cm wide and 20 cm deep and was constructed above disused Derbyshire ware pottery kilns. Whilst the presence of lead slag indicates that it was used in some part of the lead production process it is possible that it was as much a roasting as a smelting hearth. In either case it was clearly far too small to smelt a pig sized charge. The exact date of the hearth is difficult to ascertain but it is most likely to be of the third or fourth centuries.

Another excavated feature in Britain that may relate to lead processing is the possible roasting trench at Green Ore in the Mendips (Ashworth 1970). The use of such roasting trenches is noted by Pliny (Nat.Hist. xxxiv, 121; cf Healy 1986, 125). A second small hearth that may have been involved

in the processing of lead in the second/third centuries, perhaps from very localised deposits, is known from Scarcliffe on the Magnesian Limestone ridge east of the main Derbyshire lead field (Lane 1973). But little can be said of this from the published account. Further lead working ovens from Carsington await publication (below p.286) and a number of small ?smelting furnaces are known from Pentre Ffwrndan in Flintshire (O'Leary 1989, 3ff). It is perhaps likely that the types of furnace in use in Britain varied from area to area. Taller types of furnace tend to introduce impurities into the lead and are more suited to situations where silver production is the priority (Davies 1935, 95; Willies in lecture). However there is no detailed evidence at present for furnace types except from Derbyshire. It is also possible that lead production in Derbyshire used 'bole hill' furnaces placed on scarp slopes to the east of the mining area to catch prevailing winds. But no example has yet been assigned to a pre-Medieval date (on their development see Mott 1967; Willies 1972; Kiernan 1989, 40ff and Map 7).

Despite this lack of evidence for metallurgical processes (on the chemistry and practicalities of which see Tylecote 1986, 54ff) and for the technology of mining the general outlines of the industry's operation can be inferred. There is a substantial body of parallel evidence, both

literary (particularly Pliny Nat.Hist; see Healy 1986)⁹, and archaeological (e.g. Rothenberg and Blanco-Freijsiro 1981; Jones, G.D.B. 1980; Rickard 1928) from Spain and elsewhere in the empire that relates to the mining and processing of ore. Its direct relevance is limited by the fact that it refers principally to highly organised deep mining and may rely largely on local pre-Roman mining practice (Davies 1935, 10ff). Indeed detailed discussion of it is considered to be beyond the scope of the present work (for a detailed survey see Davies 1935, 16ff; and for a more recent summary Woods 1987). However, this evidence indicates the range of techniques known in the Roman world.

The actual extraction of the ore, as we have noted probably by pitting, trenching or open cast quarrying, is likely to have used one or more of three techniques. Firstly, fire setting where the rock is heated by a fire then drenched in water to make it expand and contract suddenly, thus splitting. Secondly, wedge splitting where wooden wedges are hammered into cracks in the rock then soaked to ~~make~~ make them expand thus cracking the rock, and thirdly simple hammer and chisel or pickaxe work. Once extracted the ore is likely to have been sorted by hand to remove gangue (waste minerals) and rock not containing ore, and crushed. The crushing may well have been largely done by hand with iron or even stone pounders but could have been

more mechanised. It is conceivable that some evidence from Linley Hall (below p.283) may relate to such, water powered, equipment. In addition hushing, sorting by a flow of water across an inclined surface, may have also been used to concentrate the ore further (on hushing see particularly Lewis & Jones' (1970) commentary on Pliny's gold mining section).

This dressed ore is then likely to have been roasted, for which we have seen there may be a little direct evidence, and then smelted. Where appropriate cupellation, which we have discussed above, would then follow and the resultant metallic lead would be cast into pigs. A number of more or less certain mining centres can be identified in Britain (below p.280ff), and they seem to be a commonplace in other provinces (e.g. Blazques 1984). However, it is not certain whether the ore was processed at one or more central locations in each area or at a number of more dispersed ?mine head sites. The possible inference from the inscriptions of Vespasianic Mendip pigs that processing was carried out at one or more imperially sanctioned sites (above p.243) is not necessarily applicable to other areas. Particularly Derbyshire where the lead deposits are dispersed. Indeed, the presence of the hearth near Duffield away from the probable foci of extraction suggests that processing was dispersed. As Ling and Courtney (1981, 75) point out this

is also more likely on grounds of safety, convenience, fuel supply and more modern parallels.

One important point connected to smelting that must have affected both the economics and location of the lead processing is the supply of fuel. Coal, coke or charcoal would be suitable fuels for smelting (e.g. Willies 1972, 3) but the latter must be seen as the most likely fuel in Romano-British operations. There is no good evidence for more than localised coal mining in the production areas though it could have come from areas further north (Hartley & Fitts 1988, 89f). The quantities of wood required are likely to have been very large as Allen (1970, 10f) has emphasised for the parallel case of Spanish copper and silver production. Where large supplies of wood were not available locally the cost of its transport must have been significant. Where wood was available it was perhaps a more important locational factor for smelting sites than the origin of the ore itself. Thus, in Derbyshire it may be suspected that much of the smelting occurred in wooded areas east of the orefield itself (cf. Makepeace 1985, 107), and as at Duffield perhaps mainly in wooded valleys. Medieval parallels (Willies 1972, 6) may suggest that this would tend to disperse processing, with each smelter having an area of woodland attached to it. Yet fuel supply was not the only important locational factor as the failure of a Medieval enterprise,

coincidentally also at Duffield, illustrates (Willies 1972, 5). The distance that the ore had to be brought to a smelter was also important.

The only point of technique that we have good evidence for is the casting of lead pigs. The pigs were almost certainly cast in clay moulds (though none are extant) with their inscriptions in reverse probably impressed into them with wooden formers. The moulds were filled with a continuous stream of lead (Whittick 1961). It is now accepted that the 'striations' or longitudinal 'cracks' present on many pigs do not indicate the filling of the moulds by separate ladles of molten metal (Tylecote 1986, 57)¹⁰. This is indicated by the fact that the 'striations' do not interrupt the crystal structure of the metal. They are probably caused by surface tension effects during cooling. The lifetime of the moulds is not known but the greatest number of pigs from one mould that we have is five (Nos. 29-33). It is clear that some moulds were damaged by the pouring of the molten lead for many carry a raised 'blob', often obscuring part of their main cast inscription, caused by the erosion of a 'pit' in the base of the mould (e.g. Nos. 16 and 17; Appendix 1, notes 81 and 83). The quality of the moulds varies greatly from the regularity and well-formed lettering of pig No. 56 (Appendix 1, note 173) to the poor conjoined lettering of Nos. 47 and 48 and the very rough

uninscribed pigs such as Nos. 54 and 55.

The labour force used in the Romano-British lead fields is unknown. It is possible that some of the ?lessees whose names we know from lead pigs actually worked in the industry, as well as being the owners or managers of enterprises. But even if they did they can only have formed a tiny percentage of the workforce. The possibility that some of the labour in Derbyshire was provided by farmers in their spare time is discussed in Chapter 9 (p.335ff). The size of the labour force is equally unknown, though the parallel evidence (below p.334) suggests that it may have been large by the standards of ancient 'industry', especially if support industries are included. Miller's (1984) thorough examination of the evidence for condemnation to hard labour in the Roman empire (Metallum, opus metalli and ministerium metallicorum) tends to minimise the role of convicts as workers in other than imperial operations, particularly stone quarries and the like. Whilst it seems that such sentences were far from unusual there is no evidence for the use of convict labour on a large scale in metalliferous mines; though the evidence either way is very sparse.

