



Spearman, R.M. (1988) *Industrialization and urbanization in medieval Scotland : the material evidence*. PhD thesis.

<http://theses.gla.ac.uk/2509/>

Copyright and moral rights for this thesis are retained by the author

A copy can be downloaded for personal non-commercial research or study, without prior permission or charge

This thesis cannot be reproduced or quoted extensively from without first obtaining permission in writing from the Author

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the Author

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given

Industrialization
and
Urbanization
in
Medieval Scotland:
the material evidence

By

R M Spearman

Volume 1

Thesis submitted in accordance with the requirements for
the degree of Doctor of Philosophy in the Faculty of Arts,
University of Glasgow.

September 1988

© R M Spearman 1988

For Peter and Alison
and all those in between

Acknowledgements

There are a great many people I would like to thank for assisting in and encouraging the completion of this research. So many have helped to keep my mind on the subject by simply asking "How is it going?" that, bar one, they must remain anonymous. My contemporary in so many things, Andrew Foxon, holds the cup for returning me to work in this way. I would also like to thank my various supervisors within the University for their constructive criticism and steady encouragement. My special thanks go to Dr Elizabeth Slater who was in at the beginning and saw me through to the bitter end, but also to Professor Alcock and Professor Duncan who much improved the text and to Eric Talbot who advised me in the early phases of this research. I must also record my debt to Dr David Clarke, of the National Museums of Scotland who not only encouraged me but also helped provide the time and sustenance to bring this research to a conclusion.

This thesis would have been quite impossible were it not for the work of various urban archaeologists in Scotland, the UK and abroad. It is their finds which provided the stimulus and central material of the study, and while their number is once again great, I would like to make special mention of the excavators and reporters on the Perth High Street Excavation, and my former colleagues on the staff of the Scottish Urban Archaeology Unit, Bill Lindsay, the late Neil McGavin, Jonathan Wordsworth and Linda Blanchard.

Many of the plates used to illustrate this research come from the excavations of the aforementioned. Others have been made available thanks to Alison Reid of Perth Museum, Judith Stones of Aberdeen Museum and David Caldwell and George Dalgleish of the National Museums of Scotland. I would like also to thank in anticipation Bruckmann's of München for agreeing to waive copyright on plates derived from their publication of the Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg.

Finally there is Moira who has been a grass-widow to this subject for far too long and yet has read with great care every draft.

Synopsis

The thesis is introduced with a brief review of why industrialization and urbanization should be examined together and how this may best be done in the Scottish context. There is then a critical examination of the available sources, archaeological and documentary (including technical treatises), and a consideration of their integrated use. It is accepted that in examining a topic as diverse as this that not all the sources and topics available can be fully explored. Emphasis has been given to the physical implications of manufacturing from the twelfth to the fifteenth centuries. As a result documentary sources for the sixteenth century have not been dealt with in detail and the political and social history of craft incorporations have not been discussed.

The background to modern historical, geographical and archaeological definitions of what is "urban" is reviewed in chapter 2. The sources used by these different disciplines have defined their fields of interest and have greatly influenced modern attitudes to the question of urbanization. Archaeology as a relative late-comer has helped to widened out the debate, but as yet there is still a marked reticence to integrate urban studies and examine the subject in a more inter-disciplinary way.

A review of the principal manufacturing processes known from archaeological and documentary sources to have taken

place in Scottish towns during the medieval period is presented in an extended chapter 3. These processes have been grouped together on the basis of the raw materials used and the resulting manufacturing groups have then been presented under the sub-headings of animal, vegetable and mineral based industries.

Chapter 4 examines the extent to which the manufacturing processes identified in the previous chapter can really be regarded as industrial. The significance of the raw materials that were required is considered in terms of their sophistication, origins and availability, as has the equipment, manpower and other resources needed to establish a regular manufacturing base. The advantages to manufacturers of locating in or near centres of trade are made clear, as is the need of communities and their controllers to attract manufacturers.

Finally the growth of manufacturing and towns is related to the economic and political forces of the time. It is noted that the roots of the Scottish urban economy lie deep within the political and economic management of rural communities and the farming surpluses they produce. Many of the medieval urban industries identified through excavation and documentary research would have been of local and regional rather than international importance. It is argued that while the export of wool was by far the most important earner of foreign revenue for much of this period, it was in fact the processing of hides and skins

for regional use and export that provided the major economic and industrial stimulus to Scottish urban development.

Contents

Volume 1

<u>Acknowledgements</u>	i
<u>Synopsis</u>	iii
<u>Contents</u>	vi
<u>List of Plates and Line Drawings</u>	ix
<u>Introduction</u>	xvi
Chapter 1. <u>The Source</u>	1
Chapter 2. <u>Urbanization, Manufacturing and Archaeology</u>	29
Chapter 3. <u>Scottish Urban Manufacturing Processes</u>	
Part 1: Animal Based Industries	
Introduction	59
Fleshing and related crafts	63
Hides, skins and leather	76
Fishing	89
Wool and textiles	104
Part 2: Vegetable Based Industries	
Introduction	123
Cereal processing	125
Market garden produce	137
Wood working	142
Part 3: Mineral Based Industries	

Introduction	157
Iron working	160
Edged weapons and armour	172
Guns & artillery	182
Gold & silver working	190
Lead & pewter working	203
Copper-based alloy working	212
Salt	219
Glass	230
Chapter 4. <u>The Industrial Economy</u>	241
Part 1: Raw Materials	241
Part 2: Manufacturing resources	256
Chapter 5. <u>The Market Economy</u>	293
Part 1: The Rural Base	294
Part 2: Royal Markets and Coins	300
Part 3: The Creation of Urban Wealth	315

Contents

Volume 2

<u>Bibliography</u>	1
<u>Plates and Line Drawings</u>	19

Illustrations:

Plates and Line Drawings in Volume 2

Where Copyrights exist permission has been sought for use in this thesis.

- Fig. 1 A fifteenth-century German flesher at his booth
Sources: pl. 96 Das Hausbuch der Mendelschen
Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et
al 1965. Copyright Bruckmann, München.
- Fig. 2 Sawn horn-cores from the Perth High Street
Excavation. Photographed in: Perth Museum and Art
Gallery, George Street, Perth.
- Fig. 3 Mallet-head made from an antler burr and antler
working waste from excavations at Broad Street,
Aberdeen. Courtesy of Aberdeen Art Gallery and
Museum, School Hill, Aberdeen.
- Fig. 4 A fifteenth-century German skinner at work
Sources: pl. 63 Das Hausbuch der Mendelschen
Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et
al 1965. Copyright Bruckmann, München.
- Fig. 5 A fourteenth-century tanner's yard with possible
fire-pits in foreground, excavated in the
Gallowgate, Aberdeen. Courtesy of Aberdeen Art
Gallery and Museum, School Hill, Aberdeen.

- Fig. 6 Decorated fourteenth/fifteenth-century knife scabbards from the 1975 Perth High Street Excavation. Courtesy of Perth Museum and Art Gallery, George Street, Perth. [Cat. Nos. as follows: Top, A8334; middle, A8183/C2247; bottom, A8002/C2237].
- Fig. 7 A fifteenth-century German weaver at work. Sources: pl. 9 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 8 Fragments of thirteenth/fourteenth-century woollen cloth from the 1975 Perth High Street Excavation. Photographed in: Perth Museum and Art Gallery, George Street, Perth. [i. a 2/2 Diamond Twill; iv. 1/1 2 ply; v. 2/1 perhaps napped Cat. Nos. 12340/C5097].
- Fig. 9 A fifteenth-century German dyer at work. Sources: pl. 68 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 10 A fifteenth-century German baker at work. Sources: pl. 162 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.

- Fig. 11 Fifteenth-century corn drying kiln, excavated at Mill Street, Perth. Courtesy of the late N McGavin, ex Scottish Urban Archaeology Unit.
- Fig. 12 Fifteenth-century quern-stone base of oven, excavated at Meal Vennel, Perth. Courtesy of L Blanchard, ex Scottish Urban Archaeology Unit.
- Fig. 13 Large fourteenth-century oven abutting building, excavated at Kirk Close, Perth. Courtesy of L Blanchard, ex Scottish Urban Archaeology Unit.
- Fig. 14 A fifteenth-century German brewer at work.
Sources: pl. 38 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 15 A fifteenth-century German carpenter at work.
Sources: pl. 105 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 16 Medieval woodworking tools from excavations in Perth. Photographed in: Perth Museum and Art Gallery, George Street, Perth. Smaller chisel, from Methven Street; Larger chisel, from Canal Street II; Spoon-bit from Kirk Close [Cat. Nos. 91, 92, 95].

- Fig. 17 A fifteenth-century German cooper at work.
Sources: pl. 22 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 18 Cooped barrel, reused to line a medieval pit, from the High Street, Elgin. Courtesy of W Lindsay, ex Elgin Archaeological Heritage Trust.
- Fig. 19 A fifteenth-century German blacksmith at work.
Sources: pl. 81 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 20 Bloomery site at Aulich, N side of Loch Rannoch, Perthshire. NGR NN 608 599
- Fig. 21a Fifteenth-century smidding hearth and associated features, excavated at Castle Street, Inverness. Courtesy of J Wordsworth, ex Scottish Urban Archaeology Unit.
- Fig. 21b Plan of the smiddy area excavated at Castle Street Inverness. Courtesy of J Wordsworth (Wordsworth 1982 357).
- Fig. 22 Fifteenth/sixteenth-century smiddy area excavated at Meal Vennel, Perth, showing hearth, socketed

stone and debris. Courtesy of L Blanchard, ex
Scottish Urban Archaeology Unit.

- Fig. 23 A fifteenth-century German knife-maker at work.
Sources: pl. 145 Das Hausbuch der Mendelschen
Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et
al 1965. Copyright Bruckmann, München.
- Fig. 24 Possible sixteenth-century Jedburgh staff from
Murthly Castle. Courtesy of David Caldwell,
National Museums of Scotland.
- Fig. 25 Fifteenth-century wrought iron breech chamber
from Fife. Courtesy of David Caldwell, National
Museums of Scotland. NMS Reg. LH 236
- Fig. 26 Bronze hagbut cast in 1553, probably by David
Rowan. Courtesy of David Caldwell, National
Museums of Scotland. NMS Reg. L.1979.1
- Fig. 27 A fifteenth-century German goldsmith at work.
Sources: pl. 88 Das Hausbuch der Mendelschen
Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et
al 1965. Copyright Bruckmann, München.
- Fig. 28a Central print of the Bannatyne or Bute Mazer,
made between 1314 and 1318. National Museums of
Scotland, Reg. L.1979.11.

- Fig. 28b Silver lip band of the Bannatyne or Bute Mazer, made in the sixteenth century. National Museums of Scotland, Reg. L.1979.11.
- Fig. 29 The Galloway Mazer, made by James Gray of the Canongate, c1569. National Museums of Scotland, Reg. MEQ 148.
- Fig. 30 The Ballochyle Brooch, made in Scotland c1550 National Museums of Scotland, Reg. L.1936.7a.
- Fig. 31 Map of the main gold, silver, copper, and lead mining areas in Scotland (after Wilson & Flett 1921 and Macgregor 1940).
- Fig. 32 Early workings, with possible fire-setting, at the Tonderghei copper mine NW of Burrow Head, Wigtownshire NGR NX 439 348.
- Fig. 33 A fifteenth-century German coppersmith at work. Sources: pl. 33 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 34 The twelfth-century St Fillan's Bell, National Museums of Scotland, Reg. KA 2.
- Fig. 35 Composite mould for the casting of copper-alloy pins, from the High Street, Elgin. Courtesy of

Bill Lindsay, ex Elgin Archaeological Heritage Trust.

- Fig. 36 Copper-alloy cauldron from Montraivie, Fife, found with coins of Edward I, II, III. National Museums of Scotland, Reg. MA 39.
- Fig. 37 A fifteenth-century German pewterer at work. Sources: pl. 55 Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg Edit. Treue, et al 1965. Copyright Bruckmann, München.
- Fig. 38 A possible lead working hearth excavated at Castle Street, Inverness (No /date). Courtesy of J Wordsworth, ex Scottish Urban Archaeology Unit.
- Fig. 39 Modern salt pans at Pointe du Croisic, Guerande, Loire Atlantique, France.
- Fig. 40 Medieval window glass from excavations at Elgin, Nos. 1-17 glass quarrels, Nos. 18-22 fragments from the edges of glass sheets. Courtesy of Bill Lindsay, ex Elgin Archaeological Heritage Trust.
- Fig. 41 Map of the principal medieval burghs and other towns mentioned in the text.

Introduction

Industry is not a subject that is normally associated with the medieval towns of Scotland and it would be quite wrong to imply that Scotland ever had any massive manufacturing centres comparable to the great medieval cities of northern Europe such as Bruges, Nürnberg or Lübeck. In the whole of the British Isles the only city which might be classed alongside such conurbations was London. Nevertheless the towns of Scotland, like the vast majority of urban settlements throughout medieval Europe, were industriously servicing the needs of their surrounding rural communities in which the overwhelming majority of the population lived and worked. Through their markets, and in certain instances manufacturing skills, burgesses converted the produce of their hinterland into tradable commodities and artefacts. Yet the history of manufacturing in medieval Scotland is one of the least well understood aspects of Scotland's economic development. In particular the processes of early urban industrialisation and their relationship to the emerging towns and nation has remained lamentably understudied. Recent archaeological work in the burghs has, however, drawn attention to the variety of manufacturing processes carried out in and around Scottish medieval towns. Indeed the successful interpretation of many urban archaeological finds and features has come to depend as much upon a knowledge of medieval industries as of domestic and agricultural life. With a growing number of urban excavations uncovering evidence of known or suspected industrial activity a new and important dimension

has been added to the history of Scottish medieval manufacturing and urbanization.

It is the purpose of this thesis to examine the archaeological evidence for urban manufacturing in medieval Scotland and to relate the results to the wider question of Scotland's political, urban and economic development.

Chronologically the main focus has been the twelfth to the fifteenth centuries, for these are the centuries in which the complex patterns of urban manufacturing begin to emerge. Inevitably the developments of these years are rooted in earlier times and also spill over into the sixteenth and seventeenth centuries. Where informative, evidence about the economy and manufacturing from before and after the main period of study has therefore been touched upon. However, evidence from the later sixteenth century in particular has to be used with caution because of changes in the available technology and organisation of the burghs. In addition to the archaeological evidence a considerable range of documentary evidence has therefore been considered. For the main period of interest a wide range of documentary sources has been printed, and it has not been necessary to consult manuscript sources in order to contextualise the archaeological evidence.

Nevertheless, it is clear that, particularly for the later fifteenth and sixteenth centuries, much valuable information remains unstudied in the Scottish Record Office and local authority archives. It should be noted, however, that with the exception of certain technical treatises, documentary sources for medieval manufacturing tend,

because of the methods and purposes of their compilation and survival, to be biased towards those materials and processes which were of interest to the great and powerful of the land. Inevitably, therefore, the majority of the surviving documents are concerned with large scale trade in cash crops such as wool and hide and the services and luxuries that those cash crops could be used to buy. Where references to plainer products do occur they usually relate to the purchases of finished goods rather than processes of manufacture. The very incompleteness of the documentary sources accounts in part for the lack of earlier detailed examinations of this topic. The vagaries of archaeological preservation, as well as the limited extent of urban excavations in Scotland, have likewise restricted scope of archaeological evidence. However, even where survival is partial this new source of information can be used to demonstrate many of the practical aspects of medieval manufacturing.

The documentary and archaeological evidence tend, therefore, to complement one another and their combined study has permitted the construction of a far more complete model of Scottish medieval manufacturing than was hitherto possible. The combined archaeological and documentary evidence for a great many of these urban industries and processes is, therefore, described and discussed here at some length. Wherever possible an attempt has been made to date and quantify changes in the scale and quality of the technology employed in the burghs, but the evidence does not normally permit such detailed investigations. In most

cases all that can be said is that such and such a service or type of work was available in certain or most of the burghs. Any further interpretations regarding preparatory and finishing work have normally to be based on what is known about the practical and technical requirements of the materials being worked. The intention throughout has been to illustrate and explain the complex structure of interdependence that the different urban crafts developed, without which many would not have been economically viable and could not have become as sophisticated as they clearly did.

Endless repetition of all the known evidence for individual crafts or processes has, therefore, been avoided and in one or two rare instances, such as stone masonry or pottery, specific trades have only been discussed in so far as they relate to the mainstream of medieval urban manufacturing. Stone masonry in particular demonstrates the difficulty posed by highly professional craftsmen who effectively operated outwith the urban communities. Substantial stone constructions were rare in both town and country throughout this period, and masons were forced to be highly mobile in order to remain in work. Their work tended to be tied to major capital projects in which they could have little or no financial investment. Even if it were practical, there was little point in masons building up stocks of the material in which they worked. As a result their profession was based on the marketing of personal labour and skill and not on the establishment of a steady trade rooted in market places or towns (Jones 1952 509-15).

Similar difficulties occur with the excavated evidence for regional pottery types, some of which are believed to have been produced near the burghs of Inverness, Aberdeen and Perth. Although products of the pottery industry can be important indicators of date, culture and trade, this was not normally an urban profession. Moreover, in terms of the urban economy and manufacturing tradition the clay vessel potter was of fairly minor importance. The main interest of this research has been to identify and analyse the economic requirements of, and conditions created by, those crafts which made positive use of the towns.

The sheer complexity of urban manufacturing becomes rapidly apparent in any such assessment. One tradesman's waste produce became another's raw material such that, for example, cattle slaughtered in towns became the raw material of not only the fleshers who butchered them, but also tanners, cordwainers, cobblers, bone workers, ropemakers, horners, gluemakers, gutters, candlemakers and a host of others. The example of cattle carcass utilisation may be extended to demonstrate the importance of this kind of approach in understanding something of the economics of early urban development. Although the primary market was for the flesh of the slaughtered beasts the value of their hides was considerable, and with the development of the tanning industry many beasts seem to have been slaughtered as much, if not more, for their hides as their flesh. It is equally clear that animals were not normally killed just for their horns, hooves, guts and sinews. Such 'waste' or secondary raw materials could

nevertheless be used commercially and must have added to the profit margin on the animals brought for slaughter.

The kitchens of even the smallest country estate would no doubt have endeavoured to make use of these secondary raw materials, but the opportunities to maximise on the value of these by-products must have been limited and rarely would there have been a large enough demand, or through-put of cattle and other animals, for individuals to develop sufficient expertise to make these raw materials a significant element in profitable carcass utilization. Moreover, reliable access to substantial numbers of cattle was not only essential to the processors of primary and secondary animal carcass materials, it was also a major element in the development of a wide range of other industries. Those craftsmen and merchants who made or supplied the specialist materials and equipment needed to process, store and finish animal carcass produce would have most regularly plied their trades in communities where the largest numbers of cattle were being slaughtered. Initially coopers, wrights, leather workers, merchants and others may only have been ad hoc workers in, or even seasonal visitors to, these communities. As the primary and secondary levels of carcass processing became better established and surplus animal produce became consistently available then this third level of craftsmen would have found it convenient to work and stay longer in these communities until eventually they became permanent residents. The combined forces in favour of urbanization were of course by no means as simple as indicated in this

one abridged example. Such an approach, however, highlights the purely practical factors in favour of larger more structured communities which, along with the political changes of the eleventh and twelfth centuries, gradually produced legally constituted urban communities. This examination of early manufacturing makes it clear that regional control of resources, and of agricultural produce in particular, was a key element in urban and manufacturing development. Since in post-Roman and medieval societies such control was as much personal and political as economic, it is axiomatic that the processes of urban development identified here are as much a function of larger and better structured political units as of more efficient economic organisation. Hence, although any study of the practicalities of early manufacturing inevitably emphasises the economic factors behind urban development, the main conclusions of this study point to an almost symbiotic relationship between market and political forces wherein the efficiency of collective processing of resources encouraged and was encouraged by more centralised and powerful authorities.

Chapter 1

The Sources

The history of medieval urban manufacturing presented here has been derived from both the physical and written remains of the period. The study of these remains is usually regarded, at least in the first instance, as involving two separate disciplines, archaeology and documentary history. On the positive side this divided approach has, for instance, resulted in greater specialisation and a more detailed and informative analysis of individual sources than would otherwise have been possible. However, much of the advantage in having the same problem viewed from two different perspectives has been negated by the lack of subsequent meetings of minds and information. While it may no longer be thought necessary to cut seals from charters so that the former may be presented to the Society of Antiquaries' museum and the latter to the Scottish Record Office, it is still unusual for archaeological and documentary evidence for the medieval period to be fully and successfully integrated. Much of the difficulty lies in the sheer range and diversity of both the physical and written evidence, a problem which increases dramatically during the later medieval period. Any individual who tries to come to terms with such a variety of information inevitably runs the risk of becoming a jack of all trades and master of none.

Some of the less flattering connotations of the latter

description have, it is hoped, been avoided here as a result of the emphasis given to the physical attributes and requirements of medieval manufacturing. Priority has been given to illustrating the archaeological evidence, but it is the documentary evidence which has provided the essential framework for this study. Without the full incorporation of documentary evidence for materials and manufacturers the results of excavation would have been sorely diminished. This remains, however, a study of the effects of manufacturing practice on the process of urbanization, with the result that many interesting aspects of the documentary evidence have not been addressed. For instance, the social and political organisation of crafts and guilds, which appear at some length in the documentary sources, has not been discussed, even though the development of urban manufacturing is known to have had considerable bearing on the interrelationships of these organisations (Lynch 1981).

The Archaeological Evidence

During the last ten to fifteen years archaeological excavations undertaken in the burghs have provided an important insight into the physical remains of medieval manufacturing in Scotland. Unfortunately the majority of these excavations remains unpublished and unarchived. There are numerous reasons for this delay, but most are the consequence of a lack of suitably organised post-excavation and publication resources. Excavations in Aberdeen between 1973 and 1981 and in Perth between 1979 and 1981 have been

published in Society of Antiquaries of Scotland Monographs and several other urban excavations have been published in the Society's Proceedings and elsewhere (Blanchard 1983; Dixon 1986; Hall & Lindsay 1982; Holdsworth 1988; Holmes 1985; McGavin 1982; Murray, JC 1982; Murray, H 1984; Schofield 1976; Spearman 1982b; Thoms 1982; Wordsworth 1982, 1983a &b). Major publications are awaited on excavations in Perth, Elgin and St Andrews, while further publications of individual sites in Aberdeen, Ayr, Glasgow, and the Border towns are expected in due course. Unfortunately, what was probably the most important urban excavation to have taken place in Scotland, The 'Perth High Street Excavation' or PHSE, which took place beneath what is now Marks & Spencer's on the north side of the High Street, Perth, remains unpublished. Where they have been compiled PHSE reports have been consulted in manuscript. It is unavoidable, therefore, that a significant proportion of the archaeological information used here has come from forthcoming and as yet un-archived reports, personal knowledge of many of the sites and my own excavation and specialist reports. Wherever possible appropriate references to forthcoming publications and reports destined for archives have of course been provided. Except where unavoidable, I have cited entries in Discovery and Excavation, Scotland (D & E) rather than privately circulated interim reports.

Documentary historians are normally aware of the origin, general content and continuing purpose of the archives in which they work. This is not always the case with

archaeologists. Excavations are transient affairs and if published at all, the archaeological consequences of the circumstances behind their occurrence are rarely explained. Yet the variability and necessary restrictions imposed on urban excavations at the planning stage are every bit as crucial to the range of evidence the excavations produce as the origin and maintenance of documentary archives. Among the gross factors which affect the survival, recognition and recovery of archaeological evidence from urban excavations are the availability of sites, the funding and duration of the excavation and the quality of material and stratigraphic preservation.

Urban archaeology's close association with rescue excavation is not simply the result of more funds being available for rescue than research excavation. The Manpower Services Commission has also provided substantial sums of money for urban excavations which have not been tied to rescue work. The fact is that the range of sites available for excavation is almost always determined by developers not archaeologists. Although access to some backland gardens and yards may be possible without a direct rescue threat, the majority of excavations depend on demolition by developers or pre-existing gap-sites for access to the ground. In all but the most run down of town centres, the availability of such sites is invariably the result of past and current development plans. Hence, even where a number of excavations have taken place in the same town, their distribution is determined by the current pattern of urban decay and redevelopment. It is purely

fortuitous if modern redevelopment allows archaeologists to examine all the historic districts, functions and developments of a town. In Perth, for instance, where a great deal of excavation has taken place, it has still not been possible to do more than inspect construction trenches and foundation pileing in the oldest part of the town (Spearman forthcoming e). In any case, the number of Scottish towns where several excavations have taken place is still so small that it is normally only possible to discuss their chronological, spatial and functional development on the basis of documentary and cartographic evidence. Only in Aberdeen, Elgin and Perth has there been sufficient excavation for archaeology to make a significant contribution to these important subjects, although work in Ayr, Glasgow and St Andrews is beginning to provide further archaeological evidence on the physical organisation of burghs. Until much more excavation has taken place, therefore, the main value of urban archaeology to this research is as a source of information about specific aspects of urban life, imports and manufacturing.

The size and shape of urban excavations is also rarely determined by purely archaeological criteria. The space available for excavation is frequently restricted by the proximity of standing buildings or services and the practical constraints of stepping-in or shoring the sides of deeper excavations. Opportunities for large scale excavations are rare and even when physically possible the high cost of urban excavation tends to limit both the area and duration of excavations. Before the first sod is

removed, therefore, a site's potential has already been significantly influenced by factors which are often entirely outwith the control of the excavating body. Urban archaeologists tend to accept such difficulties without analytical comment, but at the macro level they help to determine the range of evidence available.

Assuming reasonable access, time and competent excavation, stratigraphic and material preservation are the prime factors in determining the quantity and quality of evidence from individual sites. Differences in such fundamental geological and topographic factors as subsoil composition, pH, watertable and drainage inevitably result in a considerable variety of soil conditions and related artefact preservation. The greatest variations are, of course, to be found between different towns but the occupiers' use of their property can also have a dramatic affect on the stratigraphic condition of individual plots, and it is commonplace for there to be substantial differences in the archaeological preservation of even adjoining plots (Spearman 1988c 81-83). Moreover since the eighteenth century major changes in public hygiene and building techniques have resulted in much lower rates of deposition and an ever increasing destruction of earlier stratigraphy. Considerable efforts have been made, therefore, to identify the quality of stratigraphic survival in the various Scottish burghs. Unless there is prior knowledge of cellerage and recent foundations it is rarely possible to ascertain without trial excavation the extent to which sites have been damaged by use from the

medieval period to the present day. As a result many of the urban excavations which have taken place in Scotland were primarily intended to identify soil and stratigraphic conditions and have been conducted on a small scale.

As well as the limited nature of many urban excavations the number of Scottish towns which have had any form of archaeological excavation remains alarmingly low. Even using a fairly generous definition of what constitutes archaeological examination only some 39 of the 276 Scottish burghs legally recognised before 1600 have been reported on in Discovery and Excavation, Scotland by 1987 (Pryde 1965; the 39 burghs are listed at the end of this chapter). Less than half of these burghs have seen either a single excavation of any size and duration or more than one trial excavation and in only seven Scottish towns, Aberdeen, Ayr, Edinburgh, Elgin, Glasgow, Perth and St Andrews has there been a significant programme of excavations. The available archaeological evidence for life in Scottish medieval towns can only be described as a minute fraction of what has been lost and an unquantified but small sample of what has survived and remains to be excavated.

Of the few Scottish towns which have, to date, demonstrated good stratigraphy, by far the most important has been Perth. Large areas of not only deeply stratified but remarkably well preserved organic deposits have been found in Perth. The excavation of a wide range of almost perfectly preserved textile, leather, wood, and other organic remains from Perth has added invaluable to the

variety of materials and artefacts known from Scottish medieval towns. Of particular importance in the present context, has been the close association of organic industrial debris with non-domestic structural remains. This has permitted the function of a variety of structures to be identified and for similar features on sites without good organic preservation to be interpreted by comparison with the more informative Perth examples. Moreover, although certain industrial activities such as metalworking and fleshing do leave fairly robust remains or products, a considerable proportion of urban manufacturing was concerned with only bio-degradable materials. Without the organic deposits excavated in Perth and occasionally elsewhere, many important aspects of urban manufacturing would only have been evidenced, if at all, from documentary sources.

A certain bias towards archaeological evidence from Perth and to a lesser extent Aberdeen and Elgin is inevitable given the quality of the stratigraphy and the scale of excavations that have gone on there. This has serious implications for any hopes of using archaeological evidence to demonstrate the differences between variously constituted Scottish Burghs. With the exception of the episcopal burghs of Glasgow and St Andrews, virtually all the more substantial and productive excavations have been in the larger royal burghs. While this may reflect something of the real situation, it is not yet clear whether the lack of archaeological evidence from, for instance, burghs of barony, is the result of a lack of

industrial activity or of archaeologists. The picture of urban manufacturing presented here is therefore inevitably biased towards the industries in the larger Scottish towns. However, even for the larger burghs there are major gaps in the archaeological record. For instance, there is an almost complete lack of archaeological information on manufacturing from Leith, which documentary sources suggest was the main industrial centre of later medieval Scotland (Holmes 1985). Ironically the very lack of excavated archaeological evidence may help to prevent biased quantitative analysis. There is simply insufficient evidence to do other than note something of the range of activities that took place in Scottish towns. Only in exceptional circumstances is it possible to speculate upon the quantity of manufacturing in specific burghs. It is clear, however, that the lack of archaeological information on industrial activity in, for instance, burghs of barony can not be taken to mean that such burghs lacked a manufacturing base. Indeed, even the repeated excavation of deposits as well preserved as those in Perth has served to demonstrate just how large are the gaps in the archaeological record. The picture of urban manufacturing in the better excavated towns may be more sophisticated than elsewhere, but the available evidence is still extremely limited.