The lack of a military presence at most periods in the lead fields (below) probably provides a further argument against the use of convicts, but perhaps not for slaves. The importance of slaves to the Roman empire is a vexed

question but it is entirely possible that the British lead fields were partly worked by them. They were certainly present in Spanish mining communities (below p.296ff). Equally a free contract workforce is entirely possible and probably likely to some extent. Again free workers are attested in Spain.

x) The Archaeological Evidence and the Role of the Military

The archaeological evidence for the lead and silver extraction industry in Roman Britain is extremely limited and adds very little to the evidence provided by the lead pigs. However, in respect of the role of the military it is an important element. The latter will be discussed first, followed by brief summaries of the other archaeological evidence for each area.

a) The Military

The pig evidence suggests that there was no significant role for the military in the lead industry itself except in the Mendips up to 60 (above p.238ff). However, archaeological evidence suggests that the situation is more complex than this. The role of Legio II in the initial mining in the Mendips cannot be doubted from the pig evidence and is reinforced by the presence of a Claudio-Neronian fort at Charterhouse-on-Mendip (Br. 11 (1971), 278; Jones, M.J. 1975, 141). There is no evidence however for a continuation of

this role after c.60.

It is possible that the same legion had some connection with lead mining in south Wales (below) at a slightly later date. But the evidence is restricted to stamped tiles from Risca, near to the possible mine, a site which went out of use at the end of the second century (Boon 1965) and two pigs probably of resmelted scrap lead (see further below p.282). Similarly inconclusive is the presence of a tile of Legio XX at Ffrith in the Flintshire production area (Davies 1984, 101). O'Leary (1989, 48ff) has emphasised that the use of such tiles in the Pentre complex (below p.282) need not imply either a military, as opposed to official, involvement or the presence of a fort. In Shropshire we have already noted that a pig supposed to record Legio XX must now be regarded as spurious (above p.238). There is some evidence for, perhaps small scale, military exploitation of lead west of the main production area from limited work at Pentrehyling fort (Br. 13 (1982), 358). Similarly Davies (1984, 100) has suggested that local lead deposits near Trawscoed fort in west Wales may have been used for the manufacture of artifacts in the second century. But activity here can only be regarded as on a small scale.

For Derbyshire there is no evidence for a military involvement. It has been suggested that lead was smelted in the fort at Brough-on-Noe, near to the possible extraction

area of Bradwell/Castleton, (Smythe 1938). However the evidence for this is limited. The presence of stream washed ore is not proof. It is likely to have been easily available in the rivers at the site and might be picked out as curios. Moreover the quantity found could in no way be said to indicate industrial use. That two of Smythe's samples showed heating to the point of chemical activation is more interesting but could have occurred purely by accident. With no evidence of slags or furnaces (neither are present in published or unpublished excavations of the fort) this suggestion must be rejected.

Birley's (1978) suggestion that the lead tag recording Cohors I Aquitanorum, the only unit so far recorded from Brough, indicates the shipping of consignments from the area by the military cannot be substantiated. The unit was stationed at a number of other sites and the tag undated (Birley 1978). Indeed, it could equally well have sealed a consignment of military papers and anyway stamping directly onto ingots of metal would seem to be more likely than attaching tags to them. The only lead tag at all likely to be connected to mines is that of Cohors II Nerviorum (below). Although a fort has been suggested at Carsington (Makepeace 1985, 70ff) in the centre of the main Derbyshire extraction area (on the site see below) there is no evidence for such an installation. The tile and brick finds cited by Hart

(1981, 87) have been shown to relate to a civil building (Ling and Courtney 1981).

Thus, since the nearest forts to the main extraction area are Derby, Brough (and Buxton if a fort ever existed there) there seems little likelihood of direct military involvement in Derbyshire mining. This is not to say that the military were not present in the mining area at all. It is perhaps likely that they acted as a police force in all production areas as Edmondson (1987, 70) has emphasised for other parts of the empire. In the case of Derbyshire small detachments were perhaps sent out regularly from Derby and Brough; the latter at least may have had a mounted or part mounted garrison (Jones, Thompson and Wild 1966, 100; Jones 1968, 157; Jones and Wild 1969, 100f; Dearne 1986, 93ff).

Perhaps the strongest evidence for a military role in lead extraction comes from Yorkshire. Eighteen lead sealings from Brough-under-Stainmore (Richmond 1936) record Cohors II Nerviorum and one bears on the reverse META (llum). The unit was stationed at Whitley Castle near the lead deposits at Alston, N. Yorks. at least in the third century; though their whereabouts at other periods is unknown and the sealings are undated. Richmond therefore suggested that they were operating mines there. This evidence is not indisputable for only one sealing bears META (llum), assuming that the

reading is accepted, and referred to Lead not copper mining (Hartley & Fitts 1988, 89). Yet others carry a palm branch which could be linked with similar symbols on lead pigs (Appendix 2, p.506). There does seem to be some supporting archaeological evidence in the form of smelting debris from both Whitley Castle fort and from Corbridge. At the latter the high silver ore being smelted contained torbernite (a mineral wax associated with the Alston deposits) (Davies 1935, 10f).

However, it is too often assumed without supporting evidence that the military played a large part in mining. Such unfounded assumptions are typified by R.F.J. Jones (1986, 230f) who speculates on the presence of an unlocated fort at Ripley solely on the basis that there was lead mining in the area and makes an unacceptable correlation between an imperially inscribed pig at Hurst (No.67) and a military presence. On present evidence a military involvement appears to be limited to the beginnings of the Mendip industry, to exploiting minor deposits in the immediate vicinity of forts and perhaps to the Alston deposits.

b) The Mendips

No specific mines in the Mendips can be given a Roman date. However, there can be little doubt that a number of the workings around Charterhouse-on-Mendip, the largest settlement in the area and almost certainly the centre of the

industry (Davies 1935, 149; V.C.H. Somerset, 334), have Roman origins. Indeed, some small scale extraction in pre-Roman times in the Mendips seems likely (e.g. Davies 1935, 149f; Bromehead 1947, 354) and lead may have been cupelled to extract its silver and the latter traded from Hengistbury Head (Cunliffe 1987).

Other Roman extraction and processing centres may have existed at Priddy (Davies 1935, 148i Br. 1972, 344), Green Ore and Blagdon (Palmer and Ashworth 1956/7; Ashworth and Palmer 1958; Ashworth 1970; Gough 1967, 24ff; Br. 1972, 343). At Charterhouse the presence of a fort has already been mentioned and a civil settlement, perhaps including an amphitheatre, has been recognised (V.C.H. Somerset, 334). However, the site has been seriously damaged by later mining and re-smelting of ancient slags. It is known principally from casual finds and uncontrolled antiquarian investigations (Gough 1967, 21ff; V.C.H. Somerset, 334; Scarth 1875). Limited and not certainly reliable coin evidence suggests that the site may have declined c.170-280 but revived for a time in the early fourth century (Gough 1967, 31). Limited excavation at Green Ore (Palmer and Ashworth 1956/7; Ashworth 1970) indicates that it included ore processing and cupellation functions and the site might repay further investigation.

c) South Wales

Limited excavation at South Machen in south Wales tends

to suggest that the Roman settlement there, which dates to 75 or conceivably earlier, was involved in lead processing (Nash-Williams 1939). Though the site may have gone out of use by the end of the second century (Boon 1965). The nearby lead mine of Cefn Pwll-du near Dr^eathen has been reported as having first century pottery incorporated in its stalagmite formations (Boon 1965) and Roman coins are supposed to have been found in the mine before 1909 (Arch.Camb. 1936, 379). However, these may relate to the later counterfeiting activity here in the third century (Boon 1972). Nevertheless Cefn Pwll-du, which seems to have been worked in the first and second centuries, is the only relatively certain Roman lead mine in Britain (Tuck and Tuck 1971). Whether the two pigs probably of re-smelted scrap lead marked by Legio II and found at Caerleon and Caerwent (Nos.ADD 1, 9 and 10; Appendix 1 note 256) are at all significant in terms of an indigenous south Wales extraction industry is uncertain.

d) Flintshire

Flintshire has long been accepted as an extraction area and some possible elements of the industry are now known archaeologically. No mine can certainly be identified as Roman, though Davies (1935, 158) notes possible evidence from Halkyn Mountain. Some possible Deeside processing sites have now been identified including Basingwork and Greenfield (Davies 1984, 101) and the important site of Pentre (O'Leary 1989). The latter appears to indicate a settlement with

lead ?smelting hearths, and a large official building of some refinement dating c.120 to the mid-third century. It must be strongly suspected that this was the administrative headquarters of the Flintshire industry (?the procurator's residence) in the Hadrianic and later periods.

e) Shropshire

Again there is no incontrovertable proof for assigning a Roman date to any mine in Shropshire (Webster 1975a, 99f), though antiquarian records indicate some likely *candidates* (Wright 1888, 276ff; Brook and Allbutt 1973, 23, 32 and 65). These possible mines at Shelve, Snailbeach, Stiperstones and Minsterly are near to the findspots of the only known Shropshire pigs (Nos.68-71) and are in the vicinity of Linley Hall. This site, only partially investigated, seems to cover some twelve acres (4.9 hectares) and, in the small area investigated, includes possible water-driven industrial structures (Webster 1975, 100ff). The site seems rather large to be a villa, even if a number of separate phases are involved (Webster 1975, 100ff), and it must be a strong possibility that it represents an administrative and processing site for Shropshire lead. It and Pentre (above) are probably the most important sites in Britain for the future study of the lead extraction industry because of the poor preservation of other centres.

f) Derbyshire

Small-scale working of Derbyshire lead may have occurred in the Iron Age (cf. the smelted lead apparently from an Iron Age level in Harborough Cave (Armstrong 1923, 413)). But, as Davies (1935, 161) notes, there is no proof that any surviving mining level in Derbyshire is of pre-Roman or Roman date. It seems likely that the vast majority of Roman workings, probably mainly surface workings, have been obliterated by the extensive later industry. Kirkham (1968, 94-7) has discussed some of the more likely candidates for a Roman attribution, mainly on the basis of the shape and tooling of the levels. They include Mason Mine, Matlock and Rainster Rocks. She also notes the three or four coin finds that might indicate Roman workings (Deep Rake, Longstone Edge; Elton Moor (two separate finds); Crich; and at some point between Winster and Bakewell). However, it is entirely possible that these coin finds are re-depositions since none were scientifically excavated. Nor can coin finds automatically be linked to mining. We have seen above (p.211k) that many others now appear to relate to previously unrecognised rural settlements.

It should also be noted that the shape and tooling of underground levels, even if they were used by Roman miners in Derbyshire, is not sufficient to allow dating. Although there seems to be a tendency for Roman levels to be square,

or at least rectangular, in cross section, the shape of levels frequently depends more on rock type and working methods than on date (Nriagu 1983, 78).

Bearing in mind the limited nature of the archaeological evidence it is difficult to be certain how large the area of lead deposits exploited in the Roman period was. Easily workable deposits extend over a large area of the White Peak (e.g. Ford and Rieuwerts 1983, 9ff). There are particular concentrations of veins in the Matlock/Wirksworth area, to the west of Bakewell, to the west of Eyam and Stoney Middleton and west of Bradwell. The first and last of these areas are represented by pig finds (Fig.1) but mining was probably more extensive. Major rake veins with their large surface outcrops being obvious features of the landscape which can hardly have escaped notice over the whole area. The presence of a particular concentration of pig finds in the area of Matlock and Wirksworth is probably as much a result of the far greater modern activity on the east moors in this area than further north. The likelihood that pigs were *cast* (as opposed necessarily to the ore extracted) in the east of the field because of the availability of fuel (above p.273) may also be significant.

The excavated lead hearth near Duffield has been described above (p.269). Further evidence likely to relate to the Derbyshire lead industry is restricted to two damaged sites, Carsington and Rainster Rocks, and perhaps to one or

more other rural sites. Brief details of the excavated remains at Carsington and Rainster Rocks have already been given (Chapter 6, p.98 f; Chapter 7, p.185 f, p.206). It is clear that Carsington represented a major settlement while Rainster Rocks is likely to have been one of the most important nucleated rural settlements within the study area. At Carsington there is evidence in the main settlement for lead working ovens (Branigan 1985, 41; Anderson and Branigan in preparation). In addition the site has produced the stratified fourth century pigs (Nos.54 and 55) and a numerically inscribed pig (No.49). At Rainster Rocks there is somewhat more limited evidence for lead working (Smithard 1910; Lane 1973, 44; Dool 1976, 20; Branigan 1985, 41) and the site has already been mentioned as a possible scene of Roman mining.

Whilst there may be some evidence at both sites for agricultural activity neither seems to be satisfactorily explained by this alone. Rainster Rocks, dating principally to the third and fourth centuries, is the less developed of the two and it is argued below (p.335 ff) that it fits into a pattern of agriculture, and ?markets, in tandem with lead extraction. Further work at this site would be desirable. Carsington appears to be far more important, being occupied from the mid-second century or earlier until the mid-or late-fourth century. It boasts numbers of stone buildings, a rarity in the study area (above p.162). The latter in

particular suggests that some economic stimulus not present at major sites in the rest of the study area was available. The only obvious candidate for this would seem to be the processing of lead and or administration of the lead mining area.

11

This brings us to Lutudarum. This name is recorded, perhaps somewhere between Derby and Chester, in the Ravenna Cosmography (106, 43-7; Rivet and Smith 1981, 403f) and clearly must lie in Cheshire or Derbyshire (Ling and Courtney 1981, 74). It is clearly connected to the Derbyshire lead industry as it appears on most Derbyshire pigs (Appendix 2 p.500f), in some cases as a society name. Whether the name refers to a settlement or to the general lead mining area cannot be deduced from Ravenna (Rivet and Smith 1981, 403f; Branigan 1985, 39). But the actual application of the name is somewhat academic since we should probably be looking for an administrative centre even if it refers to an area.