The excavated evidence for urban manufacturing may include professional tools, raw materials, finished and unfinished goods, waste material and other by-products as well as the physical remains of industrial structures. It is, however,

not always a simple matter to identify the industrial processes which were undertaken on or in the vicinity of a site. This is not simply because of the vagaries of deposition, preservation and recovery, but because of the varied organisation of medieval manufacturing and trade. With even the simplest of trades a careful distinction needs to be drawn between the preparation of raw material and the production of finished goods. Raw materials were frequently prepared and marketed in their own right and stock-piles of raw materials without associated processing debris may be the result of trade in raw materials as easily as manufacturing activity. For such finds the question is two fold: where was the material first processed and where was it destined for? To some extent the same is true of finished artefacts: where were they made and where were they used? While discoveries of stock-piles of raw materials or finished goods are rare, it is nevertheless difficult to divorce evidence of urban processing and manufacturing industries from local, national and even international trade in finished goods and semi-processed raw materials. The substantial and extraordinarily complex patterns of trade in goods of all forms and quality make it facile to assume, for instance, that simple goods were made locally and fancy goods were imported from abroad. Each piece of evidence has to be assessed on its own merits and placed on a scale of manufacture which ranges from made in Scotland from native raw materials to the sale of imports made and assembled in foreign parts with foreign parts.

Firm evidence of in situ manufacturing really only exists where diagnostic debris and structural remains occur together so that workshops of specific craftsmen can be identified. Few workshops have been excavated and the majority of industrial remains consist of the discarded produce and waste of industries conducted elsewhere in, or even outwith, the town. Some supposedly industrial structures are only described as such because they do not fit with what is known about domestic features. Much of the structural evidence is in any case too severely fragmented or disturbed by later domestic and industrial activity to permit detailed identification of the processes which had taken place. Useful information on urban manufacturing has, however, been derived from debris which was deliberately or accidentally discarded into closed contexts such as pit groups, confined middens or occupation floors. For instance, while the recovery of isolated horn-cores can not be taken as evidence for organised hornworking dumps of horn-cores almost certainly can be. However, as the horn-cores may have been collected from urban fleshers and tanneries or imported from rural communities for working in the town, their full significance only becomes apparent when compared with the pattern of larger skeletal assemblages of the excavation and then of the town as a whole. The distribution of debris is of particular importance for those activities, such as cobbling, weaving or tailoring, where workshops and industrial yards involved would not have produced archaeologically identifiable structural remains.

The recovery of a certain amount of residual debris which has been deposited and redeposited in dumps and middens elsewhere in the town is an almost inevitable factor in intensively occupied urban sites. While such debris can indicate something of the range of industrial activity which has taken place elsewhere its value is limited especially as such evidence is normally restricted to more robust forms of debris such as slag, bone, or pottery wasters. Only occasionally does the working of such debris indicate the type of object being produced, and more commonly it is only possible to determine the material being processed.

The Documentary Evidence

Prior to the sixteenth century documentary sources for the study of the Scottish medieval town tend to be scattered and fragmentary and the written evidence for Scottish urban manufacturing is no exception. Before the fourteenth century what written evidence there is for industrial activity comes from surviving charters and a small number of law codes of sometimes debatable antiquity. Fortunately the range of information improves steadily from the end of the thirteenth century with the survival of the Exchequer Rolls (ER) and in the late fifteenth century the start of the Accounts of the Lord High Treasurer (TA). Copious documentation for burgh life is not however available until the proliferation of urban records in the later sixteenth century. The significance and use made of these three groups of material is detailed below, but the basic

approach to them all has been to demonstrate the full range and quality of information available from documentary sources, without becoming bogged down in a largely repetitive catalogue of the evidence. Such a catalogue would in any case tend to misrepresent the importance of high value industries while passing over the more basic work of the majority of urban craftsmen. It should also be noted that thanks to the quality and subject matter of the printed sources it has been possible to do this without undertaking major work on manuscript sources.

From their first appearance at the very end of the eleventh century, until the fourteenth century, virtually the only documentary evidence on the taxation, organisation and inhabitants of the burghs were charters confirming the granting of property and legal rights. Unfortunately while charters to individual burgesses existed from an early date, their survival has been dependent on the property to which they relate passing with its title deeds to a religious house. Most of these charters have been printed in publications by the various Scottish history clubs of the nineteenth century whose work is catalogued in Terry, C S A Catalogue of the Publications of Scottish Historical Clubs (Glasgow 1909), continued by Matheson, C A Catalogue of the Publications of Scottish Historical and Kindred Clubs 1908-1927 (Aberdeen 1928).

Many more crown charters would have been engrossed on rolls, but as a result of Edward I's intervention in Scottish government, the earliest surviving royal charter

rolls date to the reign of Robert I. There are also later gaps in the series, especially before 1424. Such as they are, these records are available in print in the Register of the Great Seal (RMS) with full texts in the first volume and abridgements in the others. A number of these and earlier charters do, however, provide invaluable information on the trades, privileges and properties of individual craftsmen burgesses. Detailed work by other researchers on fourteenth-century charters has demonstrated the value of such documents to the study of Scottish urban society (Ewan 1984). The charter evidence is however predominantly concerned with royal and ecclesiastical burghs and as with so much of Scottish economic history, the range of activity in secular estates and burghs of barony has to be extrapolated from what is known to have been normal practice in the holdings of church and king.

Many of the surviving early charters were issued by the king to his burgesses and other vassals, although it became increasingly common for other institutions and individuals connected with towns to confirm or grant rights in this way. Among the most important of these are the handful of charters in which the king stated the privileges and regulations of individual burghs. The earliest of these are printed in the Regesta Regum Scottorum (RRS) while many more appear in a variety of other collections (Lanark Recs.; Ayr Burgh Chrs.; Abdn. Chrs.; Glas. Chrs.). The important Dumbarton charters only survive as copies in a seventeenth century confirmation to be found in the Register of the Great Seal (Duncan 1975a 644). Few such

early charters were issued or survive and the main indicator of burgh status tends to be the use of the phrase 'my burgh of X' in charters confirming property in these towns to other organisation, usually religious houses (Pryde 1965).

Closely related to crown charters establishing the rights of individual burghs are the Leges Quatuor Burgorum which have in the past been thought of as closely based on the customs of Newcastle-upon-Tyne and drawn up during the reign of David I (Leges Burgorum). More recently it has been argued that they are in fact a compilation from various sources made over a period of time (McQueen & Windrum forthcoming). These laws have therefore to be used with caution, but in conjunction with the burgh charters and other fragments of early legal codes they do provide an outline of emerging burgh and mercantile law of the later twelfth and subsequent centuries. These various laws are published in the Acts of Parliament of Scotland (APS) and also available in the Scottish Burgh Record Society's two volumes on burgh customs and laws (Ancient Burgh Laws).

For convenience all references to these laws cited in this work make use of the Scottish Burgh Record Society's publications. The second volume of the Acts of Parliament, beginning in 1424, also records a stream of legislation about manufacturing and trade in towns but as with the earlier legislation this needs to be seen for what it is, the legislated ideal and not necessarily normal practice.

The Exchequer Rolls do provide some firm examples of urban

manufacturing as well as a wealth of essentially statistical evidence for urban trade and taxation which can be more difficult to interpret. Although Exchequer records are known to have been kept from at least 1180 they survive only sporadically from 1264 with a more regular series beginning in 1326. These records are published as they survive from 1264 and in an abridged form from 1379. The Exchequer was primarily concerned with auditing the revenue raised throughout the kingdom to which the burghs contributed an ever-increasing portion. The majority of the king's urban revenue was by this time derived from customs and ferms, the origins of which date back at least to the reign of David I. The Exchequer Rolls, however, reveal little of the crown's original sources of urban income the main evidence for which are references in early charters to personal rents, petty customs, the 'cain' or custom of ships and tolls.

The main function of the Exchequer was to audit expenditure made by the king's officers from the funds they collected or were credited with. This part of the accounts is of special interest in the present context as many of the entries record the crown's expenditure in the burghs. The variety of these expenses and the detail provided varies enormously from year to year and their value to this study is highly dependent on the nature of the goods, and the thoroughness of the clerks. A major change in the content of the Exchequer Rolls also follows upon the establishment of the Treasurer's post during the reign of James I. The Treasurer was made responsible for the collection of the

majority of casual payments due to the crown. The Treasurer's Accounts survive and are published with short gaps from 1473/4. The availability of these new accounts is however a mixed blessing. A great deal more information becomes available about the king's immediate household, but as a result of the separate accounting for the king's household the Exchequer Rolls become less informative about the management and variety of royal expenditure on non-household requirements, especially in those burghs without major royal residences. The Treasurer's Accounts almost certainly reflect a real concentration of mercantile wealth and patronage of the trades which took place in the late fifteenth century. However, the sources both create and compound the historian's perception of the importance of Edinburgh, Leith and a handful of other major burghs and it becomes increasingly difficult to assess the function of smaller burghs at this time.

Another element in the documentary record which is only available from the late fifteenth century, are port books and trade registers. Prior to their appearance the main documentary evidence for maritime trade consisted of gleanings from the Exchequer Rolls and Treasurer's Accounts as well as English and other foreign sources. The main use of these new sources has been in the assessment of shipping routes and trade patterns. However, specific port books and ledgers also record details of the goods being shipped in both directions. Most of these are in print, including the earliest kept by Andrew Halyburton, the Scottish Conservator in the Netherlands between 1492 and 1503.

These records are also an important source of information on the requirements and produce of Scottish manufacturing, but as recent work has shown, they do not indicate the complete range of Scottish exports and imports in the late fifteenth and sixteenth centuries and they have to be used with caution (Stevenson forthcoming, Ditchburn forthcoming). Moreover, so little is known about earlier trade patterns that it is not possible to say whether the trade recorded in these fifteenth- and sixteenth-century sources was representative of earlier merchandise and trading links.

Detailed documentation for the organisation and activities of local craftsmen only really becomes available in the sixteenth century. Indeed one of the main problems with later sixteenth-century documentation for the burgh is its profusion, and this is reflected in the assortment of individuals, publishing clubs, local history societies and institutions which have more or less competently printed selections of their local archives. A vast wealth of information resides in these records but again only a small proportion is specifically relevant to the hard physical, as opposed to social and political, aspects of manufacturing. Nevertheless, from the various documentary source types discussed here it is clear that this is the category which has been most under-used. Many of the reasons for this have been discussed by Ian Flett in his recent analysis of the general difficulties posed by both the printed and manuscript sources from the burghs (forthcoming). These range from editorial problems in the

case of published works to palaeographic difficulties with the original manuscripts, but the main difficulty is their sheer bulk. Any serious analysis of these sources would have necessitated major programmes of research of their own. Fortunately a certain amount of this type of research into guildry, treasury, trade incorporation and other burgh records has been and is being carried out for a few of the burgh collections. Where possible and appropriate this work has been incorporated here along with the more accessible printed sources (Booton forthcoming; Lynch 1981, 1986 & forthcoming).

The Technical Evidence

No manufacturing process appears in its entirety in the archaeological or documentary record. The craftsman's skills at trading and labour have to be extrapolated from those parts of his work which have left some trace in script or soil. An integral part of the interpretation of such evidence is, therefore, the recognition not only of the manufacturing process which is directly represented but also any preparatory or subsequent working which may have been necessary before the material could be traded or the artefact finished and sold. It is only through such analysis that the importance to the urban economy of the preparation or part-working of materials and artefacts becomes apparent. The basis for such interpretive analysis is, in the first instance, archaeological and documentary evidence from related processes carried out elsewhere in Britain or abroad. However, all such interpretative models

are heavily dependent on what is known about medieval and post-medieval materials and technology, the main sources for which include modern physical and chemical analysis of the remains, and what contemporary writers themselves had to say about the technology they had seen in use or heard and read about.

The identification and sourcing of the materials used is the starting point for virtually all research into manufacturing. The formal identification of naturally occurring materials tends, however, to be conducted along significantly different lines from that employed in the recognition of man-made materials. The recognition of naturally occurring materials used in manufacturing is normally based on an object's visually identifiable botanical, zoological or geological attributes. In contrast man-made materials are usually classified on the basis of their identification and/or chemical composition. Sourcing of these materials follows on from their identification. For naturally occurring materials this is relatively easy as their occurrence in medieval times is usually much the same as it is today. In contrast man-made materials may have undergone several stages of manufacturing and recycling before they appear in the historical or archaeological record and it is desirable to know not only from where the raw materials were collected but also where any previous processing was carried out.

These fundamental differences between man-made and naturally occurring materials are reflected in the way in

which industrial assemblages from excavations are normally reported on. They have also led to the division of part three of this research into animal-, vegetable- and mineral-based industries. The problems of identification and sourcing also mean that detailed work on specific materials tends to be carried out by specialists with a background in the relevant science, for instance, zoology, botany or chemistry. One result of this is that while assemblages which have an obvious industrial association are likely to be commented upon by the specialist concerned or the excavator or both, more latent aspects of manufacturing, which are particularly common in the case of naturally occurring materials, are often passed over without a proper discussion. For instance, while species identifications and kill-off patterns for domestic animals are recorded as a matter of course, there has been little detailed study of urban bone assemblages to investigate butchery, preserving and cooking techniques. Part of the problem is that in the case of naturally occurring materials a major programme of standardised analysis is required before the normal domestic patterns of distribution can be recognised and the significance of not only positive but negative evidence appreciated.

Evidence for those industries involved in the manufacture and use of man-made materials differs substantially from the situation with naturally occurring materials. Not only is it normally easier to distinguish between domestic and industrial processing, the available evidence is nearly always positive. Although the full sequence of

manufacturing is unlikely to be evidenced directly, information on any previous phases of work is usually inherent in the archaeologically recovered debris or products. The task of the specialist or finds reporter should be to extract this evidence and if possible trace something of the history of the object's manufacture. However, in practice, the description and discussion of finished artefacts more often than not only involves the typology and chronology of the pieces rather than their history of manufacture.

Fortunately some progress has been made in recent years towards building up a corpus of information on the composition of non-ferrous alloys and it is now becoming normal practice to have any crucible fragments and a selection of non-ferrous metalwork analysed to determine qualitatively the composition of the alloys available. The normal technique of non-destructive testing of metal alloys employed in Scotland at present is X-ray fluorescence spectroscopy, much of which has been carried out by the Research Laboratories of the National Museums of Scotland. X-ray diffraction analysis on related industrial debris has also been carried out by Dr Slater of Glasgow University, Department of Archaeology. The results of their work have been published in their own specialist reports and as part of wider assessments of industrial activity on specific sites by myself and others. Information on the casting and working technology of medieval 'bronze' smiths is therefore gradually becoming available, but given the extremely poor state of our knowledge about the exploitation of mineral

resources in Scotland, it is rarely possible to identify the source of the raw materials used.

Much the same situation exists for ferrous smithing, although in recent years several urban smiddies have been excavated and more systematic attention has been paid to smithing debris in the towns. Dr Slater has also undertaken X-ray diffraction analysis of various selections of this debris and her results have been incorporated in several specialist reports on smithing and bloomery debris by myself. However, the origin of the iron remains problematic and the date range and trading connections of the numerous rural bloomeries making use of bog-iron is still essentially unknown.

The only other medieval man-made material to have received any detailed analysis has been glass. What little work there has been on the composition and colouration of Scottish medieval glass has been carried out by Dr Tennent, formerly of Glasgow Museums and now a research fellow of the Chemistry Department of Glasgow University (Tennent et al 1984; and in Graves 1985). Further results of his examinations are expected as specialist contributions to forthcoming site reports.

As with naturally occurring materials, however, compositional analysis is not undertaken as a matter of course and these techniques are normally only employed where the excavator or specialist believes there is structural or some other associated evidence of

manufacturing. Likewise, it is still unusual for detailed analysis of manufacturing technology to be undertaken unless waste or raw material is also incorporated in the finds report. X-ray photography is frequently undertaken as an aid to identification of corroded iron objects, but only rarely as an aid to examining the construction of metalwork. Likewise hardness tests have not normally been carried out on tools from Scottish urban excavations, with the result that little is known about the use of steel or carburisation of iron tools.

There are a wide range of medieval and post-medieval texts which describe aspects of the preparation of raw materials, and the manufacture of goods. Their original purpose, authorship and readership varied enormously and this is reflected in their subject matter as well as in the quality and accuracy of their descriptions. It is one thing to describe a process you have only heard about to a patron who has no intention of carrying out such work, and quite another to describe a familiar process to future practitioners. Yet identifying the accuracy and purpose of these texts is by no means easy. The author's knowledge and even purpose often varied from subject to subject. Personal experience could be laced with transcriptions from more or less well understood Classical or Arabic texts in order to demonstrate the depth of the author's knowledge and to make the text fit more comfortably into the genre of technical treatises. Not only does this make it difficult to review the technical skills of the individual writer, it is often uncertain whether or not the work they describe

represents innovatory, contemporary or Classical technology and practice. Finally, even if it is possible to be assured that the technology described would actually work, it is necessary to relate it to other documentary and archaeological evidence in order to discover if such processes were at all commonplace in Europe and Britain.

Despite these and other difficulties, such as their sometimes fragmentary state, the treatises do provide an indispensable guide to some contemporary attitudes to manufacturing as well as the practicalities of specific processes. Fortunately a number of the more important manuscript and printed treatises are available in English translations. Of these, those which are referred to in this work include; the ninth-century Mapae Clavicula (Smith & Hawthorne 1974), the twelfth-century De Diversis Artibus by Theophilus (Dodwell 1961) and several later books such as Biringuccio's Pirotechnia printed in 1540 (Smith & Gnudi 1942) and Agricola's De Re Metalica first printed in 1556 (Hoover & Hoover 1912).

Many of the later treatises, including Biringuccio's Pirotechnia and Agricola's De Re Metalica, were carefully illustrated with detailed and annotated wood-cuts which provide invaluable two dimensional records of the materials and equipment used in many of the technical processes described in these texts. Various illustrations from medieval and post-medieval books of a non-technical nature also help to demonstrate something of the diversity of manufacturing and food processing work. Of particular

interest are illustrations of Nurnberg craftsmen from the late fourteenth to the sixteenth century to be found in the Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg (Treue et al 1965). A selection of these illustrations have been included in volume 2 of this thesis. Further illustrations of German tradesmen appear among the sixteenth-century wood cuts of the Standebuch of Jost Ammand (Rifkin 1973). The same cautionary warnings apply to the use of such illustrations as have been noted for technical texts, but even the more dubious of such illustrations always seem to retain a certain significance, while the better drawings assume unique importance as illustrations of actual working postures and practices.

The detailed discussion of Agricola's work by the Hoovers illustrates at length a difficulty common to all translations of medieval and post-medieval texts which include technical information, namely the lack of a suitable terminology. This was a problem that Agricola himself recognised and in his other writings, most notably De Natura Fossilium (Bandy & Bandy 1955), he dealt at length with the problems of geology and the classifying and naming of materials. Valuable as his work was, the development of modern chemistry has completely changed the taxonomy of materials. As a result the majority of medieval and post-medieval terminology can not be translated directly into English, either because they can not be identified at all, or because to use modern terminology would be to define them too tightly. There is, moreover, a danger that translators might have used their

knowledge of the components or ingredients necessary for a particular process to 'aid' their translation of less easily recognised materials. This inevitably divorces the reader from the knowledge of the original author, and translations which accurately reflect the original authors concept of the materials he used are necessarily rare.

The relevance of such treatises and illustrations to the use and development of technology and manufacturing in Scotland is difficult to assess. Almost certainly the main method of communicating innovative technology was to import the technicians themselves. One of the major features of urban manufacturing was, from the twelfth century on, the charters confirming the privileged position of certain foreign craftsmen sponsored by the king. Both foreign and Scottish craftsmen involved with man-made materials were working within the technology and genre demonstrated by the treatises. Moreover, a small number of such works is known to have been available in Scottish libraries during the sixteenth century and their place amongst the theological and Classical works in print at this time has been catalogued by John Durkan and Anthony Ross (1961). Our modern knowledge of their number and variety is almost certainly under-representative of their original availability, and something of the wider interest which existed, particularly in alchemy, may be gleaned from Singer's Catalogue of Latin and Vernacular Alchemical Manuscripts in Great Britain and Ireland Dating before the Sixteenth Century (1928).

Foot note:

The 39 burghs in which excavations have taken place in up to and including 1987 are: Aberdeen, Arbroath, Ayr, Crail, Cupar, Dumbarton, Dumfries, Dunbar, Dundee, Dunfermline, Dingwall, Edinburgh, Elgin, Eyemouth, Falkirk, Forfar, Glasgow, Inverkeithing, Inverness, Jedburgh, Kelso, Kirkintilloch, Kirkwall, Lanark, Leith, Lesmahagow, Linlithgow, Melrose, Montrose, North Berwick, Old Rattray, Paisley, Perth, Pittenweem, Rothesay, St Andrews, Scalloway, Stirling and Whithorn.

Chapter 2

Urbanization, Manufacturing and Archaeology

The urbanization of medieval Europe is a long standing topic of debate which, over the years, has attracted the attention of historians, geographers, archaeologists, economists, sociologists and ethnographers. One consequence of this has been a profusion of definitions of 'urban'. Most of these fall into one of two main categories which Schledermann, a major contributor to the urbanization debate, termed 'synthetic or conceptual' and 'classifying' (Schledermann 1970 119-20). Conceptual definitions often consists of wide ranging check-lists of all the social and physical attributes of a town, for instance, a town must have a market, a certain density of housing, be the centre of regional government and so on. Classifying definitions tend to be more pragmatic and are designed to test or cope with specific combinations of evidence such as the relationship between size and regional function or the differences between urban and rural demography.

Many urban historians, geographers and archaeologists have arrived at more or less avowed conceptual definitions of what they mean by a town. Conceptual definitions have, however, proved notoriously difficult to commit to paper. Few have been adopted unanimously, even within a single discipline, and none has been produced which could claim multi-disciplinary acceptance. Conceptual definitions

nevertheless provide a framework within which more source-specific studies, along with their associated classifying definitions, may be fitted. Many of the difficulties associated with defining and analysing towns stem from the diversity of sources used by urban historians, geographers and archaeologists. The component elements of any human settlement; the people, their choice of location and the physical manifestation of their activities, may all be investigated by a historian, geographer or archaeologist but the emphasis given to each element tends to vary according to the sources and research topics being examined. Considerable overlaps of interests nevertheless occur and developments in one field of urban studies frequently influence those in another. At times this can give the appearance of individuals from different disciplines laboriously re-inventing the wheel. An archaeologist has, for instance, required the population of Iron Age 'oppida' or hillforts to include:

'a significant majority... occupied in non-agricultural pursuits, such as administration, trade and manufacturing' (Nash 1976 95);

while a documentary historian believes a medieval town should have:

'a significant proportion (but not necessarily a majority)

of its population [who] live off trade, industry, administration and other non-agricultural occupations' (Reynolds 1977 ix-x).

In many ways it is reassuring to find such consensus, but the nuances of different classifying definitions provide a

guide more usually to the variety rather than to the unanimity of urban studies.

Documentary History

Historians have tended to concentrate on the political, social and economic documentation of urbanization. In particular they have looked at the legal status and origin of towns and their occupants. All of these elements are reflected in the classifying definitions and approaches advanced by historians. It was Bloch who, with his usual perceptiveness, explained the urban historian's emphasis on town people when he pointed out that the dominant characteristic of the town was that in a world of farmers, soldiers and churchmen, the burgess lived by commerce (Bloch 1961 353). This simple truth has been widely accepted as the key to many aspects of medieval urbanization and documentary historians have increasingly come to regard the social and economic attributes of town life as being their dominant concern. However, the formal nature of much of the early documentary evidence about towns and town life has inevitably meant that historians' have had the additional task of considering the legal status of urban communities and individual burgesses.

As a result of their concern with social, economic and legal matters, documentary historians have been able to throw considerable light on the function and privileged status of medieval urban communities. The foundations of this approach, which were laid in the 1920s and 1930s, are

particularly worth summarising here because the interest that was taken at that time in the legal and economic history of towns has also influenced the work of European geographers and archaeologists. The nub of the issue lay with how historic towns should be defined and whether there was any continuity in spirit or in substance between the towns of Roman and post-Roman Europe, a question which archaeologists have still not entirely left behind.

The 'Romanists' of the 1920s and 1930s tended to emphasise the continuity of urban life from Roman times through to the advent of medieval chartered towns. An adjunct to their theory was that medieval towns located beyond the Empire were believed to be planted or new towns, the model for which had been derived from Roman examples. The hierarchical status of different Roman towns led the 'Romanists' in particular to emphasise the importance of the legal definition of medieval towns and, in particular, the privileged status of burghs (Stephenson 1933 3-21). The second and largely conflicting theory was propounded by Pirenne who believed that the economic collapse of the Roman West was so complete by the eighth century that no continuity of urban life was possible. Episcopal 'cities' maintained a pretence of continuity, but in practice the old economic structure had been swept away and, despite their annual religious and trade festivals, such centres were not truly urban. These 'cities' and the more numerous smaller defended farmsteads or 'burgs' were simply the principal parts of rural communities. It was only with the revival of trade in the tenth century that first merchants

and then artisans with primarily non-rural functions could begin to operate. For Pirenne the medieval town was rooted in these small trading and manufacturing settlements which commonly began as a stockaded quarter beside pre-existing fortifications or within the diocesan 'cities' (Pirenne 1925).

Urban historians in Britain have found it difficult to resolve these two arguments, not least because documentary evidence for or against continuity is extremely sparse. However, in more recent years, Pirenne's arguments have been taken up by economic historians and archaeologists such as Hodges and Whitehouse and widened to incorporate the views of anthropologists and others in an attempt to understand the social mechanics of urbanization (Hodges 1982; Hodges & Whitehouse 1983). At a theoretical level some headway has been made, particularly in identifying the importance of the trading emporia in the process of economic centralisation. Arguments over the attributes of such centres persist, however, especially when the inhabitants of most emporia were directly involved in agriculture and, where practised, many specialised crafts were seasonal activities. Contemporary opinion as to the rural or urban status of a settlement remains therefore an important criterion, and historians have continued to put a premium on suitable documentary terminology and legislation. In the Scottish context, this has meant the focus being on burghs not towns. However, legal documents do not always reflect the true function of a settlement. There could be and were, towns without charters, and

charters without towns. Fortunately most references to burghs which appear in Scottish charters are to established rather than planned towns, even so there is often a need to define more precisely from other sources the nature of the settlement and its function.

The essentially military nature of the Roman occupations of Scotland means that Scottish historians have been denied direct access to the Romanist argument for continuity of urban life. However, Scottish urban historians have closely followed their English counterparts and tacitly built on the second plank of the Romanist argument by concentrating on either chartered or planted towns.

Scottish historians have come to accept the probability of there having been earlier settlement on the sites of many burghs, but they have had to pass over post-Roman references to civitas and urbs by, for instance, Bede and Eddius precisely because both the quality and scale of the settlements in question are unknown from any other sources (HE i 25, 138, 158-9, 243, 262; LW 72, 76). There are in any case no further instances of this type of terminology being used to describe settlements in Scotland until the twelfth-century when references to royal and episcopal burghs begin. There is a certain irony in this approach to Rome's influence on urbanization in Scotland, for if either of the two main theories of urbanization have a bearing on the Roman occupation of the region it is Pirenne's. The scale of the military presence in Scotland meant that many of the more permanent forts attracted merchants and artisans to the relative safety of settlements outside

forts, as at Newstead near Melrose, in exactly the same way as Pirenne described for fortified sites in tenth-century Europe. The fate of such settlements was directly tied to that of the military occupation, but Roman involvement in the native economy may have continued, at least in southern Scotland, for longer.

There is, of course, considerable historical justification for the association of urbanization in Scotland with the legalisation of burghs. It is clear that the twelfth century was a time of dramatic economic, political and legal advance in Scotland, as it was for many parts of north-west Europe. Hand in hand with these advances went major advances in urban organisation and terminology which are likewise documented across much of Europe. The introduction of the term 'burgh' into Scotland has been most associated with the time of earl, later king, David I's administration (1119x1124x1153). The reasoning behind this association is to a large extent that prior to David I there are no surviving documents relating to Scottish settlements which make use of the term burgh whereas after his accession, having had experience of various English town as Earl of Huntingdon, the term came gradually into common use. It is perhaps wrong to assume that the concept of what constituted a burgh was not already understood in Scotland, but David I's use of the term 'burgh' seems to have been more than just a cosmetic addition to existing urban or proto-urban settlements. He involved himself in the wider urban movement sanctioning the burgh laws and statutes which formed the basis of the burgh charters

issued by his successors (RRS 1 No 475). David's burgh legislation was comparable to that introduced on the Continent and English boroughs from where, indeed, their basic forms were derived. David's 'establishment' of the burghs can not, therefore, be seen in isolation from wider progress towards clearly defined urban communities, nor should it be differentiated from the other fundamental changes he wrought in the nature of kingship and government in Scotland. David was, for instance, the first Scottish king to mint his own coinage, and above all he greatly accelerated the rate of settlement of English and Continental retainers as knights on his land and burgesses in his towns.