As all recent discussions of the question have pointed out Lutudarum, or its administrative centre, ought on present evidence to be Carsington (Ling and Courtney 1981, 74ff; Rivet and Smith 1981, 403f; Branigan 1985). The Roman names of all other major settlements within or very near to the mining area are established. No other site has the lead working and lead pig evidence, and the superior nature of the buildings, together with Carsington's role as a route

centre (Fig.1), and its relatively early start date make it undoubtedly the best candidate.¹² Only if a significant settlement were to be found further east in the Matlock/Wirksworth area would this be seriously challenged.

g) Yorkshire

There has been some debate as to whether any workings in Yorkshire can be given a Roman date. Possible sites include Grassington and Greenhow Hill where Roman sherds and slags are said to have been found (Davies 1935, 164). Rainstrick and Jennings (1965, 7) argue that the former represents redeposition of pottery from a nearby Romano-British settlement in workings started in 1743. Possible evidence of 'defended camps' at the latter site (Raistrick and Jennings 1965, 8) might be significant but requires more proof. Hurst Mine, Swaledale could also be of Roman date. A lead pig has been found in the vicinity (No.67) and Raistrick (1926/7, 81) and Rainstrick and Jennings (1965, 7) say that it was found with mining tools in breaking into ancient workings. Raistrick and Jennings (1965, 8ff) have also suggested that there are remains of Roman workings at 'The Castles' Hamsterley (near Walsingham in Weardale). However, there are also suggestions of Dark Age activity here, as there are in areas of the south Tyne Valley suggested to have been worked by Davies (1935, 10f).

The lead pig distribution for Yorkshire such as it is

indicates that at least some of the extraction occurred in the Swaledale, Wharfdale and Grassington areas. But it seems likely that the industry may have been more dispersed than in any other area with individual deposits worked in small operations as is indicated for the eighteenth century in areas such as Arkengarthdale (Tyson 1986). In view of this it is perhaps not surprising that there is no obvious candidate for a central processing or administrative centre. Rainstrick and Jennings (1965, Fig.1) map the principal areas that might have seen Roman mining. They fall into three broad categories, Greenhow Hill and Wharfdale; Swaledale and Wensleydale; and a large area from Teesdale as far north as Alston Moor. The pig evidence relates exclusively to the former two areas, but we have seen above that there is a little evidence for military operations in the third area (p.279). Except for the presence of galena at Slack (Davies 1935, 164; Barber 1869/70), which evidence is no more conclusive than that for smelting at Brough (above p.277f), there is no indication that lead extraction was important in the north of the present study area.

h) Penpark Hole, Gloucestershire (Errata)

Investigations of the mine at Penpark Hole led to antiquarian speculations that it was a Roman mine (Nicholls 1879/80). However, there is no evidence to suggest this, though the mine is recorded as early as 833 (Davies 1935,

150). Nicholls' speculation that this was the source of the Bristol pigs (Nos.16 and 17) is questioned by Davies and cannot be entertained in view of the homogeneity of Mendip pig inscriptions.

xi) The Nature of the Comparative Evidence

A number of ancient, Medieval and early modern mining operations in Britain, Europe and South America offer comparative evidence which might be used to supplement the limited direct evidence from Roman Britain, and particularly from the south Pennines. As with all indirect evidence these cases can only be used for comparison. Further, they can only be used validly at all where the circumstances seem sufficiently similar to those likely to have surrounded the exploitation of lead in Derbyshire in the Romano-British period. A detailed discussion of the applicability of the evidence is reserved until the evidence itself has been stated. However it should be noted at this stage that some potential sources of evidence are regarded as too inapplicable to be considered at all.

Perhaps primary amongst these is the evidence from Laurion in Greece, which is both epigraphic (see particularly Hopper 1953; Hopper 1968) and archaeological (e.g. Ellis Jones 1984, 1988). Although of great importance for ancient mining in general this evidence relates to intensive silver

mining mainly in a pre-Roman city-state context rather than to dispersed lead mining under a developed imperial system. The natural resources of the Laurion area differ from those of Derbyshire and, importantly, Laurion represents a case of very long term mining development in a gradually evolving, indigenous social and economic system. Derbyshire mining represents the rapid development of a previously unexploited area by an initially alien social and economic system. Despite its long pre-Roman history of mining (e.g. Davies 1935, 94) Roman Spain provides far more applicable parallels from the ancient world. Even here there are problems of comparability and in many cases the mining is little better known than in Derbyshire. Thus, discussion is mainly restricted to the best documented case, that of Vipasca.

The best comparative Medieval evidence comes from Derbyshire itself and perhaps provides the most applicable case. However, the well-documented mining activity of the colonial powers in South America from the sixteenth and seventeenth centuries on provides perhaps the fullest account of an instance of rapid imperial development of previously unexploited ore deposits in a relatively isolated and inhospitable area. Although there are important points of difference between it and Derbyshire (e.g. in the nature of the deposits and the technology in use) there are also

important points of similarity which make it a useful comparative example.

a) Roman Mining at Vipasca, Portugal.¹³

Roman mining in the Vipasca area, principally for argentiferous copper, appears to have had its floruit in the first and second centuries with the principal activity ceasing in the mid-third century. However there is scattered evidence for a little activity in the fourth century (Edmondson 1987, 46ff). The area was centred on the town of Aljustrel, a settlement where wooden buildings were replaced by stone ones in a semi-gridded plan (Edmondson 1987, 46), but where low quality housing is also present. The nearby Valdoca cemetery suggests a wide range of wealth as indicated by grave goods (Edmondson 1987, 60 and 85). The mining, while total output would be large, appears to have comprised many small workings in an area that was perhaps an imperial estate (Edmondson 1987, 37 and 72).

The main importance of the area is in the fact that two incomplete bronze plaques were discovered in spoil heaps at Aljustrel in 1876 and 1906 (e.g. Allen 1970) which give the text of the only Roman mining administration documents so far known. For the text see most conveniently C.I.L. ii 5181; for translation see Van Nostrand (1937), 167ff; Lewis and Reinhold (1966), 188-94; Edmondson (1987), 244ff.

Unless otherwise stated the translation used here is Edmondson's which is based on Lewis and Reinhold's. The first text is that of the Lex Metallii Vipascensis, a local law code governing mining, and particularly the leasing of various concessions within the area. The second, the Lex Metallis Dicta, which appears to be in the form of a letter, gives a general law regarding the working of mines. The second law is dated by a reference to Hadrian (Lex Metallis Dicta)(henceforward Vipasca B , 2) but the first (henceforward Vipasca A) is undated (contra Checkland 1967, 48, who can have no basis for his arguments).

Vipasca A seems likely to have been enacted by the local Procurator Metallorum and should not perhaps technically have been called a Lex, though that it is may emphasise the power of the procurator (Van Nostrand 1937, 167ff). Vipasca B is addressed to Ulpianus, who may reasonably be assumed to have been such a procurator, though not necessarily the same one. It perhaps came from the provincial procurator who would be his immediate superior (or from the emperor).¹⁴ Briefly, Vipasca A deals with a number of concessions that the procurator rented out. They begin with a section indicating the existence of a 1% sales tax which was collected by a lessee (conductor) (Vipasca A, 1). Section two deals with a leased auctioneering concession and the auctioneer's fee of 1-2%. This section specifically

mentions both mules etc. (Vipasca A, 2.ix) and slaves (Vipasca A, 2.x). Section three concerns the leasing of a Baths management concession (the implication (e.g. Vipasca A, 3.v) being that the baths themselves were state property) and stipulates in detail how the baths are to be run. They are to be open every day, in the morning for women and in the afternoon and evening for men, at set charges (children, soldiers and the procurator's staff getting in free) and are to be kept in good order. An interesting feature is a prohibition on selling the wood used as fuel in the baths (Vipasca A, 3.ix).

Vipasca A, 4 deals with shoemakers (probably an important support industry in a mining community), where again there is a leased concession *but also* a stipulation that good service must be given. Much the same is true of sections five and six, dealing with barbering and fulling. Section seven concerns the leasing of a concession on re-working old slags and ?tailings, while section eight is a simple decree of immunity from taxation for teachers. Section nine is incomplete and difficult to interpret clearly but refers to the staking of claims, possibly to the claiming of mines not being worked. Its reference to 'the regulations issued for the mines' might be taken as evidence for regarding Vipasca B as contemporary with Vipasca A. Whether further clauses of Vipasca A existed or not is

unknown but there may be a hint in Vipasca, A, 3.ix that there was a wood monopoly as well and other trades as or more important to a mining community than some mentioned (e.g. the manufacture of mining tools) are not covered.

Vipasca B relates more directly to the working of mines. Its main provisions are clearly directed towards the working of copper and silver ores within a system of mines leased from the fisc. It begins with a fragmentary section (Vipasca B,1) on the smelting of copper ore. It appears to be concerned with ensuring that the price of the half share of the workings (rather than the ore; compare Vipasca B,2) belonging to the fisc is paid before smelting is commenced. Section two appears to be a parallel case for silver workings, and its comparative brevity perhaps hints that the regulations in clause 1 apply equally to silver workings. It clearly states that half of the mine was considered the property of the fisc, though it cannot be absolutely certain whether the other half was simply rented from the fisc or whether it could be privately owned. But it was handed over to the owner/lessee of the other half on payment of 4,000 sesterces. The emphasis certainly seems to be on the lessee being expected to buy out the state.

Sections 3 to 5 primarily set out regulations to ensure that the silver workings are kept in constant production.

In passing there is another reference to the half of the ore that belongs 'according to customary practice' to the fisc (Vipasca B, 5). But this time there is no reference to the lessee buying out the state. Sections 6 to 8 are concerned with the right to form partnerships to exploit silver workings. The space given to these regulations probably indicates that the cost of such mining operations was considerable. Again the matter of the fisc's half share is mentioned (Vipasca B, 8.1), this time clearly in the context of a partnership having bought out the fisc. Clauses 9 and 10, notably mentioning both slaves and free men, set heavy penalties for stealing ore or for not taking it to the smelters by the end of a day. It is notable here that the mines and smelters are clearly separate, but it is not stated whether the smelters are imperial or private. Similarly stiff penalties are stated in sections 11 to 13 for tampering with or neglecting the safety of mine shafts.

Again similar penalties are attached to clauses 14-17 which deal with the maintenance of a central drainage channel in copper mines. The incomplete clause 18 appears to be the beginning of a similar set of regulations concerning silver shafts. Again there may have been further clauses to Vipasca B, but if so they are lost.

The picture painted by these documents of the administration and economics of a mining community is the fullest that we have from the Roman world, though it leaves many

questions unanswered. The impression is of fairly small copper mines (note the 15 ft. (4.6 m) 'clear area' either side of the drainage ditch in Vipasca B, 14) and rather larger silver mines (a 60 ft. (18.3 m) 'clear area' and the implication that a number of lessees might work the same mine in Vipasca B, 18) worked by individuals and, perhaps commonly, partnerships. They leased half of the mine from the state (or conceivably bought it outright) and 'bought out' the other half share. Clearly, whether its half share had been bought out or was surrendered to them as ore, the state was at pains to ensure that the mines were worked effectively, continuously and safely by a workforce that seems to have included free and slave elements.

Broadly similar trends within mining support industries are indicated by Vipasca A, with monopolies being rented out to individuals or partnerships, who it may be noted seem likely often to have been represented by agents (e.g. Vipasca A, 6.ii). The impression gained from these regulations is that the procurator was endeavouring to ensure adequate levels of service to the miners, and indeed their families which Vipasca A, 3.i suggests were also present. Though the state and or the procurator probably made a good profit in the process.

Some of the elements represented in the Vipasca texts are supported by other Spanish evidence. Thus, an extension of the partnership idea and of the concern to provide the

benefits of a Roman lifestyle is the medical and funeral association at Rio Tinto (Davies 1935, 129; Blanco, A. Zephyrus 13 (1962), 44ff). Workmen's companies appear to have been encouraged, but not lessees' guilds (Davies 1935, 12) and this probably serves to illustrate the state's motives. Good working conditions would attract the best miners but lessees banding together might bring the possibility of the control over the supply and so price of metals being taken out of the state's hands. The constraints on prompt processing of the ore (Vipasca B, 9) and indeed the general tenor of Vipasca B suggest that the fisc was keen to carefully regulate mining. Indeed, the hand of the state is seen everywhere and Aljustrel must have been a closed economy to an extent. Evidence from Rio Tinto and other mining communities suggests that special 'mine coins' may have circulated (Davies 1935, 13; Nriagu 1983, 144; Edmondson 1987, 59) in such situations, valid only within the community.

b) Medieval Lead Mining in Derbyshire

Post-Roman activity in the Derbyshire lead field is difficult to identify before the ninth century, but probably continued at a reduced level (Ford and Rieuwerts 1983, 17). Subsequently late Saxon and Norman records including the Domesday survey indicate that the importance of lead mining again increased (e.g. Hart 1981, 116). It was widespread in the eleventh to thirteenth centuries (Ford and Rieuwerts

1983, 17f) though the importance of different areas of the lead field varied at different times (Blanchard 1971, 122ff). Eventually the Derbyshire lead field saw a heyday in the eighteenth century connected to technical developments and increased capitalisation (Ford and Rieuwerts 1983, 31). But it went into decline after 1850 and has now been replaced by Fluorspar working (Ford and Rieuwerts 1983, 45).

The nature of post-Roman lead mining is likely to have been similar to that in Roman times until the gradual introduction of new technology. Gunpowder was introduced c.1670, though its use was slow to spread. The increasing depths of underground workings necessitated developments in drainage and ventilation from the seventeenth century on (Ford and Rieuwerts 1983, 22ff). Developments in ore processing and smelting, such as the introduction of the sieve and of Humphray's bellows furnace, came earlier in the sixteenth century (Ford and Rieuwerts 1983, 30). Indeed, the first departure from the techniques likely to have been in use in Roman times probably came with the introduction of underground workings which were certainly in existence by 1470 and perhaps by 1242-7 (Ford and Rieuwerts 1983, 22). Thus, as far as technological aspects are concerned, the parallel evidence from Medieval Derbyshire for the Roman industry must be drawn principally from the thirteenth century and earlier. However, some techniques such as buddling are likely to have changed little subsequently

and buddling is little different to hushing (Ford & Rieuwerts 1983, 27ff), a technique well-known to the ancient world.