The importance of the burgh is writ large in the urban documentation of the twelfth and early thirteenth centuries. The early royal charters recording the existence of burghs were not issued to corporate bodies but to individual burgesses or religious houses holding burgh properties or rights. Many of these burgesses were clearly men of considerable substance. In 1160 Berowald the Fleming held both a toft in Elgin and land in the surrounding district for the service of one knight in Elgin Castle (RRS i No 175). It is also likely to have been the king's senior burgesses who established what may have been a trading community or 'hanse' among the towns of Aberdeen, the Moray Firth and north of the Mounth. The precise nature of this hanse is uncertain, but whatever its exact meaning William I's confirmation of its existence was specific to his burgesses acting in partnership, and other

than the principal burgh of Aberdeen, their burghs of residence were of secondary importance to their status as his burgesses. For the major religious houses the need was to gain entry to this type of personal connection and if possible to do so with royal protection. Thus when the bishop of St Andrews gained burgh status for his town and market, he also ensured that there was in his burgh a leading royal burghess from Berwick, Mainard the Fleming, with the necessary foreign contacts and experience to involve local merchants and artisans in organised burgh trade (ESC No 169).

The apparent status of foreign merchants within the early burgh communities fits well with Pirenne's emphasis on the revival of long distance trade as a key element in the development of urban settlement. The distribution of the first burghs would also tend to support his other premise, that they would be located beside earlier fortresses. The principal contenders for this are Edinburgh and Stirling, but the pattern of association between ancient royal residences in demesne land and royal burghs is even stronger. Edinburgh and Stirling were both centres of demesne land as were Haddington, Perth and Aberdeen, while Berwick, Coldingham, Crail, Culross, Dunfermline, Kinghorn, Linlithgow and others were all centres of established shires (Barrow 1973 7-68). No doubt such settlements did have a defensive military function, but the Scottish situation would suggest that equally important reasons for raising such established centres to the status of burgh were economic and administrative, and that they may have

fulfilled these functions for some considerable time (Spearman forthcoming in Driscoll & Nieke).

Pirenne also acknowledged the importance of other centralised activities, notably regional government and industrial manufacturing, in the revival of urban life. However, he saw administration as a function of state government not towns, and urban manufacturing as a product not a cause of trade. Other historians have placed greater emphasis on the administrative, political and social development of the burghs, but relatively few have addressed in detail the problem of which came first, trade or manufacturing. The mere fact that such problems exist indicates that the interaction of trade and industry, and the part played by government in that interaction, is more complex than this brief review might suggest.

Nevertheless, the emphasis given by documentary historians to the importance of trade and administration, and not manufacturing, in the re-birth of towns does not adequately reflect all the documentary evidence nor the geographical and archaeological evidence. Early charter references to individual burgesses also underscore the importance attached by the king and other estate owners to having access to specialist and even quite basic craftsmen with burgess status. It was not just merchant burgesses who were enticed into David I's burghs. A clear example of such a specialist being encouraged to establish workshops in the king's burgh is Baldwin the Lorimer who in the mid twelfth century was granted a toft in Perth free of all burghal services save for watch within the burgh and ward

of the burgh wall in proportion to his holding. His rent to the king was to be paid in the products of his craft, one terret and two collars, annually (RRS i 186-7 No 121). At a more basic, but nevertheless important, level the canons of Scone were eager to gain the king's permission for their own smith, skinner and tailor to have equal status with the burgesses of Perth (RRS i 263 No 169).

Such specific examples of the early association of manufacturing and urban development have not, of course, gone unnoticed by urban historians. However, it has been difficult for purely documentary historians to place the manufacturing information contained in such charters into a wider artefactual context. The main thrust of urban historical analysis has necessarily been with the much more numerous records of royal and burghal legislation and taxation and the formal records of merchant guilds and craft incorporations. Except where the more prestigious, and hence noteworthy, industrial processes are concerned, evidence of urban trade and manufacturing does not normally appear in such sources. Information on the work of the majority of urban craftsmen appears only by chance or implication amongst the records of more elaborate purchases or building works. It is difficult to avoid the conclusion that the practicalities of manufacturing which lie behind the records of urban legislation, taxation and trade have not received, indeed cannot receive, the attention they deserve from a purely documentary approach.

Geography

Over the last fifty years geography has emerged as a major contributor to the subject of urbanization. Urban geography has developed through the study of both individual town-scapes and functions and the regional interaction of town and country. As a result it has become axiomatic for geographers that choice of urban location and subsequent growth is determined by past and present urban functions. With certain notable exceptions geographers have, however, concerned themselves with the practicalities of modern urban planning and government rather than the historical development of towns. In helping to solve these problems geographers have made use of census and other statistical information, of a quality and detail un-heard of in any historical context. Despite their novelty, some of the techniques and definitions developed by geographers for their study of modern cities are nevertheless applicable, albeit in a simplified form, to the study of earlier towns. As a result techniques for the analysis of medieval and earlier towns have been produced which historians and archaeologists, left to themselves, would not have developed. Of particular importance has been the basic approach of geographers to defining their sphere of interest.

From an early stage urban geographers rejected the documentary historian's definition of urban status as being achieved by a specific phase or form of settlement. While accepting that not all hamlets become cities most geographers nevertheless view villages, towns, cities and

the great metropolitan conurbations as essentially a continuum of interrelated settlement with only regionally identifiable historical phases. They have concentrated on analysing the processes of urbanization rather than the urban attributes of individual settlements frozen in time. Robert Dickinson was one of the first urban geographers to examine the continuum of medieval and modern urbanization in Western Europe (Dickinson 1947). Although predisposed to Pirenne's arguments about the importance of trade in the urbanization of defended settlement nuclei, he rejected both Pirenne's and the Romanists approach to defining what constitutes a town. Dickinson argued that while it was certainly possible to identify the characteristics of fully fledged medieval towns such definitions were only applicable to the areas and settlements selected. If applied elsewhere the same definition could be quite inadequate and untrue. The main reason for this was, he noted, that individual attributes of the fully fledged town occurred in other settlements as separate elements such that there could be no clear-cut distinction between the two. There were medieval towns without walls, and even without markets, while some villages had walls and others crafts and tradesmen without any urban constitution (Dickinson 1959 14).

A different approach to the study of urban settlement was therefore called for and many geographers have seized upon regional functions, not size or administrative status, as the essential criteria of true urban character. In particular geographers have concentrated their study on the

economic functions of towns, rather than any governmental or cultural activity. Although all such functions affect the physical and locational appearance of towns it is normally a town's economic role which is most frequently and strongly expressed in patterns of land use and occupational features. For their own reasons geographers have, therefore, been in broad agreement with Pirenne's views on the importance of urban economics. However, geographers have tended to extend Pirenne's argument by regarding manufacturing as an urban function in its own right and not merely a consequence of trade.

One reason for this interest in both manufacturing and trade has been the concern of planners and geographers to understand the reason why towns thrive or decline. They have seen the urbanization and industrialisation of communities as a circular and cumulative process. Such theories emerged in part from the analysis of urban growth during and after the Industrial Revolution but they were also based on the belief that the progression from simple to complex economies was largely made through the specialisation of labour. Within this progression towns have been seen as nodal points of specialized activity, where skilled craftsmen carry out tasks best performed in centrally accessible places and for which a high degree of population concentration is an economic necessity. The agglomeration of manufacturing skills and markets provides in itself a climate of innovation resulting in new or enlarged industry, fresh markets and economic growth (Pred 1966).

Economists and geographers have developed these arguments into a study of what they have termed 'basic' and 'non-basic' urban activities (Alexander 1954 246-61). Those trades producing goods or services for export out of the urban area are seen as the basic or 'city-building' activities which bring into the community purchasing power from outside. Conversely goods and services which are consumed within the urban area are regarded as the non-basic 'city-serving' activities. Once again this concept has been developed using relatively comprehensive modern manufacturing and employment statistics, but it provides a useful means of examining the function of medieval craftsmen and merchants in terms of urban growth. For instance, the basic non-basic argument places trade in exotic imports in a slightly different light from that in which it is usually seen. While individual merchants might prosper from trading in foreign goods, imports are only the indicators, not the basis, of either regional or urban growth.

The forces behind urban growth are in part explained by extending the basic non-basic economic arguments to the regional functions of towns and the interaction of regional centres. Towns clearly did not, and do not, exist as self sufficient units, they provide a variety of services for their surrounding areas in return for which they receive, directly and indirectly, various forms of sustenance. The economic basis for a town may therefore be defined spatially as its hinterland, but it is not simply a

question of rural communities sustaining a central urban community. The occupants of an urban hinterland will also wish to derive their own basic and non-basic benefits from supporting a central settlement. Geographers have defined and debated the regional function of urban communities at some length, the three principal aspects being:

1. Central place functions of a general nature which are carried out for a more or less extensive but contiguous area by the principal settlement of a region.
2. Special functions which are carried out for non-local non-contiguous areas. These could include extractive and manufacturing industries with world wide markets, or indeed minor industries whose distributive areas are smaller than the general service area.
3. Transport related functions, which are carried out at break of bulk points along lines of communications, the importance and specialisation of which being dependent upon the significance of the trade route (Carter 1972 48, 64).

Manufacturing and trade are therefore seen as strongly related to the regional role of urban settlements. Indeed the extent to which any given urban manufacturing activity serves the town and its hinterland has been taken as a measure of the relative importance of that activity as an urbanising force. However, the arguments as to what constitutes an urban hinterland or region are almost as complex as what is urban and what is rural. The hinterland

of all urban markets, especially those on major trade routes, were potentially different for each commodity manufactured in or traded through the town. These variations reflect the value and nature of the commodities, the costs of transportation and the influence of political control. The simplest interplay of these factors results in a hierarchy of local hinterlands (Carter 1972 72-141).

The recognition of towns as regionally important settlements with a hierarchy of functions and hinterlands has been central to the geographical study of urbanization. Many studies of the distribution and function of such 'central place' settlements have appeared from the pens of historians and archaeologists as well as geographers. The study of central place functions has had the major attraction of involving regional patterns of settlement and not just recognised urban communities. However, its application is far from straightforward. The number and complexity of central place functions is assumed to vary with the size of the settlement and with the nature of the areas serviced. However, in order to demonstrate an interaction and hierarchy of settlement, geographers dealing with modern settlement patterns have found it necessary to weight the evidence. It is, for instance, particularly necessary to distinguish those places which derive additional statistical importance from political or historical accident or servicing natural resources or being located on trade routes connecting major sources of raw materials with markets. In short the mapping of central places is a tool of analysis not definition.

Archaeology

Although artefactual and, to a lesser extent, stratigraphic remains discovered below modern towns have long excited speculation among urban historians, systematic urban archaeology in Britain really began during the 1960s with the work of Biddle and others in Winchester. It is a reflection of both the quality and potential of urban excavation that in the twenty years since Biddle lamented the lack of both urban excavation and an inter-disciplinary approach to urban history, archaeology has made a substantial contribution to the subject of urban history both in Britain and abroad (Biddle 1968 109-16). Some of the practical and theoretical developments of urban archaeology over the years have been summarized in collections of essays and research reports published by the Council for British Archaeology (CBA) and others. One of the earliest of these reports examined the threat posed by urban redevelopment to the archaeology of historic towns in England, Wales and Scotland (Heighway 1972). Roman towns were not considered in detail although 'major urban centres of the Roman period known to lie under existing towns' were included (Heighway 1972 12). At an early stage in this document the authors found it necessary to establish the bounds of their interest in British urbanization. For political as much as academic reasons they chose to attempt a conceptual definition along the lines advanced by Schledermann (Schledermann 1970 115-27). In practice what they produced was a check-list of attributes drawn from

documentary and geographical definitions to most of which archaeology might hope to contribute additional information (Heighway 1972 8-9). Fulfilment by the settlement in question of more than one of these criteria established it as a town of archaeological interest; exceptions were, of course, permitted. The criteria established in 1972 have had a considerable influence on the interests of urban archaeologists in Britain. They consisted of: perimeter defences, a planned street system, a market, a mint, legal existence, a central position within a communications network, a high density and size of population, a diverse trading and manufacturing base, burgrave property layout, social differentiation, complex religious organisation and, regional judicial functions.

Despite the restricted purpose and interest of the original work, this type of check-list definition, and the approach it encapsulates, has remained popular among English medieval urban archaeologists. It was directly repeated by Biddle as a definition of Anglo-Saxon towns and it has formed the basis of the research priorities for urban archaeology in Britain identified by the CBA in 1981 (Biddle 1976 100; Schofield et al 1981 v-ix). The latter consists of a more elaborate statement on established topics of interest, notably the origin, continuity, form and settlement density of towns. It also includes a brief review of urban functions and recommends the targeting of urban excavation and analysis towards commercial, industrial, military, administrative, cultural and leisure activities. Finally the CBA advised that all of these

attributes should be placed, as they would be by any geographer or historian, in their regional and chronological context (Schofield et al 1981 v-ix). There are a number of reasons for the adoption by archaeologists of research topics previously established by other urban disciplines. Amongst the most important is the fact that British urban archaeologists are still only at the stage of making qualitative comparisons on the basis of information derived from excavations. Quantitative comparisons, even when the excavations in question lie within the same town, are so fraught with difficulties that their value is often severely diminished. The research topics borrowed by the CBA from other disciplines, therefore, provided a framework for urban archaeological studies which might otherwise have been missing. Moreover, it is only natural that archaeologists should wish to be involved in expanding the chronological and material range of well established fields of research. This has, however, resulted in something of a impossible situation for urban archaeologists. Excavators have been so involved in the extraction and supply of information that the main thrust of their work has been to develop expertise in interpreting individual case studies and the micro analysis of the evidence from excavations. Only now are more broadly based and independent methodologies for the archaeological examination of urbanization beginning to appear. Schofield and Carver, in the latest major CBA review of urban archaeology in Britain, surveyed not only developments in the wider interpretation of urban deposits but also in the analysis of excavated finds and environmental remains (Schofield

1987 1-3; Carver 1987 9-26).

The need for more subject-orientated archaeological definitions of urbanization has been recognised for some time by other branches of British archaeology. Iron Age and Romano-British specialists, as well as medievalists in Scotland and Ireland, have developed their own methodologies designed to deal with markedly different forms of evidence and settlement from that of the 'typical' English borough. The Scottish situation in fact serves as a case study of how, as the geographer Dickinson pointed out, urban settlement defies uniform definition.

Although Scotland was included in the CBA's survey of 1972 it was admitted by the authors that they had had to 'adopt a legalistic expedient' and revert to Pryde's list of charter references to Scottish burghs (Heighway 1972 12; Pryde 1965). It has been usual for such works to make no more than passing mention of the situation in Scotland. Indeed a British Archaeological Report on The Comparative History of Urban Origins in Non-Roman Europe, had 'for practical reasons' to exclude the Scottish evidence from consideration (Clarke & Simms 1985 xxvi). Only in the most recent of the CBA reports has there been any serious attempt to consider the pattern of urban settlement and urban archaeology in mainland Britain as a whole (Schofield & Leech 1987).

One reason for the lack of discussion of the wider implications of Scottish urban archaeology is that the

first stirrings of systematic urban archaeology in Scotland only extend back to the Society of Antiquaries of Scotland's report, Scotland's Medieval Burghs, an archaeological heritage in danger edited by Simpson in 1972. As Simpson, and later Brooks, noted both urban excavations and full time urban archaeologists have been few and far between in Scotland (Simpson 1972; Brooks 1977 24-27). The number of these excavations and excavators has increased slightly in recent years, although the situation remains far from satisfactory. A further delay in the development of the subjects has resulted from the sometimes considerable time-lag between excavation and publication. The current record of excavations and their publication is, reviewed in chapter one. Fortunately a corpus of urban excavation reports is at last beginning to appear. Urban archaeologists in Scotland are involved in the wider discussion of these results but due to their relative numbers, the main contributors to the resulting synthesis remain, as before, historians and geographers (Lynch et al from ; Ewan 1985; Gordon & Dicks 1983).

Unlike the situation described by Biddle in 1968, a major feature of the development of urban archaeology in Scotland has been the very close ties between documentary historians and archaeologists. Indeed much of the original impetus for urban excavation came from documentary historians such as Simpson and Brooks. The profound influence that documentary historians have had on urban archaeology in Scotland can be most clearly seen from the concentration of urban archaeologists on legally constituted medieval

burghs. This equation of urban studies with burgh studies has resulted in a fairly narrow study of urbanization in Scotland. Although legal recognition of burgh status is certainly one of the most important milestones in the process of urbanization, it is not the only one, nor is it necessarily the most relevant to archaeological analysis. One result of this bias has been that instead of urbanization being discussed as an integral part of the continuum of prehistoric and historic settlement, Scottish medievalists have tended to look for parallels among foreign chartered towns of comparable date, regardless of regional comparability.

It is certainly possible to see some trace of urban, or at least proto-urban, settlement in pre-Roman and Roman Iron Age Scotland. There is a handful of hillforts in central and southern Scotland which reach dimensions and perhaps densities of occupation which are indicative of large highly organised communities. Unfortunately little excavation has been carried out on these forts and their dating, economy and function are not as well understood as perhaps should be the case. In a number of cases field survey, sometimes combined with limited excavation, has indicated the existence of complex settlements. The two largest, Eildon Hill North in Roxburghshire and Traprain Law in East Lothian, both enclosed at various times up to 16 hectares of ground, and at Eildon Hill field survey has indentified some 300 house platforms with room for another 200 in areas of the fort now disturbed. Even if only a small proportion of these platforms were in use at one time

this still represents a site of considerable economic and social organisation. In northern Britain these two forts were only exceeded in size by that of Stanwick in Teesdale, which at a maximum of 300 hectares appears to have been one of the great settlements in Celtic Europe. Of the other large Scottish hillforts most were in the range of four and a half to eight hectares with only three others between eight and twelve hectares. The majority of these hillforts was located south of the Forth-Clyde isthmus. North of the isthmus the main forts were between two and a half and four hectares, with the exception of the unfinished hillfort at Kinpurney Hill in Angus of over six and a half hectares (Feachem 1966 77-82).

It was argued during the 1950s and 60s that the geographical regions in which these larger forts lie may be related through Roman documentary sources, such as Ptolemy's Geography and the Ravena Cosmography, to named tribal groups and that the largest of these forts may be seen as the walled towns or 'oppida' of these tribes. Such an interpretation has been contested on the grounds that they were not the equivalent of the forts of southern England which the Romans themselves called oppida (Steer 1964 15). While this is undoubtedly true, excavations within Scottish hillforts such as Traprain Law and Broxmouth have demonstrated an active mixed economy supporting developed metalworking and other manufacturing skills (Burley 1956 219-21; Hill 1982). Regardless of the name finally given to such forts, they are of major significance in the settlement history of northern Britain,

indeed they are comparable in size and perhaps function to many later Scottish burghs. Moreover, as the study of other homesteads and hillforts in northern Britain has progressed it has become possible to suggest central place functions for such sites (Harding 1982; Cunliffe 1983, 86 figs 4 & 5; Macinnes 1984 176-98).

The Roman occupation of Scotland raises the question of Rome's effect on any native trend towards urbanization. The larger hillforts of southern Scotland would seem in the main to have been abandoned either before or during Agricola's invasion. The picture is, however, far from complete, and Traprain Law at least survived and prospered, (Jobey 1976 198-203). On the other hand provisioning of Roman garrisons and the construction of roads, forts and ports must have increased existing interest in trade and basic manufacturing, as it did in England (Frere 1975 4-5). The progressive withdrawal of the Roman army from Scotland and the rest of Britain must, however, have left the inhabitants of Scotland increasingly to their own devices.

It has been suggested that the last refurbishment of defences at Traprain Law, which enclose some 12 hectares (30 acres), may date to the fourth century AD (Feachem 1956 289). As a response to the troubles of that time it seems to have been only partially successful, for the dating of finds from Traprain Law suggests that occupation ended there in the mid-fifth century (Burley 1956 143; Jobey 1976 203). It would seem that it was no longer desirable or perhaps possible to maintain such a large fort. Traprain

may already have become something of an anachronism, for in the post-Roman period smaller more easily defended sites seem to have been preferred. Changes in military and social organisation had undoubtedly taken place but it is far from clear how, if at all, the economic infra-structure of societies had changed. These more concentrated settlements may well have maintained many of the central place functions attributed to earlier, albeit larger, hillforts.

Curiously, with the exception of Professor Alcock's work on the fortified centres of early historic Scotland, the processes of urbanization in Scotland between the end of Roman occupation and the establishment of chartered burghs has received little attention from archaeologists (Alcock 1981 154). Yet the comparable period in England has been described by Hill and others as one of the main areas in which archaeology can contribute to the urbanization debate (Hill 1977 294). There are of course many differences between the study of Scottish and English settlement patterns but one of the most important, the dearth of Scottish documentary sources, makes Hill's comments about the archaeology of Anglo-Saxon towns more, not less, apposite. If, as many historians and archaeologists now believe, David I's burghs are not to be seen as de novo creations of towns, archaeology has to help define and identify those earlier regional centres which are believed to have existed. In the absence of written evidence, the urban nature of such sites will depend on their archaeologically demonstrable form and function.

Excavations at a number of regionally important centres, such as Dunadd in Argyll and Dundurn in Perthshire, have produced evidence for the control and consumption of the fruits of mixed farming (Duncan 1982; Alcock & Driscoll 1985). It is difficult, on the basis of the available excavation results, to quantify the relative importance of farming, processing and storing agricultural produce within these communities. However, centralisation of so much agricultural produce on these sites must have led to them acting as markets for regional food and raw material surpluses as well as for prepared foods and goods manufactured from agricultural by-products. On-site manufacture of tradable goods has also been attested at a large number of sites, although it is again difficult to assess the economic and political constraints under which such craftsmen worked. Excavations from as far afield as the Mote of Mark in Galloway and Birsay in Orkney have provided striking evidence of thriving ferrous and decorative non-ferrous metalworking industries (Swindells & Laing 1977; Curle 1982).

While it may not yet be possible to define such settlements as urban, a proportion of their population were clearly engaged in non-agricultural activities indistinguishable from those which formed the backbone of manufacturing industry in twelfth century and later burghs. One missing element in the progress of these sites towards full urban status was, according to Pirenne, a substantial level of

international trade. A small quantity of imported exotica has normally been found at the more politically important early historic centres but as yet none have produced the volume of imports found at the larger trading emporia of England and the Continent. The Scottish equivalents of these emporia may yet be uncovered at Whithorn or perhaps below one of the other later burghs, but it is very difficult at this stage to point to international trade as a primary stimulus to urban growth in Scotland. All the evidence points instead to regionally based trading and manufacturing being the economic base on which David I was able to build.

Turning to the functions, processes and indicators of urbanization which may be found through excavation within twelfth century and later burghs it has to be said that archaeological indications of international trade remain uncommon even in major trading burghs. A crude impression of the trading picture presented by archaeology for mid twelfth-to late fourteenth-century burghs can be gained from the proportion of pottery found in Aberdeen between 1973 and 1981. Locally produced pottery comprised c30% of the total weight of excavated pot, other Scottish wares c30%, English pottery c30% and Continental only c10% (Murray 1982 122-29). Manufacturing and the process of urbanization are the main concern of this study and somewhat inevitably urban trade tends to be seen here as a consequence, not a cause, of efficient centralised manufacturing. However, such a view provides a counter-balance to the arguments of some documentary historians

about the overwhelming importance of wool and other staple goods to urban development. Such cash crops were undoubtedly important to Flemish merchants and Scottish landlords, but for the vast bulk of the population, wool was of secondary importance to the processing and marketing of cereals, fish, cattle and other food stuffs. As an integral part of the latter trade, hides and sheepskins had an importance which is rarely reflected in the documentary sources. The results of excavation are inevitably subject to the vagaries of deposition, preservation and recovery and it may well be that evidence of foreign trade is missing because of these difficulties, but equally well documentary sources contain a considerable bias towards the more costly foreign items of trade and manufacture.

Archaeology undoubtedly does have most new information to contribute about settlement occupation where documentary sources are thinnest, and by providing an all too earthy contrast to the relative neatness of burgh accounts, excavation invariably makes a significant contribution to the interdisciplinary understanding of urbanization. Only by comparing the documentary and excavated evidence does it become possible to begin to describe and define in detail the wide range of urban manufacturing. Indeed the recognition of manufacturing as one of the definitive and driving forces behind western urbanization has come from the combined research of historians, archaeologists and geographers. Nevertheless, the last word in this review should perhaps go to the archaeologist, Childe, who in discussing Near Eastern urbanization advanced the

functional definition of urbanization. Foremost among the features which Childe used to distinguish towns from older settlements types, was the beginning of specialisation in economic activity. No longer had craftsmen to be itinerant and by virtue of their skill detach themselves from the group. By the use of surplus production they could become a specialized section of the new urban society. The emergence of an administrative class, made up of kings and priests, the keeping of records, the development of the arts, the extension of trade and the localisation of special skills are all part of the same urban process. Urbanization is seen therefore as the product of increasing specialisation and advancing technology. The only way it is possible to advance from a subsistence basis is by specialisation of economic activities (Childe 1950 3).

Chapter 3

Part 1 Animal Based Industries

Introduction

Burghs were heavily involved in the collection, processing, marketing and export of animal produce. The animal based industries were the great cash earners of the Scottish economy, and most of that cash was realised through sales in the burgh markets. A very wide range of skills was required to do this, but both technically and in terms of resources they fall into four clear categories. Those dealing with the produce of dead animals are linked by their raw materials and a need to preserve their work before it could be marketed. The work of fleshers is described first as they were the principal source of raw material for others involved in utilizing domestic animal carcasses. Users of bone, horn and other carcass 'waste' are included in this first section as their work was entirely with by-products of the fleshers' trade. The second section deals with the fishing industry and trade in preserved fish for workers in the fishing industry were not dependent on fleshers or domestic animals for their livelihood. However, these two industries, fleshing and fishing, supplied and preserved most of the protein consumed in medieval Scotland. The third section documents the role of the tanning and leather working industries which, it is argued, was a major reason for the great numbers of cattle and sheep butchered in the towns.

Finally the wool trade and the textile industry are described and discussed at some length.

All of the animal based industries, including the important fishing industry, were heavily dependent on rural communities for their raw materials. Country estates produced the live-stock and a substantial proportion of the fish which formed the basis of the carcass utilising trades. They also produced the wool and perhaps much of the cloth marketed and finished in the towns. Moreover, as burgesses were normally involved in farming the land around and even within their town, it was natural for essentially rural methods of processing to continue alongside the more developed commercial activities of the burgh. Indeed as most of these urban trades had their origins in rural methods of processing agricultural produce, firm distinctions between commercial and rural processing are normally impossible. In any case there was always a ready market in the towns for the basic preserved and finished produce supplied by both urban and country farmers and fishermen. It was this market which formed the local basis of urban trade upon which specialist craftsmen and merchants built their livelihood.

The surviving archaeological and written sources for this group of burgh industries involve substantial elements of what might be seen in other locations as strictly rural activities. Moreover, by no means all the byres, pens and other animal enclosures which have been excavated in the towns were for beasts brought in for market, slaughter and

processing. Cattle, horses, pigs, sheep, goats and fowl were commonly kept (or allowed to scavenge) within towns and on burgh muirs. They variously provided milk, cheese, butter and eggs as well as motive power for both mills and transport, before finally being skinned, butchered and consigned to the pot. When combined, skeletal remains and documentary sources for the towns do, however, provide enough evidence to sketch a fairly balanced picture of the domestic and industrial processes connected with animal husbandry, butchery and carcass utilisation. The same can not be said of the evidence for the fishing industry. Skeletal remains of fish from urban excavation are so understudied that it is difficult to draw any useful conclusions about this evidence. As a result the history of the fishing industry relies very heavily on documentary sources which are inevitably weighted towards commercial processing and marketing of fish. It is clear from hints within the documentary evidence and a comparison with the more complete picture for domestic animal utilisation that what is being described was only a part of a more complex trade. The extent of local trade in fresh fish can only be guessed at, although it was undoubtedly important and did involve the burghs.

The problem of making a distinction between commercial and domestic labours is less complex in the case of the tanning and leather industries. There is very little reason to suppose that anything more than the drying and salting of hides and skins took place outwith the burghs. Those organisations with the resources to invest in such a long

term process as tanning arranged, or already had, access to burgh specialists and markets. Surprisingly the same was not true of another notable urban industry, cloth manufacturing and finishing. There is little sign of any effective urban monopoly over the production of yarn and coarse cloth while the ownership and location of fulling mills would suggest that rural spinning, weaving and fulling flourished under the patronage of monastic houses.

With the exception of leather tanning and certain legally imposed monopolies such as the dyeing of cloth, the working of animal produce in the burghs differed only in quantity and quality from that undertaken in the rural community. Indeed for larger rural estates the primary function of the burgh was as a market for animal produce much of which they at least partially preserved and processed themselves. Even the greatest estates, however, still came to the burghs to market their surplus produce in order to purchase imported and other materials and tools which they themselves could not produce.

Chapter 3

Part 1 Animal Based Industries

Fleshing and Related Crafts

(fig. 1)

Documentary and archaeological sources attest to the importance of animal carcasses as a source of not only food but also raw materials for manufacturing industries. Both sources confirm that trade in surplus livestock, and therefore much of the flesher's work, was dominated by the valuable market in hides, skins and wool fells (see section on leather working below). However, the carcasses of the tens of thousands of animals slaughtered and butchered in Scotland each year for their hides, were themselves valuable commodities (ER ii lxxxix-xcii). Unfortunately, whilst there are numerous early references to rents and other dues being paid in the form of livestock and the gifting of teinds of livestock and hides to various churches, detailed evidence for the trade of the urban flesher is rare until the sixteenth century. Nor is it always clear whether the numerous references to 'marts' are, as was originally meant, to fatted beasts on the hoof, or, as the term increasingly came to mean, sides of salted beef. Moreover, written sources are almost invariably the product of important rural establishments which, as net producers of livestock, were normally able to supply their own needs and those of their retainers by butchering their own animals in their own kitchens. Surplus animals and

hides might well be disposed of, on the hoof, at urban markets, but only in times of special need would such households have used these same markets to buy in meat. Occasionally, however, even the king's table was caught short and, as at Brechin in 1366, his household was forced to buy meat from the burgh fleshers (ER ii 262). On other occasions, such as the provisioning of the king's castles and residences at Inverness and Elgin with salted meat in 1462, it was necessary to hire urban fleshers to do the work, even though the cattle being slaughtered were the king's (ER vi 127). Indeed, by the mid fifteenth century it was not unusual to employ master butchers, some of whom were retained over several years as the 'king's butcher', to supervise the stocking of the king's larders and where necessary purchase additional beasts (ER v & vi passim).

Fortunately the sparse documentary evidence for the urban flesher's trade has been considerably enlarged upon through work by the late Dr Hodgson and others on animal skeletal remains from medieval urban excavations in Scotland (Hodgson 1983 3-32). However, the diverse reasons for the deposition and survival of raw and waste skeletal material in medieval towns often make it difficult to interpret fully the meaning of such assemblages. The study of animal bones from urban sites has, therefore, tended to concentrate on the evidence for animal husbandry gleaned from all the species-identifiable bones from any one site. Information about the butchering of animals for meat and industrial use has also tended to come from the incidence of specific types of bones within complete assemblages,

although occasionally specific assemblages of bone recovered from discrete archaeological features have been linked with industrial activity.

There are, of course, numerous problems in discussing all the skeletal material from any one site as if it were a single sample; but it has been possible, through this broad approach, to identify in these skeletal assemblages certain recurring patterns which reflect that part of medieval animal husbandry which either took place in the towns or was geared to the urban market. The principal butchered mammals were cattle, sheep, goats, pigs, horses and red deer. At most sites the relative frequency of these species has been determined by comparison of the minimum number of animals in each assemblage and also the percentage of bones for each species present.

Even from such general analyses it is clear that cattle were overwhelmingly the commonest and commercially the most important animal slaughtered in the towns. Cattle remains are normally followed in rapidly descending order of frequency by sheep/goats, pigs, horses and deer.

Table showing percentage of minimum numbers of main meat species

Site	Cattle	Sheep	Pig	Goat	Horse	Deer	Min. No. Animals
PHSE	63.1	21.8	9.2	4.7	1.1	0.1	845?
Elgin	57.1	21.9	9.5	5.6	5.1	0.7	47?
St Ann's Lane	57.9	32.2	9.1	*	0.4	0.2	61
Edinburgh	24.8	66.5	6.3	*	1.2	1.2	254
Canal St 1978	58.5	32.3	5.5	0.3	3.4	0	59
Inverkeithing	48.7	23.1	15.4	*	12.8	0	39
St Pauls St	68.8	19.5	8.5	*	1.6	1.5	81
Queen St	58.1	26.7	13.7	*	0.2	1.2	53

Castle Street, Inverness & the Perth Monograph figures are not given in this form.

Notes on Table

* = Goat and sheep not differentiated

(Based respectively on: PHSE, bone; Hodgson & Jones forthcoming; Hodgson & Jones 1982b 449; Chaplin & Barnetson 1976 234; Hodgson & Jones 1983 515-16; Smith & Hodgson 1983 543; Hodgson & Jones 1982a 233; Smith & Hodgson 1988 196-98).

The cattle, although small by modern standards, provided far greater quantities of meat and skin, plus lard, bones, guts, horn and many other servicable raw materials per head than sheep, goats or pigs. The over-whelming majority of these cattle were of the age of five to six which would suggest that the primary requirement was for milk, draft-

animals and hides not tender meat. At some late fifteenth- and sixteenth-century sites sheep/goats remains in the middens substantially exceed those of cattle; as at the High Street, Edinburgh where sheep were two and a half times as common as cattle (Chaplin & Barnetson 1976 234). This may reflect the development of a market for sheep or goat skins and meat, but, as the quantity of meat alone from medieval cattle was usually in the order of six to seven times that of sheep or goats, cattle almost invariably remained the principal beast for carcass utilization in the urban economy (Hodgson 1983 8).

It seems that burgesses were not directly involved in the farming of sheep for wool. The kill-off pattern deduced from sheep and/or goat bones recovered from sites in Perth, Aberdeen and Elgin indicates that these animals were being slaughtered for their meat, skins and woolfells. The precise figures vary but approximately an eighth of the sheep were killed between weaning and first shearing, three quarters were killed in the next two to four years, and only the remaining eighth tend to be killed off in their later years. The vast majority of the sheep brought to or reared in the burghs were therefore killed for their mutton and woolfells. Only a small proportion of the sheep slaughtered in the towns were of a sufficient age at death to suggest they had been left for their wool crop and a more likely explanation would in any case be that these were breeding ewes and lead wedders which were too old for another year. Despite a considerable requirement for woolfells, and perhaps a taste for mutton, urban

communities would seem to have been primarily concerned with the working and trading of wool from flocks kept by rural not urban communities.

It is difficult to gauge the importance of keeping pigs in medieval times. Documentary sources tend to make only occasional references to pork and bacon while the existence of a legal right of burgesses to have pigs can not be equated with widespread pig keeping. The animals themselves are normally associated with woodland panage rather than towns and what legislation there is would suggest that even pigs kept by burgesses were commonly left to forage out with the town (Leges Burgorum ch 84). In part the lack of references to pigs may reflect their relatively minor commercial importance, whereas sheep and cattle were also sources of valuable wool and leather, pigs were primarily kept for their meat. It may be, therefore, that the domestic importance of pork and bacon has escaped the documentary record. Certainly archaeological evidence would suggest that pigs, most of which were kept until their third year, were in fact a relatively common urban animal. Although the overall proportions of individual animals recovered from excavation are usually in the order of 60% cattle, 20% sheep, 10% pig, 5% goat and 5% others it is likely that the cattle and sheep figures are boosted by animals brought to the towns for sale and slaughter while the majority of the pigs would have been kept locally.

The number of medieval horse and deer bones from Scottish towns is, in contrast, especially small and in terms of

carcass utilisation both types of animal were clearly a rarity. As few of these horse bones bear the chopper and knife marks of butchery for meat it would seem that horse flesh was not normally eaten in the Scottish towns. There are, however, references to the use of horse hides for utilitarian purposes such as bellows and it may be that even if horses were not wanted for food they were nevertheless skinned and utilised in other ways (Dunkeld Rent. 116-7).

Another recurring feature of urban bone assemblages is the preponderance, in some cases as much as two or three to one, of those bones, such as metapodials, which come from low meat yield parts of the carcass. Likewise shoulder blades and pelvic bones which are boned out from good meat areas tend to be more frequent than, for instance, upper leg bones which are normally left with the meat. Even where excavations have been conducted in various districts of the one town, as at Perth and Aberdeen, the same basic pattern tends to recur. Although part of the reason for this imbalance may be preferential collection and subsequent deposition of bones as a result of domestic and industrial practice, it would seem that not only were the best meat joints being transported around towns but a proportion of the meat may have been exported from towns. There is some limited documentary evidence to support the latter suggestion, at least at a local level. It was common practice throughout the medieval period for estates to use both live and dead marts to make full or part payment to senior officials and retainers. If necessary

quarter carcasses were provided as payments for lesser services, although normally sheep and mutton, pigs and pork were used for such payments (ER i 134, 193-4, 196). The longitudinal splitting of carcasses is also evidenced in the archaeological record through the recovery of vertebrae split with cleavers.

References to more long-distance trade in marts usually, although not always concern the movement of live animals. Wherever practical hides and meat were stored and transported over any distance on the hoof. Hence herds of cattle and other animals were regularly driven, sometimes via the markets of a number of smaller burghs, until they reached one of the larger staple port burghs of the east coast. There hide and beast parted company with the best possible price being gained through sale of the hide at place of export. Many hundreds of beasts were driven from the Highlands and Islands to Stirling and Perth to supply the leather and fleshing industries in those towns (ER i 340; v 58, 85, 164, 210, 289, 332). Inverness may have received many of the hides it exported on the hoof from the northern Highlands. In the case of Inverness, however, it was clearly impractical to herd the animals any further south to add to their meat value and instead salted marts were shipped, as in 1460, from Inverness to Leith (ER vi 664). Something of the potentially extensive trade in salted marts and bacons from Perth, Stirling and other more southerly burghs does appear in the Exchequer Rolls as the king's officers prepared for, and tidied up after, the marriage of his son and heir David during 1328-29. For

instance, in 1328, 44 marts were bought at Perth for the wedding which was to be held in Berwick (ER i 118). In all 171 marts and 413 sheep were gathered to Berwick for the wedding and, as there is mention of the sale of only 17 hides from beasts slaughtered there as a result of the wedding, it is likely that the majority of these animals were slaughtered and butchered before being taken to Berwick (ER i cxvii, 184). In any event after the wedding the remaining victuals, including meat, were transported back to Stirling, Clackmannan and Leith by sea (ER i cxvii).

With the possible exception of tallow most of the other perishable food and other stuffs butchered out from the carcasses were not traded over any distance. What little evidence there is for a market in glue, tallow, guts, sinews and other fragile organic by-products of butchery comes from documentary sources. Such materials do not survive in even the most favourable soil conditions and little can really be said about the use, if any, of gut and sinew which are not specifically mentioned in written sources. Records do, however, note the sale of offal from the king's cattle, sheep and pigs slaughtered in the towns, although the actual importance of such materials is probably more correctly demonstrated by other references to butchers' 'residues' being given to the dogs (ER i 33, 39, 124, 135, 202, 333, 375). Something of a trade in fat and lard also appears in the written sources from time to time and, although the king's officers normally sold surplus fat and lard, there are occasional references to the purchase

of fat to grease ships (ER i 30, 33, 202, 379).

Unfortunately little can be said about the early manufacture of candles from tallow. What evidence there is for the manufacture of candles relates to work by clerics to produce highly expensive candles from bees wax and dates to fourteenth-century (ER i 151). The use and availability by the mid fifteenth century of simple tallow candles is, however, indicated by the purchase of candles to light simpler buildings such as stables (ER v 485; vi 52). Finally by the start of the sixteenth century individuals, such as Donald 'Candlemaker', were being paid for sizeable numbers of tallow candles (TA i 279; ii 398, 478). The use of tapers and candles has also been confirmed by the recovery of suitable holders from Scottish urban excavations (PHSE metalwork). The absence of lamps for the burning of oil or fat, at least from urban assemblages, may also perhaps be seen as confirmation of the availability of torches, tallow candles and tapers.

In the same way as the more perishable butcher's waste, hoof and horn does not normally survive prolonged burial. Fortunately, toe bones and bone cores from inside cattle, sheep and goat horns do survive to indicate the distribution of hoof and horn working waste. Horncores, usually crudely broken from their skull, are a common find on some urban excavations and cores from a number of sites in Perth, Inverness and Inverkeithing retain sectional saw cuts across their length (fig. 2) (PHSE bone; Smith & Hodgson 1988 197; Hodgson & Smith 1982 377; Smith & Hodgson 1983 554). The use of saws on animal remains is unusual

and they appear to have been restricted to specialised antler, bone and horn workers; the butchering of carcasses was normally carried out only with knives and cleavers. Moreover the large number of horncores from sites such as Methven Street and High Street, Perth suggest an industry of considerable organisation. On the Perth High Street site 1,753 cattle and 722 goat horncores were recovered. Indeed on these two sites the minimum number of individual animals indicated by the tally of horncores is more than twice that indicated by any other bones recovered and far exceeds the six cattle and seven goat skulls which were also recovered from that site (Hodgson 1983 7). It would seem that horn on the cores was being gathered from around the town or even imported into towns for working. While some horn working in towns may have been for private use, it is clear that much of it took place on a commercial scale. From the cut marks on cores some at least of the horn was used for cups, but the majority would seem to have been removed as sheets of horn which could then be moulded, cut or laminated into anything from spoons to combs to window panes. Some evidence of the utilisation of hooves, which have the same composition as horn, has been recovered from sites in Inverness and Inverkiething where toe bones of cattle and horses have chop marks caused during the removal of the hooves (Smith & Hodgson 1983 554; Hodgson & Smith 1982 377). Hooves would not normally have been large enough to be made up into artefacts, and along with trimmings and waste horn their main use was in the production of neatsfoot oil.

One raw material derived from animal carcasses which survives in profusion is the bone itself. Not only was bone cheap and readily available it was strong and capable of being finely worked. There is a very wide range of objects and workmanship in bone. At the simplest level specific bones had virtually ready made uses, such as pins or awls made from pig fibulae, spindle whorls made from femur heads, or ice skates made from horse metapodials. Such finds are relatively common but there is also evidence from the High Street, Perth and other sites of unfinished objects and blanks prepared from specially selected bones such as bovine longbones and scapulae which suggest the existence of more organised and skillful craftsmen using bone in the towns. One of the finest groups of workmanship are five well made bone plates with incised decoration most probably made in Perth for the decoration of three caskets (PHSE worked bone). More everyday products included pins and needles, combs, gaming pieces, dice, knife handles, bobbins and toggles. However, the quality of these objects varies greatly and some at least are likely to have been home-made.

These same skilled bone workers were probably responsible for the high quality work in antler. Unlike bone however, antler must normally have been deliberately imported for working in the towns. Waste pieces of red deer antler have been found on sites in Aberdeen, Perth, Elgin and Inverness (fig. 3). Excavations in Elgin and Perth High Street have also produced pieces of roe deer antler. Part of a bone and antler working tool kit including two hammer

heads made from antler burrs (fig. 3), and an antler tine wedge have been found from medieval contexts in Aberdeen (Macgregor 1982 180-4). The principal products made from these antlers were very fine single- and double-sided combs several of which have been found from late twelfth-century contexts at the King Edward Street and High Street sites in Perth and there is also one single-sided comb from Aberdeen. Other artefacts made of antler in the burghs include knife handles and spindle whorls (PHSE worked bone; Blanchard & Ross ND; Macgregor 1982 180-4). Occasional items of ivory have been recovered from a number of Scottish towns but there is little evidence that they were worked locally.

Chapter 3

Part 1 Animal Based Industries

Hides, Skins and Leather

(fig. 21)

It is apparent from early documentary sources as well as excavations that, as elsewhere, hides and skins were prized and widely traded commodities in historic and prehistoric Scotland. It is hardly surprising therefore that when documentary sources begin in the twelfth century the preparation and use of animal skins appear as highly developed industrial activities. Professional differences were recognised, as between skinner (pelliparius) and cordiner or souter (sutor), and a wide range of technical terms were in regular use (RRS i Nos 243 & 246). Moreover, there is considerable evidence from early foundation charters to such abbeys as Selkirk, Scone, Dunfermline, Holyrood and Kelso that one of the main sources of estate revenues were renders of hides and skins, and that these revenues had long been raised in an organised manner from the ancient regional divisions of the country both north and south of the Forth (ESC Nos 35, 36, 74). Such charters make it clear that it was perfectly possible for the king and other major landowners to commit hides, tallow, wool fells and other animal produce from identifiable areas to specific insitutions (RRS i 36-8, 53-4).

The two main institutions involved in gathering and

marketing this produce seem to have been the royal kitchens and burghs. The former were an integral part of all the king's main residences. It was in the king's kitchen that many of the animals appear to have been butchered and presumably it was there too that the hides and skins were initially processed. Such kitchens were far from simple cook-houses, they were major processing and storage centres responsible for making the best of agricultural produce from large areas of the country. They worked in close co-operation with the towns which developed beside many of the more important royal residences and which were essential to the more advanced processing and marketing of agricultural produce. In addition to produce from the king's own demesne land and cain brought to the king's kitchen, specific types of goods also had to be marketed through the towns. William I instructed that ecclesiastic and secular landowners had to bring their hides, wool fells and other skins to the burghs for sale (Assise Willelmi Regis ch 40). This was not a new monopoly for since the late twelfth and thirteenth centuries only burgesses could freely trade in hides and skins (Leges Burgorum ch 16; Statuta Gilde ch 23). That these monopolies did indeed affect rural land owners is indicated by an exemption which was granted to Scone Abbey. The monks were allowed to retain in their service a wright, skinner and cordiner who were to have the same privileges as the burgesses of Perth (RRS i Nos 243 & 246).

The early variety and development of those urban trades involved in the processing of hides and skins, as well as

their continuing evolution, makes it difficult to be certain of the numerous technical terms used to describe the materials and craftsmen employed in the industry. Much of the difficulty for modern, and perhaps contemporary, readers lies in the fact that while certain terms had a general currency many also had specific meanings, the nuances of which are now lost through repeated changes in usage. Something of this difficulty may be demonstrated by the basic distinction made between hides and skins. A hide (corium) is normally the skin of one of the larger domestic animals such as cattle and horses, while a skin (pellis) came from such smaller animals as pigs, goats, sheep and calves. However a skin (pellis) could also be a fur pelt, and it is far from clear whether reference to, for instance, deer skins relate to fur pelts or to bald hides or both. There is also considerable difficulty in distinguishing between tanned and untanned hide or skin. Untanned hides are occasionally identified in sources by the suffix recens, but it is clear from the price and usage of the 'hide' in question that this distinction was frequently ignored. Latterly it became the practice to distinguish certain tanned hides with the prefix 'barkit'. Professional differences are subject to similar problems of interpretation. There are numerous indications of changes in the social and professional status of skinners, cordiners and souters. By the fifteenth and sixteenth centuries 'new' and more prestigious trades like furrier, saddler and glover had emerged to help differentiate the upper end of the market from the workers of the raw hides and simple cobblers. To make any sense of such difficult

evidence it is necessary to relate the terminology to the technology.

The flaying, processing and working of hides and skins is an extremely skilled and complex process. The produce could be both beautiful and utilitarian; breeches worthy of the king's posterior or coverings for wagons and currachs (ER vii 630; TA iii 264). The range of leather products was as great as their value to the community which, both as a material and as a source of revenue, was considerable. It is precisely because of their complexity of manufacture and potential value that hides and skins became the basis of one of the most complex and professionally organised medieval industries. Where the skins and hides could be sent directly from the flesher's slaughter-house to the tannery, as would normally be the case in a burgh, there would have been no need to cure them with salt to arrest putrefaction prior to tanning. However, it is clear from documentary sources of the late fourteenth and early fifteenth centuries that at least some of the king's hides from his kitchen at Perth and at Linlithgow were salted in the burghs (ER ii 611; iv 73). When this did take place, and references to it are very much the exception, it seems that the salting of hides, along with the salting of meat, was carried out by fleshers and not skinners. According to the guild statutes no skinners were to salt hides (Statuta Gilde ch 24). Yet, as only skinners could purchase, prepare or market hides, fleshers only had access to the hides and skins of the animals that they themselves had slaughtered (Statuta Gilde ch 30). The strong implication

of these records is that the main profit of the business belonged to the skinners and the right to salt hides was intended only to permit fleshers to slaughter animals when skinners were not able to tan the resulting skins immediately. Indeed unless skinners acted purely as middle men, only exporting hides salted by fleshers, it would appear that the many tens of thousands of hides exported each year from Scotland were tanned rather than salted. If so the leather trade must have rivalled the wool trade as a source of employment, although it was less important as a source of foreign currency.

The intended use of the leather influenced how the hides or skins were treated before, during and after tanning. Any specialised use of good quality leather, by for instance saddlers or glovers, required careful choice, processing and finishing of the hides while, in marked contrast, coarse thick hides were ideal for shoe leather. The production of the latter was therefore readily separated from the more varied business of quality leatherworking which became the preserve of specialist skinners. Souters were, however, allowed to continue to tan their own leather provided they used hides from beasts whose ears and horns were of equal length (Statuta Gilde ch 24; Leges Burgorum ch 93). The practicalities of this legislation have been explained by urban excavation. The main cattle stock slaughtered in the towns was of a variety, Celtic shorthorn, in which only fully mature animals could have fulfilled the legislation (Hodgson & Jones 1982a 237). In effect therefore, souters were being denied the use of

calfskin.

Despite the differences in the type of hides used by skinners and souters, the initial preparation of ordinary, vegetable tanned leather was the same for both. If they had been salted then the salt had to be dissolved out before the pre-tanning preparation could begin. Desalinated or fresh hides and skins were immersed in a series of lime liquors of increasing strength, which loosened hair roots and the lower layers of the epidermis. Both hair and epidermis were then scraped off over a wide beam of wood which was set in the ground at a convenient angle. The basic tool for this was a blunt edged arched knife or bone. The hides or skins were then turned over on the beam and unwanted adipose tissue cut from their underside using an arched cutting knife. At this stage the work of skinners begins to differ from that of souters in that a number of additional pre-tanning processes were required to prepare better quality leather. If a stretchy or soft leather was required a mixture of guano and dog-dung was applied to the skin so that the resulting bacterial fermentation would break it down. Decomposition of the hide was halted at the right stage by drenching the hides in a mildly acid solution derived from fermented bran. This liquid also neutralised any remaining traces of lime. After a final wash the hides were ready for conversion into leather.

Until the twentieth century immersion in a vegetable tanning liquor derived from oak bark was by far the most

important way of making leather. The hides or skins were laid one by one in a large sub-rectangular water-tight pit with chopped bark sprinkled between. The pit was then filled with water, and the hides allowed to soak in the resulting infusion for two to three months. The process was then repeated five or six times until the leather was suitably tanned. Unfortunately the organic materials and debris involved in both the preparation and tanning of hides are not normally recovered by excavation. On one site in Aberdeen, the Queen Street midden area, a thirteenth century pit was found to contain large quantities of animal hair and oak bark. This feature was 1.62 x 2.12m and 1.75m deep and apparently timber lined. Timber staining at the top of the feature was sub-circular and there was evidence of a timber walk-way between it and another pit of similar dimensions immediately to the east. The fill of the latter pit was of cess and domestic rubbish (Greig 1982, 22). These two pits had a varied history and it may be that they were at one time associated with tanning. If so it seems likely, given their size, that the pits were for the tanning of cut hides or skins. What is certain is that members of the tanning industry in Aberdeen were dumping their rubbish on the Queen's Street midden, from at least the thirteenth century.

Normally, however, the tanner's requirement for space and a reliable water supply, combined with the fact that the sites of skimmers' and souters' pits were deemed noxious even by medieval standards, has meant that tanneries were located away from town centres which have been the natural

focus of urban excavations. As a result this aspect of the industry has largely avoided excavation although recent excavations in Aberdeen have uncovered what may be a tannery (fig. 5), and trial excavations on the outskirts of medieval Linlithgow and Inverness have discovered the remains of pit groups which have been tentatively associated with tanning (D & E 1974 67; 1976 37; 1987 18-19). Despite these difficulties, the physical requirements of tanneries mean that their likely location is usually clear from the town's topography and, as with Barker Row in Perth, place name evidence often confirms their former presence (Duncan 1974 32).

In contrast with the minimal archaeological evidence of tanning pits, debris from skinners workshops within the burghs, where the hides and leather were actually worked, is relatively commonplace. Quantities of cow hair and scraps of leather have been found wherever conditions are favourable, as at the Gallowgate in Aberdeen and also the High Street in Perth (Murray un-pub. Interim; PHSE leather). The finishing of leather from the tanning pits again reflected its final use. The new leather was dried, sorted, cut and dressed to give it the required appearance, water resistance and durability. This finishing work was of considerable importance and, in the case of the best leathers, the work required considerable skill. Improperly finished leather was a recognised cause of complaint against skinners, but the best guarantee of quality for the purchaser was the skinner's reputation (Iter Camerarii ch 23). It is hardly surprising, therefore, that an early

distinction was made between skinners and souters or that latterly the best skinners further differentiated themselves as saddlers and glovers. The best leather was brought to a uniform thickness by repeated and highly skillful shaving of the new leather over the skinners' beam with sharp currying knives. A selection of larger knives of types associated with leather working were recovered during the Perth High Street excavation (PHSE metalwork). The leather was then repeatedly dressed with oil to help preserve and waterproof it. The best results were achieved with fish oils, but neatsfoot oil, tallow and brains were also used. Firm evidence for the use of fish oil is unfortunately lacking, but the organised production of neatsfoot oil and the extraction of cattle brains is hinted at by the larger bone assemblages from urban sites. Of the lower limb bones of cattle and sheep from the High Street, Perth, toe bones (astragali and calcanea) were out-numbered by shin bone (metapodials) and their absence would suggest that the feet and hooves of these animals, which are the main constituent of neatsfoot oil, had been separated from the shins for the production of this oil. On the same site, and elsewhere in Perth, regularly broken and split sheep and cattle skulls, sometimes with horn cores still attached, attest to the exploitation of animal brains as well as horn (PHSE bone; Smith & Hodgson 1988). The close association of assemblages of both animal feet and skulls with the leather trade is also re-inforced by contemporary illustrations in which the skins are shown as being sold with their lower leg and skulls attached (Rifkin 1973 64).

More specialised skimmers and furriers worked in and also manufactured their own mineral-tanned leather. The main foreign source of such leather was the Spanish 'Cordoban' leather. Strictly this was alum tawed goatskin which was naturally white but could also be dyed red. Subsequently the name also became equated with several types of good quality leather from France, Portugal, the Baltic and Flanders (Waterer 1968 27-8; TA passim). It is extremely difficult to judge how much mineral preserved leather was actually produced in Scotland before the seventeenth century by which time many thousands of alumed skins, especially goat skins, were being exported (Angus 1913 56; Smout 1965 187). Alum tawing was a feature of the skimmers trade as early as the fourteenth century (Iter Camerarii ch 24). Certainly by the early sixteenth century local mineral tawed sheepskin, known as 'basen', was available at an eighth to a twelfth the price of cordoban or Portuguese leather (TA ii 199, 203; iii 192). The main use for alum tawed leather was for quality items such as 'brodikins' (half-boots) or to cover saddles and make harnesses for such important clients as the king and queen (TA i 330, 372; ii 149, 218, 219). One of the advantages of this type of leather was its ability to take a colour. In 1503 the plain white leather was used in the queen's robe, while black leather was bought to cover a saddle, and a pair of yellow shoes of Portuguese leather were purchased from abroad (TA ii 218, 212, 237). The best gloves and saddles were considered worthy gifts for foreign embassies or feudal renders (ER iii 269, 288; iv 594). By the late fifteenth century even gilt saddles are a regular feature

of the royal accounts (TA i 228, 232, 262, 328, 348).

The range and quality of leather goods in use in the towns is evidenced by the recovery of numerous scabbards, belts, coverings, footwear, jerkins and leggings. The knife scabbards are the most commonly decorated item (fig. 23) (PHSE leather, Thomas 1988). From several sites come larger pieces of leather, some of which have button or toggle holes and are most probably leggings or items of clothing (PHSE leather; Thomas 1988 184-85; Stones 1982 197). Few of these pieces are decorated, but the quality of leather employed is often very good. Of the discarded artefactual and off-cut leather found on urban excavations the vast majority are pieces of footwear or from the manufacture and repair of turned shoes. It is impossible to put a figure on the proportion of the population that were shod but in the towns at least, shoes, including shoes for children, do not appear to have been uncommon. Many of the discarded soles had, however, seen heavy wear and in a number of cases shoe-soles have been repaired several times. No doubt basic shoe repairs were undertaken as required in their owner's household, but that at least some repair cobblers were at work by the fourteenth century is indicated by off-cuts of worn leather found in a work shop excavated at Kirk Close in Perth (Thomas 1988 183).

The main skilled work of such fourteenth-century souters would, however, have been in the undertaking of individual, and occasionally bulk, commissions for footwear, as in fact the Perth souters did for the king in 1361 (ER ii 83). The

very best quality leather work, including footwear, was provided by a small number of more prestigious craftsmen such as the king's skinner, Peter of Selkirk, and Adam Torr, burgess of Edinburgh and in 1436 the king invited a specialist shoemaker from Bruges to work in Scotland (ER ii 160, 468; iv 678). The majority of footwear and other costume leatherwork required by the king during the fifteenth century was provided by successful cordiners, such as Thomas Home, Brownehill and Henry Litster the king's cordiner, all of whome were paid regular retainers (TA i passim). During the first years of the 1500s John Davidson cordiner of Edinburgh and James Lintoun cordiner in Stirling both provided the king with numerous pieces of leatherwork. Lintoun's goods must have been of the highest quality as they were frequently dressed with velvet (TA ii & iii passim). In the main, however, cordiners undertook work with heavier leather with which they were often supplied. For instance, cordiners were provided with tanned 'barket' hides and half-hides for their work on the king's pavilion in 1496, (TA 285, 288, 294; ii 29, 446).