Technological information from this period, archaeological or literary, is sparse. Even where there is some evidence such as for the bole hill smelter (Willies 1972, 3f) research on the subject has been limited (e.g. Hart 1981, 136). More valuable is the literary evidence for the organisation of the industry which consists principally of the Laws and Customs of the lead mining area, codified first in 1288 (Rieuwerts 1988, 19). These laws and customs, peculiar to Derbyshire, appear to represent a system with Saxon origins (Rieuwerts 1988, 16) but were considerably expanded to take account of developments in the industry in and after the thirteenth century (Rieuwerts 1988, 21f). It is however only the laws as they relate to working before the introduction of such developments that are relevant here. For useful summaries of the laws see Ford and Rieuwerts (1983, 18ff); Rieuwerts (1988, 3ff) and bibliographies therein.

The lead field was divided into a number of administrative units, in turn composed of 'liberties' (essentially co-responsive to parishes). The mineral rights within these belonged in some cases to private individuals and in others to the crown, though the rights in the latter were often leased out to important landowners. The laws were administered by a Barmaster who held a Barmoot court every three weeks (the 'Small Barmoot court,' later including a jury and

assisted by a 'Great Barmoot court,' but originally just a meeting to settle disputes; cf. Rieuwerts 1988, 17). Anyone could search for ore without a landowner's permission, at least in the Kingsfield; slightly different rules applied in the privately held areas. A new vein once found was 'freed' by applying to the Barmaster to record the finder's name and paying a 'freeing dish' of ore to him as agent for the owner of the mineral rights (on the dish see further below).

Payment of the freeing dish entitled the finder to work two 'founder meers' of the vein, a length of the vein irrespective of depth or width that varied from area to area but was about 64 yds. (58.5 m). The third meer belonged to the owner of the mineral rights. The finder of the vein could buy this third meer from him (at a price set by the Barmaster based on its richness) or work through it, surrendering the ore to the owner of the mineral rights. The fourth and subsequent meers could be freed by the worker of the vein by paying a freeing dish of ore for each one in the same way as for the founder meers.

Having obeyed these rules the finder of the vein could continue to work it so long as the workings were not left idle. If they were left unworked for a period they could be 'nicked' or counter-claimed by another miner. Further royalties also had to be paid by the miner to the owner of

the mineral rights and these were known as 'Lot' and 'Cope.' Tithes were also payable to the church but would not have been present in the original system and are not relevant to the laws as comparative evidence. Lot was a fixed percentage of production, generally one thirteenth, payable in kind to the owner of the mineral rights. Cope, which may not have come in until the 1290s (Blanchard 1971, 120) and so may not be strictly relevant, was a monetary payment calculated on production excluding the Lot. It was in lieu of the mineral rights owner's right to first refusal to buy the miner's production and varied in value (Ford and Rieuwerts 1983, 19). Stiff penalties were imposed for avoidance of these royalties (e.g. Blanchard 1971, 120f).

Only a limited amount of other information is available on lead mining in Derbyshire in early Medieval times. Blanchard (1971) has examined the evidence for the scale of production and the changing geographical emphasis of the industry from the eleventh century onwards. The techniques in use throughout the Medieval and early modern periods are summarised by Ford and Rieuwerts (1983). The most basic of these, such as fire setting, must have been used in both Roman and early Medieval times. But direct evidence for their use at an early date is lacking. The complex matter of the various weight standards in use has been reviewed by Blanchard (1971, 138f), the standard measure in use for ore being the dish (a measure holding about 65 lbs. (29.5 kg));

Ford and Rieuwerts 1983, 150).

c) Early Colonial Mining in South America

Spanish colonial mining for silver in South America in the sixteenth and seventeenth centuries provides us with a case study of imperial exploitation of newly discovered deposits in a relatively isolated, recently conquered area. Details of many aspects of the industry are well recorded (e.g. Brading and Cross 1972; Chevalier 1970), with one of the most important mining centres, Zacatecas, being particularly well-known (Bakewell 1971). There are a number of points of similarity between the circumstances of this industry and those surrounding Roman lead extraction in Derbyshire. Although the mineral deposits in South America were principally worked for silver not lead they were similarly workable by surface methods, at least in the vicinity of Zacatecas (Bakewell 1971, 129ff). Similarly also the mining areas lay in generally infertile countryside with richer agricultural areas, such as the Valparaiso valley, at some distance (e.g. Bakewell 1971, 2ff). Though the contrast was much more marked in South America than in Derbyshire. Transport, initially probably a difficulty in Roman Derbyshire (Chapter 5) was equally problematic for areas such as Zacatecas, necessitating the driving of roads such as the Camino Real through difficult country (Bakewell 1971, 19f).

The evidence for the nature of the South American industry is very full and only a brief synopsis will be given here. It is based principally on Zacatecas, concentrating on aspects such as the practicalities of supply, the distribution of wealth in the mining community and the logistics of mining support industries. These aspects are more likely to be applicable parallels to the case of Roman Derbyshire than, for instance, the actual economics and technology of mining. There were significant differences both in the type of deposits being worked and in the methods available. Thus lead, and later mercury, was imported into Zacatecas as a refining agent not extracted from it (Bakewell 1971, 22).

The mineral rights in colonial South America belonged to the Spanish crown. But state mining would have been impossible and all citizens were free to prospect and mine as long as they paid the relevant taxes (Bakewell 1971, 181ff). The tax system was administered at large centres by an assay office (which checked the purity of refined silver and cast it into blocks of c.65 lbs. (29.5 kg)) and the Real Caja (which took the amount of tax payable from the cast block and stamped the remainder, allowing it to be traded freely). However, at small dispersed centres it was necessary to install a receiver who marked legitimately produced silver allowing it to be traded at a reduced value, the tax due being removed once it found its way to a large

centre. The tax rate varied over time and place but was generally 10% for silver produced by a miner from his own ores. It was 20% for ores smelted by natives or by miners on behalf of merchants (Bakewell 1971, 181ff). This taxation system was abused in a number of ways, particularly by declaring 20% taxable silver as 10% taxable, though Bakewell (1971, 185) believes that most silver was taxed at one rate or another, trade in unstamped silver being difficult.

Other than the resident treasury officials (who also advanced credit to the miners for salt and mercury which were needed in the silver refining process) the absolute authority in a mining community was the local governor appointed by the regional governor. Later he was replaced by the corregidor, an equivalent officer now appointed by the king in an effort to tighten the central control of the mining areas (Bakewell 1971, 82ff). Whilst in practice the provincial governor or viceroy and local officials such as the *alcaldes mayores* also had a large measure of influence, the *corregidores* essentially dominated centres such as Zacatecas and made considerable profits by supplying credit to miners (Bakewell 1971, 91f).

A limited system of monopolies and leased concessions and contracts also appeared in centres like Zacatecas (Bakewell 1971, 64ff, 69ff, 75f). In particular the town councils made efforts to control the supply and price of

grain (and to ensure the payment of taxes thereon) in the alhondija or grain market. A contract for the running of this was auctioned and the income from it farmed by the contractor in the second half of the seventeenth century. Although the control of grain was not always successful the auctioned monopoly supply contract system for meat in force from 1609 appears to have been more effective in controlling prices and ensuring supplies. The supply of other commodities was not, at least in practice, controlled and there appears to have been much scope for profiteering and abuse of monopolies such as that for candle making. The military played little role in the main mining centres once the area had been pacified, though forts were founded at outlying minor sites (Bakewell 1971, 30).