Skinners on the other hand undertook most of the lighter leather work, frequently preparing furs and working with tailors. In 1377 skinners and tailors in Edinburgh were paid £3 18s for the king's new apparel (ER ii 586).

Although certain specialist furriers are recorded at the end of this period it was the skinners who developed the important Scottish fur trade. It would have been the skinners who were primarily responsible for preparing the fox, squirrel, marten, cat, beaver and otter skins for

which Scotland gained a reputation during the thirteenth and fourteenth century (Assisa de Tolloneis ch 2). Such exotic furs would only have been handled by a few specialist skimmers and Inverness in particular became renowned as a source of marten and beaver skins (Bellenden, Chronicle (1936) 88). At a more mundane level linings of budge (lambs skin) and of coarser wool fells were worked by a far wider range of skimmers, but these too were a frequent export. Many furs, wool fells and hides from Scotland were traded along the east coast from as far north as Wick south to London and the Continent (ER iv 479; Veale 1966 60). It is also likely that furs from Norway joined this important trade route and there is evidence of the king making use of this connection in 1337 when he sent Robert the Skinner to Norway with diplomatic letters (ER i 450). Even by the early fourteenth century then, some skimmers were individuals of considerable influence.

Chapter 3

Part 1 Animal Based Industries

Fishing

The evidence available for Scottish medieval fisheries, especially that from excavations, is far from satisfactory. Fish bones of all sizes are collected by hand during excavation of urban midden deposits, but to assess accurately the types and proportions of fish bones present it is necessary to sieve samples of these soils (Jones 1982 79-85). Unfortunately sieving has not been widely carried out on urban sites in Scotland and it is likely that there has been a bias towards the recovery of the more collectable bones of larger fish. In any case, even when quantities of fish bones have been recovered from urban excavations in Scotland it is unusual for any attempt to be made to identify their species range (see table below). As a result of both these oversights, archaeological evidence for the involvement of Scottish towns in this important natural resource is necessarily crude and probably misleading.

Published Scottish Urban Bone Assemblages

Site	Number of Fish Bones	Species Identified	Reference
Aberdeen 1973-81	Substantial	Not done	Hodgson & Jones 1982A 230
Aberdeen Gallowgate	333	Not done	Smith & Hodgson 1984 Fich 4 B4
Edinburgh High Street	Present	Where Possible	Chaplin & Barnetson 1976 229-33
Inverkeithing	1	Not done	Smith & Hodgson 1983 542
Inverness 1979	157	Not done	Hodgson & Smith 1982 375-6
Kirkwall	Present	Not done	Hodgson & Jones 1982C 429
Perth, St Ann's Lane	None	-	Hodgson & Jones 1982B 451
Perth, Canal St (1978-9)	None	-	Hodgson & Jones 1983 515
Perth, 1979-81	Present	Not done	Smith & Hodgson 1988 150-52

Notes to Table

Whale bone was present only at Kirkwall, and then as only

two pieces of whale jaw (Hodgson & Jones 1982 429).

Species of fish identified from Edinburgh, High Street bones: Cod, Thornback ray, ray/rocker, hake, flounder, ling, and also crab (Chaplin & Barnetson 1976 229-33). It should also be noted that there are problems in interpreting the significance of fish bone assemblages from urban sites, which may be influenced by the way in which different species of fish were preserved, marketed and consumed. For instance, the salting and barrelling of smaller fish such as herring did not apparently involve their gutting, still less their filleting, until the seventeenth century (Doorman 1942 55-8). However, larger fish needed to have their guts and heads removed if they were to be preserved for any length of time. The Edinburgh assemblage presumably reflects domestic fishing and consumption.

Despite the limited extent of the evidence, where fish bone assemblages have been species identified, as at the High Street, Edinburgh, urban excavations have produced important results. Moreover the remains of a wide range of shellfish have been found in both urban and rural kitchen middens. It is clear that both fresh and salt-water mussels and especially oysters were a relatively common food source and that they were available considerable distances from where they could have been gathered. From the High Street, Edinburgh also come winkles and whelks both of which occur in sufficient quantities for the shellfish to have been used for food (Heppell 1976 228-9). Only oysters appear with any frequency in documentary

sources. In particular the burghs of Kinghorn and Inverkeithing appear to have been centres of a local trade in oysters which extended to Stirling and Edinburgh in the fourteenth and fifteenth centuries (ER i 437, 565, 566; iv 618).

Documentary sources are extremely important for the history of the Scottish fishing industry, but virtually the only fisheries to be well documented are those hunting the all-important salmon and herring. These two fish were the cash crop of the rivers and sea. However, precisely because they were caught in seasonal gluts, complex and expensive forms of preservation were required to realise the full commercial value of these fish. Salting and barrelling or salting and curing of thousands of fish required very considerable manpower and resources. It is not possible to tell if the commercial fishing industry developed gradually from local supply fishing or as a result of substantial capital provided by those that had it, land owners and merchants. However, by the twelfth century, when documentary evidence begins to become more detailed, commercial salmon and herring fishing was clearly under the control of merchants and landowners who had the capital to invest.

An exception to this may have been the bulk preservation of fish by drying. Drying fish was a much cheaper method of preserving fish than barrelling, but the product was considerably less palatable. 'Hard-' or 'stock-fish' as the dried fish were known were a cheap source of protein

which must have been especially important for the rural poor who did not have access to the off-cuts of the urban butchery trade. Much as with grain, substantial quantities of hard-fish were kept in store as a food staple. Houses in Dundee and Crail were hired to store the king's hard-fish and as seasonal supplies of dried fish became available old or putrid stocks of fish were sold off (ER i 199, 332, 336). As a readily available preserved foodstuff it was possible, in the same way as with grain, for rents to be paid in dried fish and even as late as the mid fifteenth century a tenement in Montrose paid its rent to the king in dried fish (ER vii passim). Its basic value as a food staple and the relative simplicity of production meant that there was a steady, if undramatic, market in dried fish. Several thousand dried fish were bought and brought south from Caithness in the first half of the fourteenth century and many more were bought at Aberdeen and transported south to Stirling in the fifteenth century (ER i 239, 294; v 188).

It is not normally clear what type of fish had been dried, although in the late twelfth to early thirteenth century Lindores Abbey took a rent of five hundred dried herring annually for a ploughgate at Crail (Lindores Chartulary No lxxv p81; 259). Even pike were occasionally dried as with those given to the king in 1508 (TA iv 136). In more recent times in the north of Scotland the bulk of fish being dried were cod and ling and it may be that this was the case in earlier times as well. Certainly if cod and ling were synonymous with hard- or stock-fish then this may

account for their bones being found on Scottish medieval sites, despite the fact that they are rarely mentioned in the documentary sources.

From the twelfth century there is mention of the use of luxury seafoods as a component in rents and renders to the king and others (RRS i No 118). There rapidly developed an extensive trade in such exotics as lamprays, sturgeons, whales, porpoises and even seals all of which were available, fresh or barrelled, in the coastal burghs, although the live seal brought from Pittenweem to the king when he was at Falkland in 1502 may have been for his visual rather than culinary entertainment (TA ii 342). The range of fresh fish available was extended even further by river and loch fishing. Eels, pike, perch, trout and bream were frequently presented for the king's table (TA i 305; ii 343, 350; iv 357). Many of these and other species of fish were almost certainly available to communities living near suitable waters. However, control of boat and net fishing was extensive and long established. It was not the fishermen who became rich pulling in nets and lines and there is mention of some of the above fish being presented to the king by legitimate but 'poor' fishermen in the hope of charitable reward (TA iv 357). In another instance, the inhabitants of Corntoun were given permission to have a boat for fishing on the Forth in return for agricultural services on land (ER vii 442). Virtually all fisheries were regarded as an asset of the adjacent lands and controlled accordingly. Among the most valuable were those adjacent to burgh markets, and several early grants to

religious houses link gifts of fishings with a toft in the adjacent town (ESC Nos 35, 168, 153). In the mid twelfth century the monks of the Isle of May were even allowed to sell their fish in their own harbour as if it were a burgh (ESC No 166).

Little can be said about the techniques and equipment employed in these fisheries beyond the fact that both draw-nets and stake-nets were in use (Lindores Chartulary Nos 76 & 77). Clearly boats were used in estuarine net-fishing on behalf of the monks of May Priory and others, and it is likely that the numerous small harbours along the Scottish coast served a sizeable medieval in-shore fishing fleet (RRS ii No 207; Graham 1969 200-85 & 1977 332-365).

Documentary sources indicate that both wooden boats and coracles were used for fishing on rivers and lochs. The main reason for this is their repair and maintenance, and there is mention, for instance, of the 'corrok' used to fish Linlithgow Loch being repaired in 1569 (ER vii 630). Purchases of nets for both sea and river fishing also occasionally appear in the documentary sources. A net for large and small fish was bought by the king for use by fishermen at Cardross in 1329 at a cost of 40s, while a century later another net was bought for 15s to be used at the river fishing post called 'herywatter' by Stirling (ER i 125; iv 593). Nets were relatively expensive pieces of equipment, and it is likely that commercial fisheries were provided with them by their owners or landlords. There is little documentary evidence for line fishing, although few iron fish hooks have been recovered from urban or any other

Scottish excavation (PHSE metalwork). Most are large and perhaps used for catching pike, cod, ling and other large, traditionally or necessarily, line fished species. There is no direct evidence for use of wicker fish and eel traps or of fish spears in medieval Scotland. However, as with line fishing, the materials involved are cheap and largely degradable so there is little reason for them to be mentioned in documentary sources or to survive in the archaeological record. Un-dated tidal fish traps or 'yairs' have, however, been noted in the sea-lochs and estuaries of Scotland and some at least were adapted to hold traps and are ideal for spearing flounder (Bathgate 1949 98-102).

Despite their potential, commercial lacustrine fisheries are unusual in Scotland although the burghs were involved in commercial fresh-water eel fisheries which exist from an early date at, for instance, Cluny and Loch Leven in Perth and Kinross-shire (ER i lii, passim; ii 136). The burghs of Forfar and Linlithgow both gain an early reputation for their locally caught eels with part of Forfar's rent in the late thirteenth centuries being in the form of eels (ER i 7, 50, 62). Some of the Forfar eels are specifically recorded as being salted and salt was provided by the kings officers for the eel catch at Forfar in 1360 (ER i 62; ii 33). There is also mention of special eel tanks at Forfar in the mid fourteenth century and at Linlithgow at the start of the fifteenth century (ER ii 205; iv 74; vi 563). These would have been used to keep eels in clean water in order to improve their flavour before killing. Thousands

of barrelled Linlithgow eels were sent to Edinburgh and Stirling in the mid fifteenth century while other burghs, such as Perth, provided a market-place for the eels taken each year from Cluny and Loch Leven (ER v 588). Urban involvement in the eel fisheries was to some extent an accident of location but unlike other forms of lacustrine fish eels do occasionally run in great numbers and there would have been some call for the complex measures of preservation and marketing normally associated with saltwater fish in Scotland. Fresh-water fishing was nevertheless a potentially important supplement to purse and table for both urban and rural communities with, for instance, the inhabitants of Kelso being allowed by William I to sell in their town any fish they caught themselves (RRS ii No 64). Consequently most estates kept a tight control over any net fishing, although there is little indication that fresh water line fishing was so carefully regulated. The only suggestion that this might also have been the case comes in the mid fifteenth century when poachers of pike (and perch) in Linlithgow Loch, who are likely to have used lines rather than nets, were prosecuted by the king (ER vi 553, 555, 556, 588).

By the fifteenth century the fishing of several significant bodies of fresh-water was being actively developed by important religious or secular houses. Burghs like Linlithgow, Forfar, and Stirling benefited from the increased construction of fish-ponds or stanks. Fish-ponds (vivaria) were constructed at Linlithgow along with various other works in 1426 (ER iv 415). New nets for, and perhaps

work on, the Linlithgow fish-ponds were paid for in 1452 (ER v 428). These projects were supervised by specialist fishermen appointed by those who controlled the fishing rights. In 1502 a net for pike was delivered to Widdirspune, fisher, to give to the Highland (Ersch) fisher along with 12 lbs of hemp with which to make nets. The Highland fisher, who had been in Edinburgh, then travelled to Stirling along with his gear (TA ii 142). There followed a major attempt to stock the fish-pond at Stirling with live trout. The origin of most of these trout is unknown, but some were provided by Lady Lyle and the Laird of Loch Leven. Live perch were also brought from Loch Leven to Stirling in 1503 (TA ii 367, 424). A rare illustration of how these fish were moved concerns a pike (ged) which was brought to the king in Peebles and then transported to Edinburgh in a specially made 'ged pok' (TA iii 376). Pike were often presented to the king during the late fifteenth and early sixteenth century, as by the lairds of Loch Leven and Luss, and the Prior of Inchmaholme (TA ii 136, 141, 366, 410, 424). A certain proportion of these fish were for stocking the king's fish-ponds although most were presumably intended for the table (TA ii 396, 403, 420). The stocking of ponds with coarse fish, pike in particular, may well indicate that these ponds were fished by line for sport as well as more commercial reasons.

The main towns involved with fishing were coastal. They acted as market, preservation and packing centres for marine and estuarine fish. In addition many burghs provided the materials and a market for fish, particularly

salmon, caught and often preserved by estates up-river from them. Sir William Knollis, preceptor of Torphichen, was much involved during the late fifteenth century in the marketing through Aberdeen of salmon caught from his order's lands at Maryculter on the River Dee. To do this he required a supply of good barrels for which he turned to the Aberdeen coopers (Aberdeen Council Register vi 697, 717). Part of the market for salmon was for domestic consumption and storage and many burghs were involved in providing salmon for these purposes. The salmon were widely available and there are early instances of them being bought for storage and consumption in Aberdeen, Ayr, Berwick, Dumbarton, Dumfries, Inverness, Perth and Stirling (ER i passim). If necessary supplies of preserved salmon were moved around the country to meet this demand. Perth was a major centre for fresh as well as cleaned (scoppatas) and salted salmon. Where salmon were being purchased for the larder it was normal for fresh summer (capcione estiuale) fish and salt to be bought separately and the labour for salting and transporting the fish would then have been charged on top of the cost of materials. In 1327 some 364 fresh salmon from Perth were bought for the king's larder at Scone, with 13 bolls of coarse salt and one chalder of white salt (ER i 66, 365, 524-25). Perth also marketed the king's share of the salmon caught at the fisheries of 'Schliples et Incharry' (ER i 486). The estuary at Sleepless Inch and Inchyra (three miles and six miles down-river from Perth and on the south and north sides of the Tay respectively) was fished by local tenants on behalf of various parties including the Prior of May and

the Abbot of Scone (May Recs. Nos 38 & 39).

A proportion of the salmon and herring caught in Scottish waters were preserved and exported to England and the Continent. Over six hundred salted salmon were sent from Aberdeen to David II in France between 1340 and his return to Scotland in 1341, while yet more salmon were sent to France in 1342 to pay for expenses while the king was there (ER i 456, 465, 479, 506). A pipe of salmon was also exported to France from Ayr in 1446 (ER v 215). The London market was particularly important and in the late fourteenth century large quantities of salted Aberdeen and Inverness salmon were being sold to London merchants (ER iii 90, 96, 662; iv passim). By the late fifteenth century salmon and trout from Aberdeen, St Andrews and elsewhere formed a part of Scotlands direct exports to the Low Countries (TA i 67; Halyburton's Ledger passim). Leith became an important port for the export of cleaned, salted and barrelled salmon which had been shipped there from as far afield as Moray, Banff and Aberdeen (ER iv 617; v 93; vi 319, 380, 532, 657). Dealers from Leith were to be found 'on the key of Abirdene' in 1512 purchasing substantial quantities of salmon on behalf of an Edinburgh merchant burghess (Aberdeen Council Register ix 149).

The centre of the domestic herring trade was Crail. From the thirteenth-century the town was regularly providing large quantities of herring for the royal larders and household (ER i passim). Crail's extensive twelfth-century town plan no doubt owes much to the patronage of the royal

family and herring (RRSi 6, 41-2, 48, 53; Simpson & Stevenson 1982). By the fourteenth century documentary sources show Crail to be almost a factory town for the landing and processing of herring. The shores and creeks around the town are dotted with numerous old beaching places for herring boats and regular payments were made from the exchequer for the processing of fish in the king's larder at Crail (Graham 1969 226-29; ER i 305, 414, 494, 521). Herring from the king's larder or bought on the open market in Crail were then shipped from there up the Forth to Clackmannan and up the Tay to Perth, Dundee and Scone (ER i 363, 494; ii 31; iii 57, 308). Not only was the local catch processed there but in 1330 there is record of two lasts and 3000 herring being shipped along with salt from Dysart to Crail where they were then prepared for the king's larder (ER i 266). The normal method of preservation for herring was salting and barrelling, but red herring are mentioned as early as 1377 and white, red, dry and a prepared form of herring called 'sysse', were all available at Crail in the first quarter of the fifteenth century (ER ii 575; iv passim). There was a small market for white fish (fresh fish other than salmon) in most coastal towns but Crail was the only regularly named source of white fish. White fish and salted fish were sold in Crail and transported to Scone, Cupar, Lindores, and Inverkeithing (ER i 521; iii 216, 235, 308, 531). Crail's fortunes have waxed and waned with the herring, but even in 1584 the town's importance as a leading fishing port was recognised by Parliament when for a short time Crail and Leith were the principal packing points for white fish

caught in the Forth (APS iii 302).

There is, however, little indication that Crail sent herring directly abroad. Indeed herring, probably for export, were bought in Crail and shipped to Leith on behalf of the king in 1397 and 1398 by the Edinburgh merchant, John Forsyth (ER iii 423, 450). Other east coast towns involved in herring fishing for export were Inverness and Berwick. As early as the thirteenth century substantial quantities of herring were bought for the king in Inverness and shipped to Leith (ER i 19). At the same time the petty customs relating to Berwick have a detailed provision for trade in both fresh and dry herring (Assisa de Tolloneis, ch 6). It is likely that in the case of Berwick the market for herring and other preserved fish involved both exports and imports from England (Duncan 1975 507). Although the markets were smaller a significant traffic in herring, and to a lesser extent haddock and white fish, existed on the west coast as well. Large quantities of herring were regularly bought by the king on the open markets of Ayr and Dumbarton during the fourteenth century (ER i passim). Lasts of herring could even be bought in the markets of up-river towns such as Rutherglen (ER i 70, 198, 199).

Scottish merchants were not averse to bringing back preserved lampreys and hard-fish from the great Swedish fish fairs of the fourteenth century (ER i 134, 135). However, Scotland's fisheries were generally sufficient to supply the native population and also the inhabitants of various parts of Europe. The old Spanish term piscinata

Scotia is claimed by Don Pedro de Ayala at the end of the fifteenth century to have become a byword for plenty even in distant Spain, (Brown 1891 44). During the late fifteenth century a concerted effort was made by the Scots to increase the size and quality of the commercial boats going to the fishing grounds (APS i 179, 183, 235-7, 242, 345). This was in part an attempt to compete with the increasing presence of the Dutch in the Scottish fishing grounds which by the 1530s had reached such a level that there was a fishery war between the two countries. Higher tariffs were also imposed on fish exported from Scotland by foreigners. An important result of this competition was that the Scots were forced to adopt some of the techniques of the Dutch fishermen and so improved the capacity of their whole fishing industry (Samuel 1918 85-87; Lythe 1960 59). As a result although the herring fisheries were shared with the Dutch, shipments of herring and salmon in 1611-14 had risen to about one-fifth of Scotlands visible exports (Lythe 1960 58).

Chapter 3

Part 1 Animal Based Industries

Wool and Textiles

(fig. 7)

Many of the tools and all of the raw materials and produce of the wool trade and textile industry were of organic composition. As such they are only preserved in exceptional soil conditions and inevitably archaeological evidence for the wool trade and textile industries is limited. In apparent contrast, purchases of cloth and taxation of the wool trade attracted considerable documentation. However, on their own, written sources for either the Scottish wool trade or textile production are far from comprehensive or fully comprehensible. The surviving custom returns on wool are incomplete and erratic until at least the late fourteenth century and, as there was no duty on exports of Scottish cloth until the 1420s, there is no reliable guide to the importance of this export until the mid fifteenth century. Moreover, because of their unique value and the fact that they came to be reliant on a specific foreign market, the wool trade and cloth industry were completely at the mercy of the vagaries of international trade, politics and war. Any interpretation of these largely statistical sources has, therefore, to take into account not only the gaps in the record but also changes in the international market for wool. Several attempts have been made to do this, but

there remains a fundamental need to look behind the statistics at the material evidence for the wool trade and textile manufacturies.

Archaeological evidence may be rare but where textiles have been preserve they provides a unique insight into the technology and production of woollen cloth in the burghs. Several hundred samples of medieval textile have now been recovered from excavations in Perth (fig. 8) to which may be added a number of pieces of medieval textile from Aberdeen and Elgin. (Bennett 1988 159-73; PHSE textile; Bennett 1982 197-200; Bennett forthcoming). These discarded rags provide examples of the basic, and occasionally exotic, medieval textiles that were available in at least some of the more important Scottish burghs. Such finds avoid the problems of translation and definition inherent in written descriptions of cloth. In terms of urban manufacturing there is, however, a major problem in identifying which of these fabrics may have been woven and finished in the burghs, as opposed to the surrounding countryside or imported from abroad.

The original purpose of keeping and breeding wool-producing sheep was for local textile production. It was not to produce wool for sale abroad. To this extent even the Flemish cloth industry was based on the prior development of local wool production and weaving. Indeed it has been argued that in the eleventh century, during the early development of their cloth industry, Flemish weavers were self-sufficient in raw materials (Lloyd 1977 2). The early

textile industry of Flanders appears to have been based in the countryside and cloister, as were the wool gatherers and weavers of England, Scotland and elsewhere. The centralisation of cloth finishing and quality cloth production, in specific market settlements was the origin of the Flemish success (van Werveke 1954 240). A similar highly profitable control of the textile market was the desire of most other rulers in Europe, including northern Britain, where there was a suitable climate, sheep and weaving tradition. Although the evidence is appallingly sparse, charters and early urban assizes in Scotland and northern England confirm that urban tailors and dyers were being given a monopoly over the manufacture and finishing of quality cloth (RRS ii Nos 467 & 475; Leges Burgorum ch 20; Ballard 1913). It is difficult to assess the interaction of rural and urban cloth production, but it is significant that there appears to have been no attempt to control the manufacture and sale of everyday cloth.

It is far from certain when the Flemish cloth industry began to require additional wool from abroad, but the major increase in Scottish sheep farming which took place between the last quarter of the twelfth century and the third quarter of the thirteenth was almost certainly tied to Flemish demand for wool during that period (Duncan 1975a 366; Postan 1952 182-4; Carus-Wilson 1952 367-88). Melrose Abbey was certainly trading in Flanders under the protection of Count Philip of Alsace as early as 1180 (Melrose Liber i Nos 14 & 15). Stocks of sheep and wool production for the local textile industry must have been

established on a commercial basis well before the late twelfth century.

Although wool was sent from an early date to England, France and Italy it was the strength of the Flemish market which permitted high levels of taxation on wool. While the market lasted it was wool which earned the foreign bullion that permitted the whole Scottish economy to move from subsistence to profitable international trade. Indeed plucked (as opposed to shorn) wool, woolfells and shearlings bore the brunt of all export duties throughout the medieval period (ER passim; PHSE textile). Scotland was not able to compete successfully with the Flemish trade in quality cloth, and to some extent it was not in the country's interest to do so. In a highly volatile market there were definite advantages in minimising investment by dealing in wool and letting others take the risks of actually producing luxury cloth. The exporting of wool might not have involved any major urban processing, as for instance did fish, but its storage and movement through the royal burghs attracted foreign merchants and formed the basis of a sophisticated system of international credit which permitted other forms of trade to develop (Donnelly 1980 105-25).

It has long been recognised that wool exported to the Low Countries, and presumably elsewhere, was graded according to its origin. At St Omer in the thirteenth century, it was illegal even to mix wool from the recognised Scottish wool producing districts of Aberdeen, Berwick, Montrose and

Perth. Scottish wool was regarded as second only to the best English wool (Stevenson forthcoming). Moreover, it is clear from the graded quality of the wool used in textiles from excavation that the wool itself was being sorted prior to use. The best wool went for export or to be made into good quality Scottish cloth while the remainder was woven into the coarse cheap cloth which was widely used and exported by the Scots (PHSE textile). The importance of purchasing the right wool and also legal restrictions imposed in Scotland on aliens wishing to purchase wool and sell their own cloth, as elsewhere, led to a considerable number of Flemish merchants taking up residence in the burghs (Leges Burgorum ch 16; Statuta Gilde ch 23). These resident Flemish merchants then acted as agents for business associates in the Low Countries. Flemish merchants were so numerous in Berwick that they had been able in the late thirteenth century to maintain a guildhall in the town known as the Red Hall (Chron. Walter de Hemingburgh ii 96-9). The Flemish were not alone in establishing strong trading contacts in the Scottish wool ports, English merchants abounded, while French merchants, although present, were not always differentiated from their Flemish neighbours (ER i 78). Italian merchants and bankers are also known to have purchased wool from a number of Scottish religious houses during the mid thirteenth and early fourteenth centuries (Duncan 1975a 592; TA i clxxxiii n). However, the Italians were never able to wrest control of the 'futures' market in Scottish wool away from the established Flemish merchants, as for political reasons they were able to do in England (Lloyd 1977 60-98).

The documentary evidence for the Scottish wool trade with the Low Countries has been re-examined in recent years and the following account summarises this work (Stevenson forthcoming). The early custom returns are patchy, and all the returns are in any case incomplete because certain nobles, prelates and monastic houses were exempt from paying duty to the crown. The first considerable period for which more or less comprehensive figures may be shown, 1372-6, appears to co-incide with the peak in national exports. For these years the quantity of dutiable wool exports were, including woolfells, just under 1100 tonnes. This was about 20% more than it had been earlier in the fourteenth century and wool exports proceeded to drop back by 25% over the next 15 years prior to the great slump at the end of the century. These figures indicate that dutiable wool exports were running during most of the fourteenth century at about a fifth of English levels and that they climbed to well over a quarter by the early 1370s. They then remained at that level as both countries were equally affected by the collapse of the Flemish market (ER i-iii passim; Carus-Wilson & Coleman 1963 passim). The situation was, however, even more serious than these figures suggest, for while wool exports may have held up until the 1390s their value had almost certainly slumped. Northern English wool prices dropped by as much as half between the start of the century and the 1380s (Lloyd 1973 passim).

The collapse of Scottish wool exports at the end of the

fourteenth century was due to a variety of causes but essentially wool was no longer wanted in the main Flemish towns to make quality cloths. However, it was still in demand elsewhere in the Low Countries for the manufacture of medium-quality cloth. Although the downturn in wool exports started in 1398 the great slump took place from 1400 with the advent of an English naval blockade (Grant 1984 43-4). Increasing uncertainty and prohibitions led to the Flemish cloth producers turning to Spanish wool as an alternative to Scottish and English sources. A 19% reduction in the export duty on wool in 1426 did little to improve the situation and when regular trade between Scotland and the Low Countries was again possible, in the early 1430s, Scotland had lost ground to the Spanish wool producers (APS ii 12 c 22). In any case there was scant opportunity for peaceful trade over the next few years and despite occasional upturns there was an overall decline in wool exports until by the 1450s returns were a third of their level in the early 1430s. The situation continued to decline and by the end of the fifteenth century Scottish wool was sometimes held in store for over a year before a suitable buyer could be found (Halyburton's Ledger xxi-ii, 71, 206, 270).

Despite this formidable decline wool remained Scotland's most important export throughout the middle ages. In 1434/5 wool and woolfells still provided nearly 77% of all the receipts for Scottish Customs (ER iv-v passim). Other markets for Scottish wool were developing and by the start of the sixteenth century much of Scotland's trade was with

Normandy. Between 1510/11 and 1512/13 sailings from Leith were almost equally divided between Dieppe and Veere (SRO, E71/29/2-3 noted in Stevenson forthcoming). During the course of the sixteenth century repeated attempts were also made to protect and increase Scotland's own textile industry at the expense of the wool trade. By the last quarter of the sixteenth century there was even the extraordinary situation of the Convention of Royal Burghs calling for bans on the export of wool and on the importation of English cloth (Burgh Convention Recs. i 75, 76, 359, 464; Pagan 1926 154). After 1581 the export of wool was nominally illegal, but it continued under royal licence (APS iii 220). In the early 1600s major efforts were being made to attract foreign weavers to the Scottish burghs to boost the Scottish textile industry (Reg. Privi Council 1st ser. vi 123, 232, 274, 309).

The conversion of wool into cloth was the most labour intensive medieval manufacturing process. Despite the availability of improved machinery during the Middle Ages, spinning wheels, new looms and waulk-mills were not taken into general use and the production of cloth remained extremely laborious. It might be painstaking work, but perfectly servicable cloth could be made without any exceptional skills, equipment or raw materials. Cloth for everyday use could be and was produced in a domestic rural context without involving urban specialists. Indeed it was this level of manufacture which formed the backbone of the Scottish textile industry. The basic gathering, sorting, and washing of the wool were tasks necessarily and best

carried out in the country, near the sheep where there were suitable sources of water and wood ash to make the lye needed to wash the wool. Moreover, as the carding or combing and spinning of wool into yarn was carried out in the home by women, this too would have been done where the bulk of the population lived, in the country. Only at the stage of actually weaving the cloth did the numbers involved drop and the potential for more skilled work begin to favour specialisation. Even then there was no automatic requirement for weaving to be carried out in the towns. However, once the wool was woven its increased value dictated that any attempt to improve the cloth's marketability by careful finishing should be carried out by the best possible specialists. If the work of dyeing, napping and shearing the cloth was bungled the product of many hours of labour could easily be ruined. It was therefore only in the finishing stages of the better cloths that the level of specialisation was tied directly to the market place.

While direct documentary evidence for the rural cloth industry is lacking, something of its development can be deduced from evidence for its relationship with urban specialists. By the late twelfth century there existed a well established rural cloth industry which was capable of producing variegated cloth from coloured yarn and even of dyeing self-coloured cloth. The king's concern was not that such cloth was manufactured outwith the burghs but that they might be manufactured and sold outwith the control and profit of his burgesses. The role of urban

specialists in manufacturing, finishing and marketing good quality cloth was therefore converted by charter in the twelfth and early thirteenth centuries from a service to a right, and only specific parties, presumably for instance those great estates and monasteries with waulk-mills, were exempted from this new control (Dryburgh Liber No 161; Morton Reg. lxvii; Holyrood Liber Appen. 2 14). Control of marketplaces and professional expertise allowed a profitable distinction to be drawn between town and country. Urban waulkers and websters clearly did exist, but they were essentially manual labourers and therefore prohibited from joining the merchant guild (RRS ii Nos 467 & 475; Leges Burgorum ch 20). Perhaps even more important, for other manual craftsmen could join the guild if they abjured their craft, far from being tied to the market place, a waulker or weaver could find work in both town and country.

Although wool was the most important of the fibres used to make cloth there are instances of coarse cloth recovered from Perth made from goat-hair and threads, cords and yarns of cow-, horse- and goat-hair. Vegetable fibres such as linen do occur but they are very rare as they do not survive well once buried. The availability and working of linen has, however, been indicated by finds of flax seeds, linen working tools such as glass smoothers and a possible flax breaking mallet from Perth (Robinson 1988 200; Fraser & Dickson 1982 242; PHSE textile, wood, glass). There is also widespread documentary evidence for the availability of linen and flax, especially in the fifteenth century when

Scottish ships returned from the Baltic with large quantities of Prussian flax, presumably to supply the Scottish textile industry (Ditchburn forthcoming).

Spinning wheels, of the type later known in Scotland as the 'muckle wheel', were in use in England during the fourteenth century and they are likely to have been introduced into Scotland at about this time. However, drop spinning produced a better yarn and spinning wheels were sometimes only used to produce the weft (Patterson 1956 202). There are no indications from the surviving examples of textiles from Scottish sites that spinning wheels had been used to prepare either the weft or the warp, nor has any part of a medieval spinning wheel been recognised amongst the worked wood from Perth or any other Scottish excavations (PHSE textile). Wooden spindles and a great many spindle whorls have been found and testify to the continued popularity of drop spinning in both town and country throughout the medieval period.

There is also some debate about the types of loom used to weave cloth at this time. The choice is between the traditional vertical two beam or warp-weighted looms and the more complex horizontal loom with its potential for a shedding-mechanism for lifting and lowering alternate warp-threads by treadles (Patterson 1956 211-214). The former has been associated with women weaving at home and the latter with professional male weavers (Carus-Wilson 1969 165). Unfortunately the various weaves and selvages found on examples of medieval cloth cannot positively confirm the

use of the horizontal loom, and to date no part of a medieval horizontal loom has been recovered through excavation. In contrast several pieces of cloth from Perth have starting edges of the type found on cloth produced on vertical looms and there are weaving swords and pin beaters and possible weights for use with such looms from Aberdeen and Perth (PHSE textile, wood, worked bone; Fenton 1982 180-1; Trewin 1982 184-5; Macgregor 1982 182-3). It is therefore apparent that vertical looms were in use in the burghs during the medieval period, and it may be that horizontal looms were exceptional. There is, however, a slight indication that horizontal looms were being used to produce particularly wide woollen and linen cloths towards the end of the fifteenth century. Even when dyed the price of this 'braide clayth', as it was known, was only between 1s 6d and 6s an ell and it may well have been of Scottish manufacture (TA i passim).

It is quite impossible to tell what volume of cloth was manufactured. However, to judge from the proportion of different textiles recovered from medieval contexts, it seems likely that the common cloth of the burghs was a 2/1 twill. As it had been prepared for spinning by combing rather than carding the resulting cloth would have been like a type of coarse worsted. Once woven the cloth was often fulled but did not normally have a raised nap. There are various problems in identifying the presence of dyestuffs on these pieces of textile and the number of pieces forwarded for testing has been small. However, a sample of pieces from Perth suggests that only some 30% had

been dyed, while around 60% of the remainder had some natural pigmentation (PHSE textile).

In order to full the cloth it was submerged in an alkaline solution derived from a mixture of water, fuller's earth, wood ash and even stale urine. There it was agitated by 'waulking' under foot in tubs or under the mallets of specialised water powered waulk-mills so that the alkali combined with oil on the wool to produce a simple soap. The clean and pre-shrunk cloth was then rinsed and carefully dried on tenter hooks to pull it back into shape. Virtually all cloth needed to be finished by fulling and this is reflected in the high proportion of fulled cloth in the archaeological record.

The manual fulling of cloth was hard, laborious and noxious work, and the introduction of waulk-mills must have significantly affected the pattern of cloth finishing if not cloth weaving as well (Carus-Wilson 1932 39-60). The first waulk-mills that are recorded in Scotland date to the late twelfth century (Dryburgh Liber No 161; Coupar Charters No 60). Evidence for waulk-mills in medieval Scotland is, however, slight with only a handful of mills being identified as being for the fulling of cloth (Morton Reg. lxvii; Holyrood Liber Appen. 2 14). This may in part be because it was unnecessary to specify the nature of a mill when recording its rent unless there were both corn- and waulk-mills at the same place. The known examples, perhaps because of the importance of monastic records, appear to have mainly been tied to the holdings of

religious houses and certainly not the burghs. Their location in the countryside can not, however, have been for purely practical reasons of water power, for virtually all burghs were well provided with corn-mills. It seems more likely that the economic and perhaps social organisation in the burghs was against funding capital projects to lighten the load of the lowly waulker. The only urban waulk-mills that are known were near Cupar in Fife, but it was not until the end of the fifteenth century that there is any indication of a direct connection between one of these mills and the burgesses of the town (ER vi 75, 248, 611; x 748).

Unlike fulling, the finishing of cloth by dyeing and/or by raising and shearing a nap was unusual and almost certainly restricted to the best quality cloth. In the lower grades of cloth, which compose the majority of the excavated examples, any colouration depended upon the natural pigments of the wool. However, documentary sources confirm that hanks of yarn and bolts of cloth were being dyed to produce variegated and self coloured material.

Artificially coloured cloth was associated with quality and status and inevitably there was a call for more prestigious and expensive imported pigments such as madder, woad and brasil (Assisa de Tolloneis chs 3, 7, 11). Regardless of the pigments used successful dyeing was an extremely skilled job, but with the value of the cloth and some of the pigments involved dyers also required substantial working capital (fig. 9). Not surprisingly then, some dyers were men of considerable substance and a few reached the top of the burgh hierarchy. For instance, Ralph dyer

(tinctor) was custumar and then provost of Linlithgow between 1327 and 1331 while another dyer Stephen was provost of Banff in 1340 (ER i passim). There seems, though, to have been a decline in the status of dyers towards the end of this period and by the mid fifteenth century dyers were being excluded from the general cloth trade (APS ii 49 c9).

By no means all of the dyer's materials required to be imported. The seed remains of a few dye plants such as weld (dyer's rocket) have been identified from sites in Elgin, Aberdeen and Perth (Fraser forthcoming; Fraser & Dickson 1982 242; Robinson 1988 206). Originally dyer's rocket must have been introduced to the country for use as a source of pigment, but it is not possible to tell whether or not this plant was being grown commercially in and around the burghs. The two most important pigments, woad and madder, had to be imported. Neither plant could be grown commercially in Scotland, the nearest source at this time being France. Among other goods required by the textile industry seized by the English as they were being sailed up the east coast of England in 1394-5 were quantities of woad and madder (CDS iv No 462). The accounts of Andrew Halyburton at the end of the fifteenth century record frequent imports from the Low Countries of woad as well as madder, alum and some vermillion (Halyburton's Ledger passim).

It is likely then that cloth was being dyed in many of the burghs. Personal names in the fourteenth and fifteenth

centuries suggest that the skill was widely available and occasionally there is evidence of work being commissioned, as in the case of the woollen and linen costumes of the king's jesters which were dyed various colours in 1448 at Stirling (ER v 318). Custom returns for the late sixteenth century do, however, mark out Dundee as paying more in the import duties levied on dye-stuffs than any other Scottish town (Grant 1930 319). Even internal trade marks Dundee as exceptional at this time for there is mention of £20 of woad being sent by the litsters or dyers of Aberdeen to Dundee for dyeing cloth to be manufactured there (Booton forthcoming). In exceptional circumstances Scottish cloth was also taken abroad to be dyed. This seems not, as it has sometimes been portrayed, a result of a lack of facilities in Scotland, but a means of financing specific deals and trips. In the 1420s quality Scottish white cloth was permitted into Flanders for dyeing. Once dyed, however, it could not be sold in Flanders but had to be exported, presumably to other markets on the Continent (Rooseboom 1910 16, App. 21 & 26). Nor was the shipment of cloth for finishing entirely one way. In 1490 French cloth bought for the king in Scotland was napped and sheared prior to it being made into clothes (TA i 139, 149). An almost holiday atmosphere surrounds the accounts of two Dundee tailors travelled to London in 1610 to have 'blew clayth' and yarn which they took with them dyed violet. Sale of the yarn and half of the cloth was to finance the dyeing and pay for merchandise bought by them in London (Wedderburne Compt Buik xxxvi 79).

Trade in Scottish cloth increased dramatically during the second half of the fifteenth century. Very little is recorded about shipments of cloth around Scotland, although by this stage it seems that cloth producing burghs were even competing for each other's home markets. Aberdeen council attempted to protect its local cloth industry in 1464 when it ordered the prohibition of woollen cloth from Dundee (Aberdeen Council Registers v 828). As a result of changes in the range of goods subject to duty there is slightly more evidence for the extent of cloth exports from Scotland after 1426. The fact that this duty was imposed on the value and not the weight or length of cloth being exported, as was the normal practice for other commodities, would itself suggest that cloth of widely differing values was being exported. The relatively complete figures for 1434/5 clearly indicate that Edinburgh with 59.2% of the export market dominated the scene. The next in importance was curiously Kirkcudbright which had 28.4%. None of the other burghs was heavily involved in exporting cloth; Dundee with only 2% was behind Linlithgow (4.4%), Aberdeen (2.7%) and probably Ayr (Stevenson forthcoming Table 3). Edinburgh almost certainly acted as a clearing house for the cloth from various east coast burghs. The surprising figure is Kirkcudbright which seems to have built up under Douglas patronage a substantial trade for itself with presumably Ireland, Brittany, La Rochelle and Spain. This is not reflected in any other export commodities, as staple goods were mainly taken to the east coast and directed towards Flanders. The fact that the Douglasses saw and were able to develop a substantial trade in cloth does itself

mark out the potential of the product and of new markets. Scottish cloth found a market from the Baltic to the Bay of Biscay but ironically the principal market seems to have been in Flanders. Despite attempts to ban it in 1497 public demand in Flanders was strong enough to have the cheap cloth of Ireland and Scotland allowed in.

There is very little written evidence either for the range of cloth imported or for the manufacture of clothes until the fifteenth century. Excavations have however produced some fragments of extremely high quality pattern woven woollen cloth, silks, lace, and even silk ribbon finished with filaments of precious metal (PHSE textile). The range and quality of imported fabrics available in Perth from as early as the twelfth century is as striking as that to be found in the fifteenth century Treasurer's Accounts. Although cloth could be bought separately and taken to a tailor to be made up into clothes, the purchase, storage and use of often extremely expensive cloth and sometimes furs was the basis of a tailors trade. The majority of the cloth used by tailors would have been bought at specialist markets as when Augustin tailor purchased cloth during a fair at Dundee between 1264 and 1266 (ER i 8). The social status of tailors must have been very varied, but for those who 'abjured their craft' and worked as specialist middle men or even import merchants the rewards were considerable. Like dyers, tailors occasionally became bailies and provosts of their burghs, although not in any of the larger burghs. Gillot tailor was a bailie and later provost of Peebles in 1330-31 and another tailor was a bailie of that

town in 1343 (ER i 299, 353, 517). William tailor was custumar for Cupar in 1327-28 while his namesake was provost of Rutherglen in 1329 (ER i 77, 95, 162).

The excavation of a wide range of bone, copper alloy, and iron needles and occasional iron scissors and shears from Perth and elsewhere may testify to domestic and perhaps professional cloth working (PHSE metalwork). Working practices and the divisions between private and professional tailoring are, however, difficult to identify at the lower end of the professional scale. Even the role of shearers in the finishing of quality cloth and clothes only becomes apparent in the late fifteenth century.

Whatever their earlier working practices, by this stage the senior members of their profession were not simply finishing cloth but also marketing it and, presumably in conjunction with tailors, finishing garments (TA i passim). A few fragments of felt, one from Perth being of good quality, perhaps indicate the re-use of the shearer's trimmings and an undocumented aspect of their work (Bennett 1988 166).

Chapter 3

Part 2 Vegetable Based Industries

Introduction

The number of industrial activities dependent on vegetable raw materials was relatively small compared to that involved in animal and mineral exploitation. Nevertheless vegetable produce was an extremely important part of the medieval economy. In one form or another, cereals were the staple foodstuff of the entire nation. The involvement of the towns in the cereal trade is, therefore, dealt with first. Vegetables were presumably also eaten, but the commercial importance of vegetables seems to have been restricted by difficulties in their preservation and storage. There was, however, a limited market for fruit and fruit trees as well as more exotic vegetables and vegetable seeds. This trade is briefly discussed under a section on market gardens which also includes what little information there is on the growing of non-food plants useful to man, including flax, medicinal and dye-plants. Finally the very varied use of wood and timber is discussed along with their associated crafts.

The first of these topics, cereals, demonstrates the strong connection between the work and needs of the rural community and the importance of the urban granary and market place. The storage, marketing and distribution of grain was primarily a matter of local trade, but when a

region was blessed with plenty or cursed with famine, national and foreign trade in grain became an important feature of burgh and regional economies. Urban involvement in cereals also went beyond storage and marketing to include the bulk preparation of bread and ale for consumption by townsfolk and visitors. Nevertheless the technology employed was not significantly different from the central facilities which existed in many rural estates and, apart from the volume of their trade, there seems to have been little that was specifically urban about the cereal related industries. As with many of the animal based industries, therefore, only the existence of a lawful market and the large quantity of cereals processed in towns really distinguishes urban storage and working of cereal from similar work in rural communities.

Much the same is true of the wood and timber working trades, for despite a strong national and international trade in timber the management and use of woodland was an essentially rural occupation. As with the textile industry it was only at the very top of the woodworking profession that trades such as shipbuilders, wheelwrights and coopers came to be firmly established in the burghs. Unlike the textile trade, however, these specialist woodworkers primarily catered for the professional requirements of other trades rather than the more general domestic consumer market.

Chapter 3

Part 2 Vegetable Based Industries

Cereal Processing

(fig. 10)

Successful cereal farming by the rural community lay at the heart of the whole population's ability to feed itself. However, successful storage and trade in grain by the urban community permitted not only seasonal and harvest shortages to be evened out, but also profits to be made on surplus grain. The preparation and storage of grain was both an urban and rural industry, although all large scale trade in surplus grain took place in the towns. Scotland was usually a net grain importer and the need to feed both urban and rural mouths was one of the most persistent motivations of Scottish merchants. Much of the imported grain came from England and across the North Sea as part of the Baltic and Danish trade, while additional supplies were routed through the Low Countries (Ditchburn forthcoming; Stevenson forthcoming). Except in times of Scottish famine the quantities of imported grain were, however, of minor economic importance when set alongside the production and marketing of Scottish grain.

To judge from the frequency of their appearance in the documentary record, three cereal genera were widely grown and traded in medieval Scotland. Oats (Avena) were universally grown and, in the form of meal, provided the

staple foodstuff of the population. There are also occasional references to the use of oats for horse fodder and malting. The other major cereal, wheat (Frumentum), was grown on the better arable land. In addition to its local consumption, wheat was an important 'cash' crop and it frequently appears as a component in annual renders from arable land (Coupar Angus Charters Nos 18 & 19). As early as the twelfth century the Abbey of Scone was granted a teind of the king's ferm from his estate at Longforan in Gowrie. The ferm was at that time paid specifically in the form of wheat (RRS i No 248). Unmalted barley (Ordeum) makes a more limited appearance in the documentary records than either wheat or oats, and when it does appear it is usually in the context of ancient renders such as to the Celide of Loch Leven and also St Andrews of Kinkell (RRS ii Nos 35 & 347). This may reflect a slightly different market for barley in earlier times, but by the twelfth century it was mainly used for brewing and it is as malt (Brasium) that barley is usually referred to in charters and other records. A fourth cereal, rye (Sigalum), provided an alternative source of flour to wheat, but by the end of the fourteenth century references to rye all but disappear from the charters and accounts of the Scottish crown. All four cereals are well represented in the archaeological record, with oats and wheat being by far the most commonly occurring cereal from urban cess. Most of the oats are common white oats (Avena sativa) although a number of other varieties do occur. The sub-species of wheat and rye are less easily identified, although of the former bread and club wheats have been identified (Robinson 1988 205; Fraser

& Dickson 1982 239-243; PHSE botanical).

These differences of use and availability were reflected to some extent in the price and perhaps also the ways in which cereals were stored and marketed. The price of grain could be extremely volatile and was substantially affected by the quality of the grain and success or failure of the harvest. However, wheat (and rye) tended to cost approximately a half to a third more than either barley or oats (ER i liii-liv 289, 341, 367, 40; ii c). Likewise malted barley was about a third more than the ungerminated grain (ER i 505). An additional aspect of cereal production is perhaps also hinted at in the accounts of the king's granaries where, as at Roxburgh Castle in 1266, wheat was rendered at the castle by various estates still bound as sheaves while the barley and oats came in already threshed (ER i 29).

The fundamental place of cereals in the early economic and industrial structure of Scotland is epitomised by the well established use of grain, and especially wheat, as a means of paying teinds and rents (RRS ii 51-52). In contrast to the traditional tribute in cash or kind due to the king by virtue of his lordship or regality, might be paid in silver, cattle, swine or cheese rather than cereals (RRS i 52-3). When trying to raise disposable income by setting demesne land at ferm the first choice was silver or failing that cereal. Grain was an easily divisible, durable crop which could be readily traded for silver. It is no accident that a grain of wheat became the smallest standard unit of weight or that the main use of

this measure was in the weighing of silver. The final alchemy of changing cereal into silver was one of the principal functions of the burghs.

The evidence for trade in home-produced cereals is extremely difficult to interpret, but there would seem to have been a steady market in bulk grain in the main arable regions of Scotland from at least the thirteenth century. After harvest, what was not required locally, either for consumption or to pay church teinds and other expenses, found its way to urban markets and mills. All burghs were involved in the conversion of agricultural produce into silver but the main centres of the cereal trade were inevitably strategically located in the arable heart land of the east coast. Aberdeen, Perth, Stirling and Edinburgh/Leith were all centres of marketing infrastructures which, along with a number of smaller burghs, serviced predominantly arable hinterlands (Coppock 1976 9-22, 43-92). Aberdeen, with Inverness and Elgin, dealt mainly in produce from the extensive fertile lands of the Earldom of Moray. Perth gathered similar produce from the Carse of Gowrie and Stirling, along with Clackmannan, was the market for much of the grain from the Carse of Stirling. The great wealth of the Lothians was channelled into Edinburgh and Leith through Haddington and Linlithgow (ER i Passim). The missing town from this group of major king's burghs is Berwick. Undoubtedly Berwick did receive cereals and other agricultural produce, especially wool, from Tweeddale, but because of that town's chequered ownership there are few royal accounts for Berwick. It is

also conceivable that cereals from demesne farms went either by necessity or tradition to Roxburgh. The importance of Berwick as a trading centre before 1333 is nevertheless apparent from references to, for example, rye provided by a Flemish merchant in Berwick, Clays de Tore, to the king in the 1320s (ER i 173), or the monks of Kelso committing certain of their tenents to transport grain and other commodities to^o and from Berwick (Kelso Liber ii 456, 461).

The involvement and influence of the rural land owners in the organisation of the urban cereal markets was considerable. The trading executives of the great arable estates were their senior 'girnalmen' or 'granitars'. These men were in charge of their lords' granaries and also the marketing of estate produce and the purchasing of both luxuries and necessities required on their estates. They were based, however, in the great market burghs. The senior granitars of major land owners like the bishop of Dunkeld lived and worked in Perth and Edinburgh/Leith (Dunkeld Rent. passim). In the case of the king's girnalmen there was the task of provisioning the king's urban fortresses and residences. Roxburgh castle, or perhaps the town, contained a royal granary, of which accounts survive for 1266. In that year some of the barley which had been kept there was sold in the town while a quantity of barley also had to be written off as it had gone bad through long storage (ER i 29). There is also mention of a timber granary at Stirling castle in 1368, while in 1451 two houses were rented in Stirling to contain

the king's oats and other victuals (ER ii 306; v 479).

With the growing importance of Edinburgh and Leith in the fourteenth and fifteenth centuries Leith appears as the principal centre of the Scottish grain trade (ER iii 45, 243, 367, 377). The granaries of Leith frequently received shipments of grain from Moray and there are even references to the transporting of grain from Moray by boat to Stirling (ER ii 168, 352; v 347; x 38, 85). The origin of the grain that was being traded is in the main un-recorded, although in addition to the grain from Moray there are occasional references, as in 1434, to barley brought from 'northern parts' and sold in the market at Leith (ER iv 579). Leith may also have been the main port of entry for the grain, including barley, shipped from the Low Countries through the office of Andrew Halyburton in the late fifteenth century (Halyburton's Ledger 178, 194, 223, 228, 231, 104). The quantity of grain recorded in this Ledger is small, and it was normally carried as part of a mixed cargo. It is not clear therefore whether this was casual speculative trade, or whether the grain was for seed. That there was specific trade in seed grain is clear from the returns of Linlithgow for 1435, when oats were provided by Patrick Don, chamberlain of Menteith, to John of Waltoun one of the customars of Linlithgow for sowing at Inveravon (ER iv 530).

The trades involved in the preparation of grain for consumption fall into the two broad categories of food and drink. While both girnalmen and baxters were frequently

involved in local, regional and even international trade, their main task was the preparation of grain for both storage and milling by careful drying. Almost as an adjunct to this work baxters were also involved in the actual baking of bread and the preparation of malt. Medieval distinctions between gernalmen, baxters and maltmen are frequently blurred, and much the same equipment was required by each of these trades. The brewing of ale, however, required somewhat different skills and equipment, and brewers were generally regarded as belonging to a separate and less prestigious trade.

The drying of grain was an essential and skilled process, for the moisture content of grain not only affected its storage and flavour but also the volume of flour or meal 'turned-out' by the mill. In the case of oats, for instance, the optimum moisture content for milling is 8-14%. Above and below 8-14% moisture by weight there is a fall off in the weight of oatmeal turned out during milling (Findlay 1956 183-4). The fundamental tool of the grain trade in both town and country was therefore the grain drying furnace. Many such furnaces have been identified from field survey and examples of different dates have been published (Scott 1951). Structurally the furnaces consisted of a hearth and drying chamber, usually separated by a flue to prevent any flames reaching the grain. Viewed in plan they have the outline of a key-hole, with the drying chamber forming the eye of the hole. The drying chamber usually took the form of an inverted cone or pyramid with the grain spread over a coarse cloth or a

loose bed of twigs and straw suspended across the top of the chamber. The hot air entered at the apex of the cone and rose through the broad top of the chamber drying the grain. That fires did occasionally break out in the drying chamber is evidenced by the carbonised grain, wood and straw found within excavated drying furnaces at, for example, Mill Street, Perth (fig. 11) (Robinson forthcoming a).

The majority of published drying furnaces are individual structures which date to the agricultural improvements of the eighteenth and nineteenth centuries. They are normally found on marginal land and their capacity is unlikely to be representative of what would have been required by the more intensive farming practices of the main cereal producing areas or in the towns. Examples of the large scale processing of grain have recently been excavated in both prime arable countryside and urban contexts. In the case of the rural community the large scale medieval storage and processing of grain has been demonstrated by the complex of drying furnaces excavated at Chapelton in Angus (Pollock 1985 363-70). Comparable complexes of urban drying furnaces have been found for instance at Mill Street, Perth (McGavin et al forthcoming).

In marked contrast to the number of excavated drying furnaces, there are few known medieval granaries or mills from either rural or urban contexts. In part the problem is lack of excavation, but there are also problems of identification and survival. The buildings excavated at

Methven Street, near the Perth City Mills may well have been granaries as they did produced varying amounts of grain. But as grain in a granary would most probably have been stored in sacks and any flour in barrels, firm evidence of their function is understandably lacking (Spearman forthcoming a; ER ii 138, 177). The structural remains of mills are far more diagnostic, but as yet few medieval water mills, rural or urban, have been excavated in Scotland. The likelihood is that most urban mills were of the undershot type, although the only example excavated to date is on the outskirts of Glasgow on the Poldrait burn (D & E 1981 36). A wooden cog wheel, most probably from the gearing of a water mill, has also been recovered from excavations on the High Street, Perth (PHSE wood). In addition to the commercial powered mills some limited grinding of grain for private use is indicated by the recovery of rotary hand querns from a number of urban excavations. The use of hand querns was theoretically restricted by law both in terms of how many querns burghess families could have, and when they could use them (Statuta Gilde chs 22 & 46; Articuli Inquirendi ch 58).

Structural remains from the baking of bread in the burghs fall into two categories. A thirteenth-century example of the simplest type of oven was excavated in Aberdeen (Murray, H 1982 54 Ill 26). This consisted of a single chamber of wattle and clay constructed in the form of a bee-hive over a substantial hearth stone. At Meal Vennel in Perth the stone base for such an oven was made from reused rotary quern stones (fig. 12). Such ovens were

heated by lighting a fire on the hearth stone inside the chamber. Once the oven was hot enough the embers were raked out and the bread placed inside on the hearth stone. The chamber was then sealed and as the oven cooled the bread baked. Such a basic and small scale oven may have been mainly for private use. A larger fourteenth-century oven, which was more certainly for commercial use was excavated at Kirk Close, Perth (fig. 13) (Blanchard 1988 42). This was constructed from stones as well as wattle and clay against the wall of an out-building with a paved working area around the oven itself. A fire was kindled in a pit below the baking chamber so that heating could be continuous and controlled.

The central piece of equipment in the production of malt was the drying furnace. This was the same type of structure as that used by baxters to dry grain, and in many cases the production of malt must have been a normal part of the baxters work. Only minor additional equipment would have been needed for baxters to also engage in malting grain. The main requirement was for an enclosed working area with a tank or 'coble'. The grain, normally barley, was steeped with water in the coble and once sufficiently swollen spread out and turned on a couching floor to germinate. Once the shoots were the same length as the grain, germination was halted by heating the malt in a drying furnace. This last process required a careful and gradual increase of furnace temperature as the duration and peak temperature affected the colour and quality of the malt. Finally the rootlets were brushed from the grain and

the latter was crushed by milling to produce the grist malt (Accum 1820 15-19).

The main use for malt was in the brewing of ale which took place in the burghs on a large scale (fig. 14). This was distinct from the hopped beer which was imported into Scotland in small quantities from Germany and elsewhere from the mid fourteenth century onwards (ER ii cii, 177, 227, 229, 451). The brewing of ale began with the mixing of grist, flour and hot water in a large coopered or lead lined tub to produce the wort. This water, enriched with starch and sugar, was then decanted off and boiled until it achieved the desired specific gravity. The final stage before fermentation was to prevent the wort from going mouldy by cooling it rapidly. The main fermentation was also carried out in a coopered or lead lined tub and as fermentation slowed the ale was decanted from the tub into a range of smaller barrels. All of the containers were sterilised with quick-lime and after boiling and fermentation the alcohol helped to keep the ale from going off (Accum 1820 46-100). The main equipment required in a brewery consisted, therefore, of a range of coopered and/or lead lined vessels and a metal boiling cauldron or vat erected over a hearth to form a simple boiler. A reliable supply of clean water was also required, which in an urban setting usually necessitated the construction of a well.