The labour force used in actually working the mines had a number of components. In some parts of New Spain forced paid Indian labour (*repartimiento*) was used. But in other areas the most important element of the workforce was probably free Indian contract labour (Bakewell 1971, 121, 125ff). Such contract labour perhaps relied on the accommodation and food provided by their employers and the *pepena* (a quantity of ore which they were allowed to collect for themselves at the end of the day) more than on wages and appear to have represented a mobile labour force. Measures such as debt peonage were not uncommon in attempts to keep workers, though shortages are perhaps more attributable to

poor conditions than to an actual dearth of labour. More valued as mine workers, though less in number, were slaves, mainly negroes and mulattos (half-castes), and other small groups included negro freedmen.

Mining areas in colonial South America tended to be centred on small towns. Although much larger than most Zacatecas appears to be representative of such centres (Bakewell 1971, 114) and is relatively well-recorded (Bakewell 1971, 41ff). In contrast to the stated intentions of the ordinances issued in Spain for a grid planned town with good stone housing Zacatecas was a 'straggling linear settlement' in a largely barren narrow valley. *Few houses* in the sixteenth and seventeenth centuries were of stone, the principal construction material being adobe. Public buildings were slow to be established and again were only of adobe. The main stone buildings, in the centre of the town, were the houses of leading miners, merchants and officials. Elsewhere in the town single storeyed adobe houses predominated, often combined with a shop front. House ownership seems to have been common and there is little evidence for the investment of mining profits in urban property, though religious orders did eventually come to own many houses. Beyond the Spanish core of the town Indian townships grew up, and along streams outside the town haciendas de minas, the homes of many of the miners including ore processing and smelting facilities and accommodation for

the Indian workforce, were built.

To an extent communities such as Zacatecas were closed ones with their controls on food importation and administration largely centralised in the person of the corregidor. Yet examples of far more closed communities are available from colonial contexts. The copper mines operated by British companies at Tharsis in Spain in the late nineteenth and early twentieth centuries were almost British colonial enclaves in Spain. There were three closed communities here, Tharsis, La Zarza and Corralles (Checkland 1967, 168ff, 179f). These centres were brought into existence by, and entirely dependent upon, the mining companies. They were self-contained and governed by the mine manager who held his own court and employed armed guards. The company provided the church and very limited schooling, a hospital and the poor quality housing. Food, which had largely to be imported and was recognised by the company as the greatest potential source of unrest, was available from company shops which sold at cost price, absorbing transport and running costs. Indeed in bad harvests they subsidised costs.

Food supply was also of crucial importance at Zacatecas since miners were too busy to grow it themselves and the area was anyway barren (Bakewell 1971, 18f). However, in contrast to Tharsis, there was little need to take measures to ensure supplies. Though we have already noted the partially successful monopoly systems in force more to control prices

than supplies. The presence of c1,500 Spaniards and c3,000 Indians, slaves etc. at Zacatecas represented a market lucrative enough to guarantee the importation of food from more fertile areas by traders (Bakewell 1971, 58). It was the necessity of bringing bulk supplies, principally of food but also of other commodities, large distances to towns such as Zacatecas that provided the main stimulus to the improvements in the communications system in the area. Once the Camino Real had been built a system of feeder roads developed from it to existing and newly established agricultural areas. Transport was by native porters, mule trains and waggons and road stations grew up along the roads. Indeed, the opening up of the area that the supplying of Zacatecas required played a large part in the colonisation of New Spain (Bakewell 1971 , 19-26, 58).

The development of areas supplying agricultural produce was a major concomitant of the mining at Zacatecas and other centres (Bakewell 1971, 59ff). Although the general area of Zacatecas was largely barren where there were river valleys that could be irrigated they were utilised to grow staple crops, particularly maize and corn. However, due to the infertility of the immediate area, it was principally distant areas that profited from supplying food to Zacatecas, most notably the Bajio. Fluctuations in the prosperity of Zacatecas were soon felt in its distant supplying areas. Agricultural land in the form of rural haciendas in colonial

South America was generally owned not by people who began in farming but by those who owed their origins to public life, trade or mining and found it a profitable investment with the demand for food. In this way some vast estates were built up with the initially high food and draught animal prices dictated by supply and demand (Chevalier 1970, 165ff). Whilst such estates were owned by those who had left mining those still involved in the industry also added local land to their haciendas de minas (out of the limited supply of local fertile land) to ensure grain, meat and draught animal supplies and to increase their social status. Most of these holdings were relatively small, though land was easily available through grant, purchase or just squatting.

Agriculture represents the most important of the direct and indirect support industries that were stimulated by the presence of miners, from many of which large fortunes were made (Brading and Cross 1972, 546). It is notable that there were far more merchants and shopkeepers at Zacatecas than mine owners, reflecting both its role as a regional centre and the lower outlay and steadier income from trade as opposed to mining (Bakewell 1971, 77). As well as resident merchants there were some 100-200 travelling merchants even in the early seventeenth century who travelled around more minor centres with pack trains of goods. Most of the goods sold in Zacatecas had passed through Mexico City, whose merchants in some cases opened branches at Zacatecas, just

as Zacatecas' merchants opened smaller branches in subsidiary centres. Though the very richest Zacatecans were successful miners most of the town's rich men were in fact merchants (Bakewell 1971, 80). The town population included numbers of grocers, general store keepers and other more specialised traders including clothes sellers, butchers, candle makers, confectioners, charcoal suppliers, shoemakers, tanners and cartiers. Indeed, it is clear that a great percentage of the population which relied on mining for a living were not miners but traders and workers in the support industries. A similar picture emerges from the nineteenth century at Tharsis where more reliable figures are available (Checkland 1967, 168). Here only half of the 3000 population were miners, the other half being women, *children and support workers*.

Despite this large support sector however it is clear that much of the profit derived from Spanish colonial mining ended up in a limited number of hands (Brading and Cross 1972, 560ff). The Crown made vast profits by taxing the silver produced, and its agents as we have noted probably profited too. Much of the rest of the profit tended to accrue to a few large concerns, particularly since the mining and ore processing were capital intensive industries. Thus, at Zacatecas we see a few very rich men and many relatively poor, and in the case of the Indian workforce probably very poor, men as reflected in the standards of housing. Much the

same was true of support industries, the growth of the distant agricultural suppliers being based on large haciendas.

xii) The Applicability of the Comparative Evidence

We have already noted that the usefulness of the evidence cited above is dependent on the comparability of the circumstances surrounding Roman lead extraction in Derbyshire and those surrounding the industries being used as parallels. Elements of these comparative cases have already been seen to be inappropriate (e.g. the details of mining and processing at Zacatecas) and it is clear that each case has different merits and drawbacks as a parallel. The value of the Vipasca evidence lies principally in its contemporaneity with the mining in Derbyshire. Clearly evidence from a Roman provincial context, especially bearing in mind that Vipasca B seems to be a generalised law probably applicable to the whole empire, is more likely to reflect the situation in another Roman province as regards its organisation than any other evidence. The use of lessees and partnerships at Vipasca reinforces this since the pig evidence suggests their presence in Derbyshire as well. Whilst it has been pointed out that the Vipasca evidence would be inapplicable to the scale of work at a site such as Rio Tinto (Rothenberg and Blanco-Freiheiro 1981, 174), the workings in Derbyshire would be of a far more comparable scale.