No urban medieval breweries have been positively identified through excavation in Scotland. This is largely because the brewing process leaves few archaeologically diagnostic

remains. However, recent excavations in the NE tower of Craignethan Castle, Lanarkshire did uncover a substantial boiling furnace and a stone water trough with settling hollow which are almost certainly the remains of a major brewery (Cox pers. com.). The remains of similar potential boiling furnaces are known from a number of urban sites, including Castle Street, Inverness; North College Street, Elgin; and Meal Vennel, Perth (Spearman 1982 350-1; Spearman forthcoming a; Blanchard pers. com.). However, as such furnaces are in effect only a means of heating large volumes of liquid they may have had a wide range of industrial and domestic uses. Indeed, the equipment required for a brewery would to a large extent have been available in the households of many important burgesses and this may account for the number of brew houses in towns. One of the more poignant of the Burgh Laws forbade dyers, fleshers, shoemakers and fishermen from brewing ale for sale unless they had a second, presumably uncontaminated, vat (Leges Burgorum No 94). In an age where ale was one of the few safe drinks its brewing was carefully monitored with ale tasters being appointed by burghs authorities (Abdn. Recs. cxix; Torrie 1986 28, 35). Most of the named brewers from Philip the Brewer, who was active in Perth during the mid thirteenth century, to those who appear in burgh records of the sixteenth century are male (ER i 2; Torrie 1986 105, 158, 161, 164). However, there are occasional references to brewstresses, such as those of Clackmannan in 1359, and it is possible that brewing was also undertaken at more than just a domestic level by the wives of maltmen and other burgesses (ER i 2, 573).

Chapter 3

Part 2 Vegetable Based Industries

Market Garden Produce

Most garden or specialist agricultural produce was for private consumption, although there was some trade in food and non-food plants. The importance of this trade, and indeed the variety of garden produce traded, is extremely hard to judge. Even in the later records, references to vegetables and other specialist plants are generally rare. Archaeological excavations have, however, demonstrated that a great many Scottish burgess plots contained substantial gardens, while botanical remains have been instructive as to the range of plants and fruits available in the towns. Unfortunately, it is not always clear which of these plants were actually grown commercially.

Herb and vegetable gardens as well as orchards were an integral feature of later medieval residences. From at least the fourteenth century the crown maintained gardens in Clackmannan, Forfar, Haddington, Linlithgow and elsewhere (ER i 8, 37, 223; ii 606). During the fifteenth century the gardens at Edinburgh Castle, Linlithgow, Stirling and Falkland were substantially extended and it is as a result of this work that something of the market in seeds at this time has been recorded. Various vegetable seeds, including cauliflower, scallion and onion seeds, were bought in Linlithgow and Edinburgh for the king's

gardens at Falkland and Doune (ER v 304, 502; vii 334, 383, 664). The purchasers of these seeds are occasionally identified, and their occupations indicate that, at least with large gardens, herb and vegetable cultivation was the responsibility of either the kitchen staff or specialist gardeners (TA i 176; ii 356). Many of the best gardens were attached to monastic houses and occasionally members of religious orders acted as specialist gardeners at royal residences such as Stirling (TA i 388; ii 358).

Botanical evidence for the vegetables consumed and perhaps grown in the towns is heavily dependent on both soil conditions and excavation policy. Results have therefore been very varied. One of the more common genera identified are the Brassica which include cabbage, kale, turnip, and swede, but these species are difficult to distinguish from related wild plants. Firm identification to commercially grown or domestic species is not, then, normally possible although at Kirk Close, Perth, significant quantities of what are believed to be the seeds of turnip rape (Brassica cf. campestris oleifera) have been identified. These seeds may have been used for the production of oil for, as with most Brassica, if the plants were only being grown for consumption they would normally be cropped before going to seed. Flax seeds which could also be processed for oil were likewise found at Kirk Close (Robinson 1988 200, 206). The remains of peas and beans are much less common on archaeological sites, although some have been found at King Edward Street, Perth (Robinson forthcoming b). Documentary sources make it clear, however, that these were an

important specialist crop for which there was a widespread market. That there was a long-distance trade in peas and beans is indicated by burgh regulations on the unloading and purchase of beans and peas from ships at the quay (Statuta Gilda chs 26, 27, 49). The cultivation of peas and beans must also have taken place and beans were bought for the garden at Stirling in the late fifteenth century (TA i 388). Peas also appear as part of the petty custom at Dysart in the mid fifteenth century (ER vii 515).

Most monastic gardens and some of the larger secular gardens would have included plots for the growing of medicinal herbs. The function of religious hospitals could be quite varied, and although some, like the Augustinian house at Soutra, Mid Lothian were deliberately established in rural settings the majority were urban houses (Cowan & Easson 1976 162-200, Moffat et al 1986). Evidence of the actual herbs being grown is, as yet, sparse. Various apothecaries are known to have been active in Scotland and the number of early herbals would suggest that herbal remedies were widely used (Moffat forthcoming). The remains of various plants with medicinal properties have been recovered from urban excavations in Scotland. Most could have been growing wild but rarer narcotic plants such as henbane (Hyoscyamus niger), deadly nightshade (Atropa belladonna) and the opium poppy (Papaver somniferum) may have been encouraged (Robinson 1988 206-07 Fraser & Dickson 1982 242).

In the first years of the sixteenth century large numbers

of fruit trees, including pear and plum trees, were bought for the king's orchard at Stirling. The origins of these trees were quite varied and included merchants in the Canongate, orchards in the Carse of Gowrie, and probably the abbeys of Lindores and Coupar Angus (TA ii 83, 354, 358, 425). Considerable prestige attached to the possession of such gardens and fruit was a delicacy which was commonly presented to the king by barons, provosts, abbots and friars. Wild fruit was also considered a worthy gift and many poor were rewarded handsomely for bringing such fruit to the king (TA i cclviii). Wild fruit was also an element in the basic urban diet and palaeo-botanical finds include elderberry, rowan, blaeberry and bramble (Robinson 1988 206; Fraser & Dickson 1982 242). From at least the early fourteenth century barrels of what would seem to be Scottish apples and pears were also being traded commercially (ER i passim; iii 43, 110). There is, however, little indication of either the production or consumption of cider in Scotland (TA i ccxiii).

There is some minor suggestion that dye plants may have been grown in or around certain Scottish towns. Parts of some towns derived their name from association with dye plants, as in the case of the Madder Yards in Aberdeen where the Carmelite friary was later built (RRS vi 260). Dye plants have also been identified from excavation samples, and while some of these are undoubtedly naturally occurring, others such as dyer's rocket (Reseda luteola) are thought to have been introduced (Robinson 1988 206; Fraser & Dickson 1982 242). It is also worth noting that

parts of wild plants such as heather, bracken, and bog-myrtle which were brought in to the towns for roofing, bedding and various other purposes could also have been used for dyeing (Dalrymple 1985).

It is far from clear to what extent the burghs were directly involved in the cultivation of flax, as flax was known to have been a common import into Scotland from the Baltic ports and elsewhere (Ditchburn forthcoming). Moreover, the recovery of flax fibres from excavations is rare as they do not survive well even in anaerobic soil conditions which are also normally acidic. Flax seeds are however a relatively common botanic find on excavations, indicating not only the availability of seed for the production of linseed oil but also use of flax fibres (Robinson 1988 200, 207; Fraser & Dickson 1982 242).

Chapter 3

Part 2 Vegetable Based Industries

Woodworking

(fig. 15)

Wood was and is the single most important vegetable raw material. However, very largely because of the considerable differences between modern and ancient woodland, its medieval cultivation and use has become the subject of various misconceptions. Any assessment of the use and economic importance of wood in the burghs must, therefore, include some consideration of the management, content and produce of medieval woodlands. This is no easy task, for while Rackham and others have examined various sources of information for the management of ancient woodland in lowland Britain, there is little contemporary documentation to demonstrate the extent of medieval woodland management in Scotland (Rackham 1976; *ibid* 1980). From what evidence there is, and what can be gleaned from the few excavated or surviving examples of Scottish medieval woodwork, it seems that at least in lowland urban areas woodland management was basically the same as that described by Rackham for England. As in England a distinction was drawn between wood (boscus) and timber (meremium). Wood included poles, brushwood, and similar scrub useful for fencing and wattle building construction, as well as for firewood or charcoal burning, timber meant the trunks of trees suitable for beams, planks and building

work. These were two quite distinct crops; the former being produced by coppicing, pollarding and hedge trimming, while the latter were selected trees left to grow on until they reached their desired size. For example at Jedburgh in 1288 there was a sale by the king of dead wood (boscum mortuum) which raised £1 6s 8d, while other timber (meremium) was transported there for work on the castle (ER i 43, 44).

Documentary sources inevitably emphasise the importance of timber as opposed to wood because of its greater individual value and use in documented building projects. However, archaeological excavations, especially at Perth where large quantities of medieval wood and timber have survived, make it clear that underwood was an equally important woodland crop. Wood in the form of wattle and light posts was the main component in all backland and many street frontage buildings. Timber, where it occurs, almost invariably retains traces of working which indicate its repeated re-use (Crone & Barbour 1988 87-88). However, the lack of new timber in Perth should certainly not be taken to indicate any shortage of timber in Scotland as a whole. It is possible that the substantial use of coppiced and other wood, rather than timber, in medieval Perth reflects instead the combination of specific building and woodland management traditions. The management of woodland to produce wood rather than timber optimises the quantity of the woodland crop and while it is difficult to say which came first, the development of a building type which made use of wood rather than timber or this form of intensive

woodland management, its success and efficiency is clear. Moreover the construction of buildings from wood rather than timber minimised the need for professional house builders and specialist tools. The quantities of wood required by towns for both fuel and building must have been considerable and all the indications are that woodlands around them were intensively used. Even in the earliest surviving burgh charters, the king's peace was extended to those bringing wood or timber to towns such as Perth (RRS ii. 430).

Unlike wood, which was not worth transporting far because of its bulk and relatively low value, the value and relative ease of handling of timber meant that it was frequently carted and shipped considerable distances. Moreover, timber for major building projects was not necessarily felled in the nearest forest and transported to site by the shortest route. It was normal for landowners to ensure a supply of cheap timber by including payments of both structural timber and wood when setting appropriate land at ferm. In this way it was often cheaper to make use of existing assets rather than purchase wood commercially. Hence in the building of the king's beacon at Berwick in the first half of the twelfth century, special timber (truncis) was provided by the monks of Coldingham (ESC No 174). As centres of transportation the burghs were the main beneficiaries of this often extravagant economy, for instance in 1366 timber was brought from Inverness for work on the church of St Monans in Fife (ER ii 243). By the fifteenth century the forests exploited for building timber

begin to be named and include, among many others, Glenlyon in Perthshire, the Water of Allan in Stirlingshire and Darnaway in Forres, as well as forests in Loch Lomond side, Badenoch, Clydesdale and Rannoch (ER vii 3, 237, 358, 446; TA i 246-8, 389, 319; Dunkeld Rent. 129-30). A striking exception to the careful management of mature woodland must have been times of military campaign. During the English invasions of the early fourteenth century dozens of carpenters and sawyers travelled with Edward's armies constructing defences and siege weapons from timber from Scottish forests or shipped north in kit form from England (Colvin 1963 409-20).

In the normal course of events, much of the timber passing through the burghs was of Scottish origin, but in the case of the boards bought in Dundee in 1377 for the king's work at Haddington, or the timber bought in Inverkeithing during the early fifteenth century the origin is less certain (ER ii 557, 565; iv 482, 537). From at least the fourteenth century seaport burghs, especially Leith, also dealt in specialist timber from Scandinavia and the Baltic. The basis of this trade was twofold. Soft woods such as pine, spruce and larch, which are ideal for sawing into boards, did not grow naturally in the more southerly latitudes, and their large scale shipment to many parts of Europe resulted in the early establishment of water powered saw mills and an even more successful trade in sawn wood (Rackham 1980 151). Eastland boards, as much of this sawn wood was known in Scotland, appear in documentary sources as early as 1329 when they were imported for the chapel around Robert I's

tomb (ER i 215). Others were brought into Scotland through Berwick in 1332 for the roofing of the Franciscan friary at Roxburgh and various other buildings (ER i 411). Timber specifically from Prussia appears in 1382 when it was required for work and engines at Edinburgh Castle (ER iii 170). During the fifteenth century wood in the form of boards, wainscot, clapholt, bogenholz, masts, barrel staves, ship blocks and oars were all imported from the Baltic ports, either directly or via the Low Countries (Ditchburn forthcoming).

An inherent feature of those trades involved in the use of timber is that much of their work was carried out in the woods and forests, or at rural building sites. Nevertheless, there are occasional pieces of evidence which indicate that some of the more specialised timber workers were based in the burghs. The most obvious urban beneficiaries were those merchants who transported Scottish and foreign timber. Many of these were general merchants, but towards the end of the fifteenth century specialist 'timbermen' begin to appear in the documentary record. Most of the timber handled by these specialist merchants was imported planking and boards and most of these timbermen, including at least one Dutchman,^{were} consequently based in the port of Leith (TA ii 282). The mainstay of the local timber and building trade were carpenters. It was they who chose, cut and worked the major structural timbers needed for instance for the king's work at Stirling, Tarbert and Cardross during the fourteenth century (ER i 40, 48, 55, 128, 131). The name

carpenter appears in association with burghs, both as a patronym and as a professional description. Several families of Carpenters achieved considerable importance; in Aberdeen one of the influential Carpenter family, Malcolm, became provost during the 1340's (ER i 455). Something of the standing of these families is further underlined by the activities of Adam the Carpenter who in 1364 bought, on behalf of the king, £41 6s 8d worth of wine for Edinburgh Castle (ER ii 177). By the early fifteenth century the king retained carpenters at Stirling Castle and elsewhere on an annual basis (ER iv 245, 271). Amongst these retainers were ecclesiastical carpenters, such as Friar Andrew Lisouris, much of whose work was for the artillery and other military projects (ER v 534, 535; vi passim).

The first references to sawyers and their assistants appear in the late fifteenth century. This may be the result of more complete documentation of those years, but it has also been noted in England that there was a change in building traditions at about this time from the use of squared trunks, split with wedges and dressed with an adze, to sawn beams (Rackham 1980 147). This appears to have been the case in Scotland as well with sawyers being paid for the sawing of oak beams, boards and spars for buildings, boats and the artillery (TA i 246, 281, 283, 284). Such a change in building practice may also have resulted in an erosion of the standing of carpenters dealing in the use of complete trees. It was Scottish sawyers, not carpenters, who were sent to France in 1503 to cut and prepare timber (TA ii 283). There is also some evidence that there was a

difference between the quality, or perhaps price, of blades available in France and Scotland, as these sawyers purchased, while in France, four saws for 15s to bring back to Scotland (TA ii 286). Unfortunately no medieval saws or saw pits have so far been found in Scotland.

A further important source of employment for skilled urban woodworkers was in the building, repair and maintenance of boats and ships. Many of the ships built during the medieval period were intended for both merchant and military service. On the west coast galleys were an essential and ancient means of transport, and their fundamental military importance in the Western Isles is documented as early as the seventh century in the Senchus fer nAlban. Their later medieval use is also well attested and, from descriptions of their use, it would seem that the ships maintained for Robert I and the Earl of Moray at Cardross and Tarbert were of the same west coast galley tradition (ER i cxxi, 6, 32, 57, 123, 125-7, 136, 269). Originally the construction of these galleys may have been a feature of island rather than urban communities, although by the fourteenth century many of the supplies required to equip these vessels were derived from the burghs, and by the late fifteenth century barges and boats were being built for the king at Dumbarton (TA i 245-6, 254).

In contrast, the construction of cogs for the North Sea and east coast trade was from an early date an urban specialisation (Unger 1980 107-13, 138-40). A large proportion of domestic trade and virtually all

international trade involving Scotland was dependent on east coast shipping. From the earliest documentation of seaborne trade, in the reign of Alexander I, it is apparent that seaborne trade between the burghs was well established and subject to royal tolls. Alexander I's grant to the church of Scone in 1124 was specifically addressed to English merchants and presumably attests to the use of English rather than Scottish vessels (ESC No 46). The existence of Scottish owned or at least chartered vessels is, however, clear from a grant by David I about six years later exempting a ship of the abbot of Dunfermline from similar tolls (ESC No 88). To what extent these vessels were built in Scotland can not be known, but it would be inconceivable that regular shipping, some of which was based in Scotland, was not serviced with supplies and repairs by local burgesses. Certainly by the mid thirteenth century the potential of Inverness as a shipbuilding town was sufficiently well recognised for the Count of St Pol and Bois to have a substantial ship built there (Anderson, Scottish Annals 295n).

What was probably a more common range of vessels is represented by the nine pieces of ships timber recovered from late twelfth-and thirteenth-century levels on Perth High Street. These include four frames and two pieces of planking from clinker built boats, two tholes and an oar port cover. It has been suggested that these finds would be compatible with ferry-type river boats of about ten metres in length (PHSE wood). Such smaller vessels, especially where they were to be used on specific fresh

water lochs, inevitably tended to be built and repaired at their place of work rather than at urban ship yards. References to both the building and repair of such boats appear in various documentary sources and it seems to have been a mixture of urban shipwrights and local carpenters who carried out these repairs. Timber and boards were purchased in 1364 for repair of the boats at Lochleven (ER ii 167). In the fifteenth century carpenters were at Linlithgow to repair the king's boat there with iron and 'eastland' boards, while in the early sixteenth century the bishop of Dunkeld had a boat built at Cluny for use on the loch there (ER vi 563; Dunkeld Rent. 233-9).

The mounting of artillery on ships, which began towards the end of the fifteenth century, led to a rapid development in specialist ships of war. James IV expended vast sums on the construction and maintenance of a Scottish navy. The principal shipbuilding ports used were Leith, Newhaven, and the now abandoned site of the Pool of Airth formerly on the Forth at Airth near Stirling where further docks were built. Both Newhaven and Pool of Airth were chosen as suitable sites for the construction of dry-docks but also for their proximity to major burghs with suitable armouries, Edinburgh and Stirling respectively. The construction of several major ships, including the 'Margaret' and the 'James', was accomplished but the undoubted culmination of this period of building at Newhaven of the 'Great Michael' (TA iii lviii-lxx; iv xxxviii-lxiii).

Detailed archaeological evidence for those woodworking trades not connected with the building of houses or ships, such as those of turners, coopers or wheelwrights, is scarce. Their raw material, produce and waste is not normally preserved and when it does survive is rarely sufficiently diagnostic to allow the identification of specific workshops. Nor, unless in connection with larger purchases or legal disputes, do documentary sources normally record the activities of such craftsmen or their produce. It is, therefore, very difficult to gain an accurate impression of the full scale and variety of the non-constructional use of timber. A rare inventory of domestic vessels was made following the fire of 1458 at the king's house in Elgin. This confirms the widespread use of wooden containers in such households and includes iron bound vessels of wood or leather (amphoris), barrels, goblets (ciphis) and other wooden bowls (ER vi 485). Rare archaeological finds of turned and coopered bowls and coopered buckets help considerably to illustrate the types of vessels involved. Two turned bowls of birchwood were found during excavations at 42 St Paul Street, Aberdeen (Fenton 1982 179-80). The range of vessels is greatly extended by examples from both the High Street and Kirk Close excavations in Perth. From these two sites have come numerous examples of turned wood, including bowls, plates and platters, as well as staves from coopered bowls, tankards, straight and splayed buckets (which may include the remains of butter churns), and a porringer (PHSE wood; Ford et al 1988 141-46). The origin of such domestic vessels is by no means clear, for although wooden vessels

were obviously used and marketed in the burghs, several were bought in Aberdeen for the king's use in the fourteenth century, there is little evidence that they were actually made in the burgh (ER i 532). The only wood turner's cores found to date on a Scottish urban site are two from High Street, Perth which had been made into bungs for casks (PHSE wood). It may be that the relevant workshops remain to be excavated, but it seems likely that the turners and coopers who made the vessels which were used and sold in the burghs undertook most, if not all, of their work in or near the woods which provided their raw material. One such cooper is documented at the start of the sixteenth century when the bishop of Dunkeld employed a cooper, formerly of Blair, to repair a variety of vessels in Dunkeld (Dunkeld Rent. 132-33).

There seems to have been a distinction between those turners and coopers who manufactured general domestic containers and utensils and the more skilled coopers who provided the containers and equipment required by urban merchants and other craftsmen (fig. 17). The raw materials and markets of both groups lay at least in part in the countryside, but the more specialised coopers were firmly linked by their most important market to the towns. This distinction would also seem to be reflected in the traditional divisions of the coopers trade into three main standards of work, dry, white and wet coopering. Dry coopering was the least specialised of the three being involved, as the name suggests, in the production of containers for dry powders and other materials. White

coopering was more exacting as it covered the making of pails, butter churns, tubs and a variety of other utensils for dairy and household use. However, it was the third category, wet coopering, which was both the most exacting and also the most closely associated with the burghs. These coopers produced water and air-tight barrels of specific volume which were essential to the trade and long term storage of perishables (Jenkins 1957 150-3).

Coopers supplying the urban industrial market with barrels are occasionally recorded, as at Aberdeen and Berwick during the fourteenth century (ER i 12, 221, ER ii 449). The purchase of the barrels they produced and the services of coopers in packing foodstuffs was also occasionally recorded as in connection with salted meat at Berwick in 1329 (ER i 217). The early years of the fifteenth century saw the rapid development of a trade in the staves of 'Hamburgh', 'salmon', 'small' and 'herring' barrels (ER iv passim). Taxes were levied on the basis of both merchandise and barrel size and clearly a basic range of barrel sizes was in operation (ER iv cxxvii-viii). Small and herring barrels were not always taxed at the same rate, but their relative sizes are clear from the Aberdeen entries of 1429 in which the taxation on a Hamburgh barrel amounted to 45s, on a small barrel 25s and on a herring barrel 20s (ER iv 475). Attempts to produce a national standard for salmon and herring barrels had to wait until 1573 (APS iii 82 c4).

A proportion of these barrels may have been 'empties'

returned to Scotland after they had been used to transport fish out of the country and it is likely that part of the urban coopers time was spent on assembling and repairing barrel kits. Such repairs also extended to goods damaged in transit as for instance with the consignment of barrels containing salmon shipped from Moray to Leith in 1460 (ER vi 657). The latter work in particular emphasises the need to have skilled coopers in the towns who could act quickly to save perishable contents. A major source of these barrel staves, as the 'Hamburgh' name suggests, was northern Germany and Poland (Ditchburn forthcoming). It is not known what sort of wood was used for these staves, although it is unlikely, because of the need for such barrels to be water and air tight, that they were made of the same softwoods which were the basis of the Baltic trade in planks and boards. Where barrel staves and tops have been recovered from excavations, as for instance with the barrel used to line a pit at the High Street, Elgin (fig. 18) the barrels have been of oak, as would be normal practice today for water tight barrels (Lindsay 1978 178; McAskill & Wordsworth 1982 375). There is no indication from such finds that the wood was anything other than from native tree species (PHSE wood).

Another specialist task of woodworkers was the production and maintenance of carts and wagons. It has long been thought that prior to the statute labour roads of the seventeenth century the use of wheeled transport in Scotland had been minimal. However, recent work in pulling together disparate medieval references to roads and wheeled

transport makes it clear that alongside the pack-horses and human porters, carts and heavier wagons were in regular and effective use (Barrow 1984 49-66). The use of especially the larger wheeled vehicles appear nevertheless to have been restricted to those organisations and individuals who could afford to commission and maintain such expensive equipment. Moreover, the use of even lighter carts would have been restricted to the wider tracks and it is unlikely that larger wagons strayed far from the main roads which ran between the burghs. The practical and economic restrictions of wheeled transport meant, then, that carts and wagons were the preserve of the greater estates and specialist burgess traders. Unfortunately, virtually nothing is known about the forms these vehicles could take. No pieces of wagons or their wheels have been recognised from medieval excavations in Scotland, and documentary references provide only occasional references to the use of boards and iron bands for the construction of wagons (CDS iv 460). However the activities of urban wheelwrights and even of carpenters constructing wagons appear in the documentary sources from the fifteenth century. Wheels for wagons were sent from Forfar to Falkland in 1426 while 36 years later two cart wheels were bought in Cupar, Fife at the high price of 24s 6d for the work at Ravensraig castle (ER iv 423; vii 153). Much of the work on both wheels and wagons which appears in the documentary sources during the fifteenth century is in connection with the mounting and transportation of artillery. These references include direct evidence for the making of carts in the burghs. Timber for the making of carts was brought from Birnam to

Perth by Friar Andrew Lisouris, carpenter, while wheels for the artillery were made by another carpenter, John Maware (ER vi 357; TA i 232, 320, 322, 326).

Wood was employed in virtually every sphere of medieval life, domestic or industrial. It was used for furniture, domestic spindles and industrial cog wheels, for cooking ladles and flax breaking mallets. The vast majority of wooden implements used in both urban and rural households were carved, all be it from carefully selected pieces of wood, with the simplest of tools. However, more complex implements and equipment, such as delicate toiletry combs or coopered containers, would have required specialised tools and skills as well as reliable supplies of wood and timber. Their production is likely, therefore, to have been restricted to those of better than average woodworking skill; the carpenters and coopers of the documentary record. Such individuals catered to a large extent for specialist markets and, if they were not resident in the towns already, would have brought the bulk of their produce to urban markets for sale. Something of the tool-kits used by these specialists has been found in urban contexts including for instance various awls, chisels, and augers, punches and a rasp from sites in Perth, Inverness and Inverkeithing (fig. 16) (PHSE wood; Wordsworth 1982 368-70 & 1983 546). The importance of woodworking is apparent even from the numbers and variety of these tools for they far exceed any other category of metal tools recovered from medieval sites.

Chapter 3

Part 3 Mineral Based Industries

Introduction

A wide range of urban crafts was involved in the acquisition and use of minerals. In order to discuss their work in related groups they are described here under a number of broad material based headings. Those trades using metals are dealt with first, with iron and steel being by far the most widely available and used of these metals. Ferrous metals were essential to the manufacture of the tools and weapons needed in rural and urban communities alike. However, there were considerable differences between those blacksmiths who produced only the general ironwork needed in both town and country, and specialist smiths who also made and maintained edged weapons, armour, crossbows, guns and artillery. Specialist iron smiths have, therefore, been covered under their own headings after a section on general iron working. A range of skills can also be found among the non-ferrous metal working crafts. These are described in turn under the headings of copper-based alloys, lead-based alloys and gold and silver working. However, as many of the basic techniques used by non-ferrous metalworkers were the same whatever the alloy, it seems to have been common practice for non-ferrous metalworkers to use a range of alloys. The main professional differences related to competence rather than materials, with personal commissions for wide ranging

practical and art work, or the casting of bells and guns, going to the most specialised hammermen. The substantial working capital and contacts needed in virtually all gold and silver work meant, however, that only the wealthiest hammermen gained a reputation for precious metalwork.

Prospecting and mineral extraction inevitably linked urban hammermen with rural communities. In the case of bloomery iron and steel made from Scottish bog-iron these links may have been quite highly developed, but where precious metal ores and more complex extraction techniques were involved much of this work was done by specialist miners. The reworking of scrap metal and the repair of broken or worn tools no doubt further increased contacts between urban smiths and their rural communities, but, unlike most of the animal and vegetable based industries, metal working, especially high quality non-ferrous metal working, was heavily urbanised. The only significant exceptions to this basic pattern were major rural building projects which required lead and iron working to be undertaken at the construction site, and even here the smiths involved were often on contract from the towns.

Only two major mineral based trades are considered here which did not involve the working of metal as their primary activity, the salt and glass industries. The salt industry was of crucial importance in the preservation of animal produce. What seems to have been a very ancient but only regionally important industry developed during this period until it was able to provide salt for the international

market. Unlike the metal working industries the production of salt tended to be dispersed along the shores of the major Scottish estu^aries. In this respect salt making reflected the distribution of the animal based industries, but unlike many of these trades the production of salt was always a specialised and carefully controlled craft, producing for the market place rather than private consumption. The glass industry was likewise purely concerned with commercial production, but unlike the salt trade the goods produced, windows, table-ware and some jewellery, were effectively luxury goods. The use of glass in Scotland, as elsewhere, was fairly restricted until the sixteenth century but, because of the various levels of technology required, the history of the glass industry is a useful guide to the general state of technical manufacturing in the country.

Chapter 3

Part 3 Mineral Based Industries

Iron Working

(fig. 19)

Iron ore is by far the most widely occurring metalliferous ore in Scotland, but by no means all of these ores were suitable or accessible to medieval metal workers. Unlike non-ferrous metals iron with a melting point of 1525°C could not, except in exceptional circumstances, have been produced in a molten form in the simple low temperature bloomery furnaces that were used in medieval Scotland. Instead, once cool, a fused mass of metal, slag, fuel and cinder would have been separated from the furnace and forged at temperatures around 1115°C . At this temperature the slag and cinder softened and could be squeezed out to leave a purer workable iron. There was normally a low yield of iron from bloomery furnaces, but the quality could be good provided suitable ores were used and the slag and cinder were carefully removed from the blooms.

The two main types of iron ore exploited during this period were bog-iron and haematite. Bog-iron ore is an iron hydroxide deposited in swamps and lakes, probably by bacterial action. It may be found in many parts of Scotland in the form of a limonite associated with peaty podsols. Moorland bloomery furnaces which made use of bog-

iron ore abound, although few have been dated (fig. 20). Late thirteenth or early fourteenth century pottery has been recovered from the vicinity of one such bloomery in Ardmarnock Forest, Argyll (Aitken 1970 196). Documentary dating of such furnaces is equally scarce, although the production of iron is mentioned on a number of occasions in the second half of the fifteenth century and it is clear that 'Spades' (vangis) of iron were, from the mid fifteenth century, part of the king's ferm of the lands of Duchray, in Stirlingshire (ER vi 278, ix-x passim). No accessible haematite sources are known near Duchray and it is likely that the ore used was bog-iron. The Royal Commission have identified a number of moorland bloomeries along the upper reaches of Duchray Water in Glen Dubh some of which are associated with buildings (RCAHM Stirlingshire ii No570).