Yet, there are a number of features of the situation at

Vipasca that may well have been rather different to that in Derbyshire. Firstly, the principal metals extracted at Vipasca were copper and silver, and these are the types of mines to which Vipasca B refers. In Derbyshire the ores were of lead, and silver was probably of limited importance. Thus, the general law which Vipasca B represents will not have applied to Derbyshire. Moreover Vipasca B applies to underground workings, while in Derbyshire surface workings were probably predominant if not ubiquitous. Although it is not unreasonable to suggest that a general law covering lead mines existed and was perhaps similar to Vipasca B, the difference in working practices may have necessitated an entirely different law for Derbyshire workings. Even stronger reservations apply to Vipasca A. The Vipasca mining operations were centred on the small town of Aljustrel. In this situation the partly closed economic system with extensive leased monopolies to be found in Vipasca A would have been relatively easy to maintain. Yet the Derbyshire lead field seems likely to have been both large and dispersed (above p.285), the only major settlement within it being Carsington.

It is difficult to see how a leased monopoly system could be maintained in this situation for many mining operations would be distant from this centre, far nearer to other major sites such as Brough or Derby. Indeed, we

cannot be sure that Vipasca A represents a system ever in use beyond Vipasca itself, besides which no date can be given to the tablet recording it. The possibility that Aljustrel lay at the centre of an imperial estate makes assumptions that Vipasca A can be used as evidence for other mining communities even more uncertain (see further below p.330f).

The Medieval Derbyshire evidence is perhaps the most applicable of our parallels. It applies to the working of the same deposits in largely the same ways as in the Roman period though mainly to the administration of the mining itself, rather than to the support industries that the Vipasca evidence includes. Although there are clear differences between Roman and Medieval mining in Derbyshire, the fact that the basic geographical, technological and transport limitations are likely to have been very similar must make it valid as a source of comparison. The most significant difference between the two situations is likely to be that there were more nucleated settlements in the Medieval period. Indeed, the liberties making up the various fields are mainly synonymous with parishes, each centred on at least a village. This allowed the mining laws to be enforced by a court moving from village to village. Such a set of laws in the Roman period would presumably have had to be enforced by roving officials working for a procurator

probably based at Carsington.

It seems likely that the ownership of mineral rights in the Roman period belonged in part or whole to the state. Such may be the implication of the Vipasca evidence and of the late Roman development of a royalty system (above p.224). The Medieval evidence from Derbyshire is again in line. Whilst the mineral rights devolved in some cases to private landowners or were rented from the crown by them (and were augmented by a tithe which clearly would not have applied in Roman times) the principle is the same. One further difference in the Medieval situation may be noted. Roman extraction represented a new industry brought by a conquering power. The Medieval system, as far as we can tell, developed during the Saxon period, probably in an ad hoc fashion in a relatively small kingdom. Though from the eleventh century on it was 'inherited' and administered by the conquering Norman nobility. In the Roman case there were empire wide administrative structures already established whereas the Medieval example probably represents a more parochial and perhaps practical development.

The example of Spanish colonial mining, notably at Zacatecas, is perhaps the least directly applicable of the parallel cases. However, there are a number of points of broad similarity to the situation in Roman Derbyshire. Its greatest merit is in the detail in which it is recorded, giving a picture of all aspects of mining and the social and

economic concomitants of it. As with Roman Derbyshire the mining occurred in a relatively newly conquered area of a large empire, the social order of that empire being alien to the native population. Again like Roman Derbyshire the area was relatively inaccessible and agriculturally backward and unproductive (both more markedly the case in S. America than Derbyshire).

Yet there are important differences in the colonial Spanish situation. Foremost must be the level of technology available, which makes the details of the actual mining operations inapplicable as parallel evidence. The fact that the main product was silver not lead is also significant. Its greater relative value may well have produced a much greater 'boom' in mining and support industries than lead would have. It also seems that, while there were many *small* outposts within the whole mining field, the industry was essentially based around towns of various sizes. As we have already seen in the case of Vinasca, this may have dictated different administrative structures to the case of Roman Derbyshire.

Notes

1. A lead cistern from Pompeii has been claimed as of British lead based on isotope activation analysis (Brill and Wampler 1967, 70) but as the authors themselves point out the technique is neither developed enough nor yet applied to a sufficient range of control samples to give any confidence to the attribution.
2. The whole of Pliny's section on minerals and metals in his Natural History is of great importance for ancient mining (for a commentary see Healy 1986). However, it is likely that much of it was derived from first hand experience in Asturia and Gallaecia since he was procurator of Hispania Tarraconensis from 73 (Healy 1986, 111). It is *therefore likely to be* of limited relevance to British mining since the type of mining undertaken in the areas, reflecting their different geologies, varied greatly. Moreover, that the technology in use, as reflected in the terminology, was based on pre-Roman local practices emphasises that techniques were not necessarily standardised throughout the empire.
3. It is regrettable that little work has been done since Besnier (1920; 192a; 192b) on provenancing pigs on an empire-wide basis. Earlier Gaulish pigs are easily distinguished from British ones by their rounded tops and distinctive thin cartouches; early Spanish ones are similarly rounded as is at least one German Legionary one (Von Schnurbein 1971). However, later they become similarly sub-triangular in cross section to British ones (e.g. Laubenheimer-Leenhardt 1973 nos. 15, 16 and 19, at least one of which may be Gaulish and one German (193ff); and Parker 1974 and Domergue 1966, 63 for the later Spanish ones).
4. For a brief synopsis of the variations in mine administration in Spain see Mackie (1983, 186).
5. Attempts have been made to calculate back from the modern situation. For instance Ford and Rieuwerts (1983, 12) suggest that between three and six million tons of ore have been removed from the Derbyshire field since mining began (though the problems of even making this calculation are underlined by the fact that thirteen years earlier the same authors (Ford and Rieuwerts 1970, 5) had calculated the figure at one to two million tons). However, we have insufficient information on Medieval and even early modern production to assess the Roman element in this.

6. Attempts to link other inscriptional elements to desilverisation (e.g. Webster 1952/3, 8) cannot be accepted since none can be shown to be exclusive to desilvered pigs.
7. Gowland (1901, 359) followed by Davies (1935, 55) suggests 0.01% to 0.002%. The lower figure is backed up by the pigs but the higher is too great compared with them.
8. A few possible mining tools, chiefly spades and iron wedges etc. are recorded in antiquarian accounts (e.g. Wright 1888; Davies 1949, 119f), but most have been lost and proof, especially bearing in mind that Medieval tools are likely to have been of similar forms, of a Roman date is lacking in all cases. No details of the tools said to have been found with pig No.67 (p.288) are available.
9. See note 2 above.
10. Thus the bronze ladle supposedly to be connected with the casting of lead pigs (Wooler 1926) must be rejected as such, and as evidence of Roman mining activity in Weardale.
11. On the spelling see Ling and Courtney (1981, 74) who argue that an -on ending in the Ravenna Cosmography is due to the use of a Greek original.
12. Makepeace (1985, 107) has noted the finds evidence for the possible presence of a settlement in the Eyam-Stoney Middleton area. However, in the absence of further proof for its existence or nature it must be disregarded.
13. For the site see also Alarcao (1988 I, 73ff and II, 177f), though his interpretation of the epigraphic evidence is markedly different from e.g. Edmondson's (1987) (who is generally followed here) reflecting the problems of the detailed translation of the text.
14. It is more often assumed to be the former. On the latter possibility see Mackie (1983, 18 note 25).