Haematite has a quite different and more limited distribution. It occurs as a readily recognisable metamorphic mineral in both igneous and sedimentary associations. Any substantial exploitation of haematite requires, therefore, more formal rock mining techniques than would have been necessary to exploit bog-iron ore. There are some fifteen substantial sources of Scottish haematite ore which could have been worked prior to the advent of nineteenth-century deep mining techniques (Macgregor, Lee & Wilson 1920 203-10). Although there are no known medieval workings beside any of these sources this is probably a reflection of the lack of archaeological as opposed to geological survey. Nuggets of haematite have certainly been found on a large number of Scottish sites

from the Iron Age on, and although the haematite may have been collected for purposes other than smelting many of these sites have also produced iron slags (Swindells & Laing 1977 122; Spearman forthcoming b). It is clear therefore that the distribution of haematite was well known from an early date and this source of iron was almost certainly exploited during the medieval period. Among the rights given to of the monks of Pluscarden in 1233 and confirmed by the papacy in 1263 was a tiend of the iron dug in the forests of Pluscarden and nearby 'Hochtertyr' (Auchtertyre) (Macphail, Pluscardon 201-04; Spalding Misc ii 403-5). The extent and mineral resources of these forests is unclear, but there are sources of haematite only twelve miles to the southeast of Pluscarden near Craigellachie in Strathspey (Macgregor, Lee & Wilson 1920 203-10).

No bog-iron or haematite ore has so far been discovered from urban excavations in Scotland nor have any iron smelting furnaces been found in the burghs. Iron working slags are, however, an almost ubiquitous find and a number of smithing furnaces have been excavated. Iron working debris found in the towns usually takes the form of a cinder slag of very variable iron content that is often mixed with wood or peat charcoal, and only small quantities of any more vitreous slags have been found. The ratio of these two types of debris contrasts strongly with that found at moorland bloomeries where vitreous slags were produced in great quantities. All the evidence points therefore to the conclusion that iron ore was not smelted

in the burghs, and instead blooms of iron were imported into the towns where they were further refined and worked. Indeed, where smithing hearths have been excavated, as at Elgin, Inverness and Perth, large quantities of this bloomworking cinder debris have been discovered in association with the remains of hammer-scale and waste iron (Spearman forthcoming a; Spearman 1982a 346-55; Blanchard pers. com.).

The same pattern of trade in iron blooms rather than ore is also apparent from iron working debris from major rural settlements such as Castlehill of Strachan in Aberdeenshire, and Tuquoy in the Orkneys (Spearman 1984b 346-9; Spearman forthcoming c). Trade in iron blooms seems, however, to have been a medieval development for at a number of Iron Age sites as far apart as Broxmouth in Lothian and Kebister in Shetlands the ore was smelted in the settlement (Slater forthcoming; Spearman forthcoming d). Reasons for this change are far from clear, but it may be that the volume of iron being traded and worked had increased to such an extent that it was no longer practical to bring both ore and fuel in bulk to the place of work and that instead smiths undertook seasonal work at the source of their ore.

It is impossible to quantify how much iron was produced in Scotland during this period. However, it is likely that most of the iron that was prepared and worked in Scottish burghs came from the many as yet undated Scottish moorland

bloomeries rather than abroad. It is even conceivable that Scotland could have contributed to the international market in iron which was one of the principal sources of urban wealth in Scandinavia. Wrought iron 'currency bars' have been found in some of the earliest levels at Scandinavian ports such as Helgo and there are references to the trading of iron in Norse texts (Martens 1981 41). Scotland certainly had similar bog-iron and human resources to those which led to the large scale trade in Scandinavian Osmund iron during the thirteenth, fourteenth and fifteenth centuries (Thorkander 1975 68-70).

From the fifteenth century other sources of iron became more widely available and Scotland imported iron from a variety of countries. By the 1430s Kirkcudbright, in Dumfriesshire, was an important entry-port for Spanish iron. From Kirkcudbright Spanish iron was shipped north along the coast to Dumbarton from whence it was transported across to Linlithgow and Leith (ER iv cxxxix, 558, 606-7). By the end of the fifteenth century yet more foreign iron came into Scotland via the Low Countries. Much of this iron may have been re-exported Scandinavian or Spanish iron but some of it may also have come from France and Germany. Between 1496 and 1497 Andrew Halyburton organised the shipment to Scotland from Middleburgh and Bruges of some 36,000 lbs of iron. This figure may have been unusually large because of additional needs for iron during the Anglo-Scottish hostilities of those years. Certainly the urgent need for iron seems to have passed by 1499 when the quantity of iron purchased through Halyburton dropped to

only 7,000 lbs in that year (Halyburton's Ledger 43, 47, 57, 58, 69, 75, 116, 191, 208, 232, 272). The purchases of iron recorded in the Treasurer's accounts for this period include various quantities of 'French', and 'Spanish' iron. During 1496, for instance, 17 wall 1 st 6 lbs of 'French' iron was purchased for work on the king's artillery, canon shot, and other purposes (TA i 287, 291, 292, 299). In the course of the same year 13 wall 1 st 1 lb of 'Spanish' iron was purchased for work at Stirling and on the artillery (TA i 282, 284, 291, 292). It is difficult to be certain about the weight of iron in each wall or waw, although in statutes attributed to David I, but probably of a later date, a waw was defined 12 st (APS i 673).

References to the purchase of foreign iron are, however, largely restricted to the fifteenth and sixteenth centuries and even during these years they are far outnumbered by purchases of iron of unspecified origin. At least some of the latter iron must have been of Scottish origin. Exactly where and how the iron was marketed in Scotland is not normally noted, but it would seem that most of the iron was purchased in the burghs and then transported to where it was needed. In 1366 iron for the king's work was bought directly from a smith in Kinghorn (ER ii 259). Eighteen years later iron needed for work on the Isle of Bute was bought at Linlithgow (ER iii 123). It is not clear if the latter iron was bought from a smith or a merchant. By the fifteenth century merchants were clearly trading in foreign iron, and they may well have also dealt in Scottish iron, for in the Treasurer's accounts of 1496, there is mention

of ordinary 'iron' being transferred from a merchant's property to the smiddy where it was to be worked (TA i 289).

The form and composition of this iron is largely unknown. From the outset of the trade the quality and intended purpose of the 'iron' is likely to have been extremely varied. The first Scottish references to the purchase of steel only occur on the mid fourteenth century when it was used for highly specialised work such as the production of instruments for moneyers (ER ii 66). It is not until the late fifteenth century that references to the purchase of steel become at all frequent. In 1494 and 1496 several pounds of steel were bought for the finishing of tools such as picks and mattocks (TA i 252, 292). The rarity of references to the purchase of steel is belied by its frequent and skilled use in the manufacture of excavated iron tools. It is likely, therefore, that smiths normally produced their own steel by carburizing good quality iron (Tylecote 1986 191-201).

Any suggestion that this good quality iron came from abroad, or can be identified by price is fraught with difficulties. Prices of French, Spanish and unspecified iron bought in Scotland at the end of the fifteenth century would seem to be broadly comparable at between 2d-farthing and 4d-farthing per pound (TA i 249, 250, 282, 284, 285, 287, 291, 292, 299). It is not known if the units of weight or quality and form of the iron are comparable between entries. Nevertheless, there is a striking

difference between the price of iron in Scotland and that bought for between a third and and three-quarters of a penny per pound by Halyburton in the Low Countries during the 1490s and 1500s (Halyburton's Ledger passim). From the few references to the purchase of steel in Scotland during the late fifteenth century it would seem that it fetched around 6d per pound (TA i 252, 292).

The range of artefacts produced by individual smiths must have varied considerably, but the main division in quality and type of work seems to have occurred between smiths in villages or small burghs who catered for largely agricultural communities, and a far smaller number of more versatile smiths based in the principal burghs who were able to undertake more complex commissions. The interaction of these different smiths is seen most clearly in the management of large estates, as in the early sixteenth century accounts of the diocese of Dunkeld. The bishop's own smith in Dunkeld, which was a Burgh of Barony by 1511/12, was provided with his iron tools, horse-hide for bellows, buildings and a retainer of meal all which reverted to the bishop upon the death of the smith (Pryde 1965 57; Dunkeld Rent. 107, 116-7). Iron and smiddy coals were normally provided for the Dunkeld smith through the bishop's officer in Perth, while larger or more skilled orders such as decorative door bands, window bars, large purchases of nails, or steel were bought from smiths in Perth (Dunkeld Rent. 110, 203-5, 214-9, 233-9, 242-4).

The greater capacity and skill to be found in the larger

urban smiddies is emphasised in the royal accounts. Some smiddies were capable of undertaking commissions ranging from the manufacture of several thousand nails to pieces of wrought-iron artillery. The earlier exchequer accounts record many such projects but say little about the individual smiths hired for the work. However, with the start of detailed Treasurer's accounts, in the late fifteenth century, it is apparent that the more complex commissions went to a few favoured smiths. John Lame of Leith and another Leith or perhaps Edinburgh smith, Thomas Barker, both figure prominently. Lame seems to have been the senior smith working on the royal barge at Dumbarton in 1494 for which he provided bolts, chains, 'yong frowis' and collars to roof the boat (TA i 252-3). In 1496 his smiddy was able to produce many thousands of nails for the repair of Edinburgh Castle, as did another Leith smith, Hobbe Forno (TA i 291, 307, 310). Lame himself was heavily involved in work on the carriages and guns of the artillery both in 1496 and 1497 (TA i 281, 290, 334, 339). Thomas Barker had a similarly heavy commitment to the artillery during 1496-7 travelling to Melrose, Lindores and Hume to work on the carriages and guns (TA i 290, 330, 339). He was then commissioned to make a great gate for Dunbar Castle (TA i 334).

An excavated example of these later large scale urban smiddies is the smithing complex from Meal Vennel, Perth. This vennel was known from sixteenth- and seventeenth-century property rentals to have been the main iron working quarter of the town (Milne 1891 passim). Some of the

practical details of these smiddies were discovered during the 1983 excavations to the west of the vennel when many hundreds of kilograms of bloom and iron working debris were recovered from within and around a substantial smiddy. The smiddy furnace would seem to have been set at ground level as the rectangular hearth stone was very severely heat damaged. Adjacent to the furnace was another substantial rectangular stone with a central square socket (fig. 21). The socketed stone may have held an upright timber but its detailed function is unknown. Part of a substantial fifteenth-century smiddy has also been excavated at Castle Street, Inverness (fig. 21a & 21b). Despite the damage caused by later disturbance sufficient of the furnace base survived to indicate that this too had been fired at ground level. There had been some form of partition wall between the furnace and a further work area which contained a clay lined pit, which presumably held a water-butt (Spearman 1982 343, 351-2 fig 11). This type of ground level furnace would seem to have been similar to that described in some detail by the twelfth century monk Theophilus in his 'De Diversis Artibus' (Dodwell 1961 65). The lasting popularity of such a simple furnaces may owe much to the limited amount of maintenance required. Any more elaborate form of smiddy furnace, where the hearth was raised up on a platform at waist level, would have required much more substantial building materials and maintenance. A sequence of three such smiddy furnaces was discovered from fourteenth century contexts on the North College Street site in Elgin. They would seem from the stratigraphy to have been replaced in fairly rapid succession, although their individual

working life can not be calculated from the associated finds. They were, however, of quite a substantial size, and the last furnace was 2 x 2.6 m in plan (Spearman forthcoming a).

While a wide range of iron objects has been recovered from urban excavations, few have been associated with smiddies. As a result neither the tools nor the unfinished products of these smiddies are clearly represented in the archaeological record. Excavations in Perth have supplied the only possible smithing tool of medieval date and the only archaeological evidence of artefacts under manufacture. A pair of tongs was recovered from the High Street excavations, while hammerscale debris fused with fragments of nail had been dumped into a sixteenth century pit near Canal Street (PHSE metalwork A04-0496; Spearman 1983 514). Neither site produced any structural evidence of iron smithing. However, it has been suggested that Building 53 on the High Street site may have been connected with some form of metal working. A number of hearths surrounded by wattle screens were associated with Building 53 as was a quantity of 'slag', 'white ash' and five barrel padlocks, bolts and keys. There is also a gully with a wooden sluice drilled with holes from beside Building 53. Unfortunately there has been no formal analysis of the function of these features, although it has been suggested that padlocks were being manufactured or finished in this complex (PHSE stratigraphy; buildings; metalwork).

Documentary evidence for the existence of specialised locksmiths appears as early as the mid thirteenth century. Smiths provided the king with locks for Invernairn in 1264-66 and both supplied and installed the locks for Tarbert in 1326 (ER i 29, 58). Details of the variety of locks that were available become more common in the later accounts and there is mention of 'hanging locks' for the treasure chests, door locks, cupboard locks and the more general 'locks and bands' for the artillery carts (TA i 99, 184, 287, 365). There is even record in the fifteenth century of the locks of the royal treasury having to be opened by a smith before an inventory could be made of the contents (TA i 83).

The working of iron was undoubtedly the most widespread and important part of the hammerman's trade. During the course of the middle ages iron came to be employed not only as a material for tools, farming equipment and weapons but as a regular building material and for a wide range of domestic equipment. Good iron and skilled smiths were, therefore, essential to the development of regional economies.

Documentary sources make it clear that the towns played a key roll in the exploitation and use of iron. Not only did the burghs contain highly skilled smiths but their merchant burgesses are known to have traded extensively in iron. Finds of iron working debris from recent urban excavations would suggest that by no means all of this iron was imported and that much of it may have come from Scottish bloomeries.

Chapter 3

Part 3 Mineral Based Industries

Edged Weapons and Armour

(fig. 23)

We have only a very limited amount of evidence for the appearance and weapons of Scottish soldiery until the Later Middle Ages. What direct information there is has come from the chance survival of weapons and armour, now in museum and family collections, supplemented by occasional archaeological discoveries. Additional information has also been gleaned from equally scarce illustrations and descriptions of warriors and their weapons in contemporary monumental sculpture and transcriptions of early texts. These sources inevitably tend to illustrate the equipment of military leaders rather than common soldiers, but it is clear from surviving examples of both prestige and basic weaponry that a wide range of manufacturing skills were employed in the production of weapons and armour from an early date.

The arms of the ordinary foot soldier seem to have changed very little until the more general use of artillery in the sixteenth and seventeenth centuries. The dagger, spear, leather shield and perhaps light body armour, identified through excavation and heroic literature to be the mainstay of the early historic fighting man, continued to be the basic weaponry required for fifteenth century wapinschaws

(Alcock 1973 327-35; APS ii 10 c17). Only the wealthier tenants were required to also have swords, helmets and more elaborate body armour. Following the Scandinavian invasions axes were also commonly used as weapons, and these too feature in the wapinschaws of the fifteenth century in conjunction with targes of leather or pine boards with two bands on the back (APS ii 45 c3). It is widely held that long-bow archery never achieved the general military importance in Scotland that it did in Wales and England, however there were repeated attempts in the wapinschaws to have men equipped with bow and arrows (Oakeshott 1960 passim; APS ii 10 c17, 45 c3). The skills involved in manufacturing such basic weapons and armour were essentially those of blacksmiths and tanners. In stark contrast, weapons of the quality of the eleventh century silver inlaid 'Danish' or broad axe from Loch Leven, Kinrosshire, or helmets and chain-mail armour were clearly not made by agricultural blacksmiths (Caldwell 1981a 269 fig. 144). Such items may have been acquired as plunder or through trade and gift exchange, but their maintenance still required specialist craftsmen.

Any distinction that may have existed between the military equipment of the war leaders of Scotland's various hosts and their followers was considerably increased by the introduction of mounted knights during the twelfth century. Initially the weaponry and armour of the greater thanes may not have been very different from the new knights. Indeed bowmen (with horses) and even some foot soldiers were organised as part of the new military service (RRS i No

300; RRS ii Nos 131 & 404). However, there was a rapid increase in the specialisation and cost of mounted knights during the twelfth and thirteenth centuries. The gap between the equipment of those able-bodied men who were required of old to provide military service and the professionally organised knights must have been ever widening.

It comes as no surprise, then, to find that at the same time as grants of land were being made to ensure knights' service, others were made confirming the privileged status of skilled armourers and lorimers in the burghs. In the 1150s Baldwin the Lorimer held land in both Berwick and Perth. His Perth tenement was held free of all burghal service save for watch within the burgh and his share of the work on the burgh defences. His rent was not in the form of cash and instead he was to provide the king each year with one terret and two collars. Moreover although he was the king's vassal, Baldwin's land in both Berwick and Perth was his own and he was free to leave and sell his land and houses as he wished (RRS i Nos 121 & 172). In the 1210s another Perth property was granted to William the helmet-maker. This was to be held in feu and heritage for an annual render of two iron helmets (capellos ferri) rather than the usual cash payment (RRS ii No 532). By the later thirteenth century Robert Armour had been appointed to take charge of the king's weaponry (ER i 43). The social standing and importance of armourers in the urban community is further confirmed when, in the early fourteenth century, Stephen Armour became provost of Forfar (ER i 62).

Few Scottish examples of even thirteenth- and fourteenth-century weapons or armour survive. Fortunately there are, from the later twelfth century, contemporary illustrations of knights from their seals. Walter fitz Alan, high steward of Scotland, is depicted on his seal of c1170 as a knight on horseback armed with a spear and protected by a conical helmet, hauberk and shield (Stevenson & Wood 1940 iii 600; Caldwell 1979 7 & fig.). A number of the early seals depict knights with spears or lances but by the end of the twelfth century these are the exception, and most of the mounted figures carry swords instead (Birch 1905 figs. 1-12; Stevenson & Wood 1940 i-iii passim). These illustrations are supplemented during the thirteenth and fourteenth centuries by a handful of lowland grave effigies (Brydall 1895 329-410).

Much of this equipment is familiar from finds outwith Scotland and there seem to be few major differences among the weaponry of the more important Norman knights wherever they resided. As has been shown some of these weapons and harnesses came from the burghs and more were made in the armouries of royal fortifications such as Edinburgh Castle (ER iii 82). Nevertheless it is likely that those knights with lands in France and England purchased their equipment abroad in the centres of fashion and retained armourers in their households. One of the significant royal purchases of the mid fourteenth century was the jousting equipment and armour bought for David II. 'Jousting equipment' costing 40s was bought from John of Albourge and then John

of Aberleuedy was paid £5 6s 8d for armour. Both were paid out of the king's income from Aberdeen (ER i 493, 531).

From his name John of Albourge is likely to have been foreign, but it is not clear whether he was simply a merchant or an armourer who had moved to Aberdeen.

Although John of Aberleuedy was clearly a Scot it is still not clear if he was a merchant importing armour or a manufacturer of it. Given the status of the customer it seems likely that the armour was indeed imported.

An exception to the general similarity of most Norman weaponry is a group of fourteenth- and fifteenth-century swords, the hilts of which develop a distinctively Scottish appearance. Several of these swords are illustrated on contemporary effigies and there are also a few surviving examples. Most swords carved on thirteenth and early fourteenth century monuments have short quillons, sometimes curved up (towards the blade) at the tips, and lobate pommels. This form is similar to a number of Scandinavian medieval swords and they may already demonstrate the beginnings of a Scottish tradition in armaments (Wallace 1970 9-10). Indeed a Scandinavian-type sword hilt (Petersen's type U) was recovered from thirteenth-century contexts during the High Street Excavations in Perth (Caldwell in PHSE metalwork; Petersen 1919 153-4). By the late fourteenth and fifteenth centuries the quillons of these swords angle more sharply towards the blade and terminate in pointed swellings or in flat spatulate shapes. The pommels are usually wheel shaped or, later, globular. Most of the evidence for these swords is of Highland origin

as they are widely illustrated on grave slabs from this area (Steer & Bannerman 1977). Their greater circulation is, however, suggested by their depiction on the royal seal of John Balliol at the end of the thirteenth century and grave effigies such as the early fifteenth century slab of Gilbert Greenlaw at Kinkell, Aberdeenshire (Birch 1905 fig. 14; Stevenson & Wood 1940 i 5-6; Caldwell 1979 13, 20-24). Latterly these characteristics were used on the hand-and-a-half and two-handed swords. Four such swords are known but they are poorly provenanced. It is likely, but unproven, that the hilts of these swords were produced in the Scottish burghs, but the blades were undoubtedly imported and some are believed to be from either Passau or Solingen in Germany (Scott 1981 13-20).

That a good proportion of the armour being purchased in Scotland in the fifteenth century was made in the burghs is clear from a number of documentary references. In the 1440s and 1450s a number of Dundee armourers by the name of Moncur, who were probably related, provided the king with various pieces of armour including three sets of leggings and one set of splints (TA i 268, 306, 373). Towards the end of the fifteenth century there is a suggestion that, much as in precious metalworking, the majority of quality work was being done in Edinburgh and Leith. Andrew Moncur, who is likely to have been one of the Dundee family of armourers, is recorded as working under royal patronage in Edinburgh. Between 1494 and 1518 he is known to have been a master and then dean of his craft and latterly a town councillor (TA iii 361, 381, 384, 385; Smith 1906 xcii 18;

Edinburgh Burgh Recs. i 174). At this time an Edinburgh and Leith armourer, John Tait, was retained by the king (ER x 142, 297, 357, 388, 460, 534, 613). Tait was succeeded as royal armourer at the start of the sixteenth century by Allan Cochran, another Edinburgh master, who was capable of supplying complete stands of armour (TA ii 93; iii 39, 112).

The very best plate armour in late fifteenth- and sixteenth-century Scotland, however, still had to be commissioned abroad. Several temporarily successful attempts were made to set up horse powered armour mills in Edinburgh, and perhaps at Stirling, with both the armourers and at times the equipment being imported from France and Flanders (TA i 270; ii 365, 411, 430, 432). French armourers continued to attract royal patronage until the death of James V in 1542. However, by the Battle of Pinkie, in 1547, it would seem that most of the nobility had abandoned fine plate armour in favour of leather jackets reinforced with iron plaques. Two such iron plaques were found at Coldingham Priory in Berwickshire (Caldwell 1975 219-21). These reinforced jackets or brigandines were covered with fine cloth and decorated with the studs that held the iron plaques in position. The best must have looked impressive but they were essentially simple outfits which could well be made in the Scottish burghs.

Despite evidence for the use of steel to produce domestic and industrial tools, documentary evidence for manufacture

of edged weapons in the Scottish burghs is scarce. The majority of surviving edged weapons are of Continental manufacture and basic munitions are known to have been imported in considerable numbers. However, with the major exception of sword blades, all of which are likely to have been of foreign manufacture and only mounted in the burghs, a wide range of daggers, spears, axes, bows and crossbows were actually made and mounted in the burghs. Of certain urban use and perhaps manufacture are a number of weapons recovered from thirteenth-century contexts during the High Street Excavations in Perth. These rare items, like the sword pommel also found on the site, may show a slight Scandinavian influence. They include two spearheads (Petersen's type K) and a broad axe (Petersen's type M) (Caldwell in PHSE Metalwork; Petersen 1919 31-3, 45-7). A bewildering range of long-shafted weapons were either made in or imported through the burghs. By the start of the sixteenth century some of these weapons were sufficiently associated with specific burghs to take their names from them hence, the Jedwart (Jedburgh) staff (fig. 24) and the double-edged Leith axe (Caldwell 1981a 253-314).

A number of medieval arrow heads have been recovered from excavations in Perth and other burghs. The majority are military arrows with flat, shouldered blades although there are some barbed examples which may have been for hunting. Ironically, for a nation with such a poor reputation for the use of archery on the battlefield, references to the work of bowyers are far more common in the royal accounts than to any other form of home produced edged weapon. In

the mid thirteenth century 220 stone of iron was sent to Ayr for the manufacture of 1700 quarrels. The senior crossbowman there was also provided with thirty-six yew staves, perhaps for the mounting of long-shafted weapons which was a task normally undertaken by bowmakers (ER i 5-6). Bowmakers and crossbowmen make occasional appearances in the royal accounts over the next 250 years. Both were normally associated with burghs, including Aberdeen, Roxburgh, Haddington and Edinburgh, although the latter may be more specifically tied to armouries in royal fortresses (ER i-iv passim). Certainly crossbows were being made in Edinburgh Castle in 1381 (ER iii 82). During the second-half of the fifteenth century there are a great many more references in the royal accounts to urban bowyers. In part this is due to the fuller records of the Treasurer's Accounts but there are also more references in the Exchequer Rolls. In 1472 Nicholas Pannaile is the first recorded royal bowyer (ER viii 189, 191). A few years later Stirling appears as an important centre for the manufacture of bows and crossbows. Between 1488 and 1491 a certain John or Jok of Stirling was regularly paid in cash and kind for making and equipping these weapons while another Stirling bowmaker, Nicholas Montgomery, is known to have been paid various sums by the king from 1489 to 95 (TA i 92, 181, 184; ER x passim). Despite this lively industry it seems that English bows were reckoned to be of greater value than their Scottish equivalent, fetching 16s as compared to 9s in 1536. There was also an Englishman, John Bowmaker, working in Edinburgh in 1530-4 (TA v 407, 408, 431; vi 30, 36, 209). French influence is also apparent in

the appointment of John Tessart in 1539 as royal crossbowmaker, and in the following year he was paid for servicing the twenty-two crossbows on the royal ship, Sallamander (RSS ii No 3068; TA vii 356).

Detailed evidence for the origin of most Scottish weaponry and armour is scant. Nevertheless there is clear indication of four levels of armament manufacture taking place, all but one of which must have directly encouraged the urban economy of Scotland. The agricultural smith of the smaller burghs could well have produced the simpler spears and axes of the general foot soldier and indeed both these items would have been in general use in agricultural communities as tools or protection against wild animals. The more specialised smiths of larger burghs may have produced these items in larger numbers while manufacturing the lances, daggers and armour of the poorer knights. In direct competition with these urban smiths would have been the armourers employed in private and royal fortresses. Further competition to urban smiths, but not to urban trade, would have come from the foreign blade-smiths and armourers who provided the nobility with their armour and weapons.

Chapter 3

Part 3 Mineral Based Industries

Guns and Artillery

The technology and resources required for the manufacture and maintenance of artillery were considerable. From the first use of guns to their adoption as the principal siege and battlefield weapon their production and upkeep was a classic demonstration of the relationship between specialist burgh craftsmen and their king. The first firm documentation of guns being used in Scotland comes in the Exchequer Rolls of 1384 when 'Uno instrumento dicto gun' was bought for Edinburgh Castle at a cost of £4 (ER iii 672). Four years later there is mention of a keeper of crossbows and of instruments for the guns at Stirling Castle (ER iii 687, 693). There are also records of payments to Maurice Gunner between 1383 and 1386 (ER iii 667, 676, 683). Little is known about the form and origin of these guns, but they are likely to have been simple wrought-iron cannons of small size. The royal accounts are then silent about any other artillery until 1430 when Nicholas Plumber, who also provided the king with lead and iron work, was given a considerable sum of money (£590 8s 2d) to pay workmen engaged on the production of the king's bombards and other instruments of war in Flanders. There then seems to have been some difficulty in transporting these bombards and other siege weapons to Scotland. Not only was there a dispute over the contracts to ship the weapons, but whilst

loading one of the great bombards a jar of wine was smashed (ER iv cxlvii-cxlix, 677-81). There is no indication as to the form and composition of these bombards although it is likely that they were wrought-iron siege weapons comparable to the great gun, Mons Meg, which is now in Edinburgh Castle. The latter siege gun was made in the Belgian town of Mons in 1449 and gifted to Scotland some eight years later by the Duke of Burgundy (Gaier 1967 425-52). There is, however, a suggestion from Bower that one of the bombards brought to Scotland for James I in 1430 was of copper-alloy: 'immanem fundam bombardicam aeris metallo fabricatum' (Chron. Bower 490).

Although clearly of foreign manufacture, the involvement of men like Nicholas Plumber and John Turner (an Edinburgh burghess who was in charge of these accounts) indicates that the Scottish end of the transaction and supervision were in the hands of burghesses. In addition the burghs supplied the wide range of supplementary staff, provisions and equipment that was needed to keep the artillery firing. In 1444 an Edinburgh burghess Andrew Crawford provided the king with gunpowder for the bombards (ER v 147, 149). In the 1450s a great cable and three and a half stone of iron were purchased in Edinburgh for work on the king's bombards (ER v 382, 502). Alexander Napier, a senior burghess of Edinburgh and officer of the king, organised both carriage and stone shot for the bombard used in the 1453 seige of Haltoun, in Strathdon (ER v 606). John Were, burghess of Linlithgow, was with the bombards at the 1456 siege of Threave and was paid for work on the carriage and a wheel

of a great bombard (ER vi 122, 161, 200).

Whatever the validity of Bower's assertions that one of the 1430 canon was of 'bronze' the new development of cast 'bronze' guns which could fire lead covered iron shot had reached Scotland by 1473. An early surviving treasury account for that year records a considerable expenditure (£780 6s 5d) on gun founding in 1473-4 (TA i 74). At least some of the casting was done in a building in the grounds of the Blackfriars priory in Edinburgh. The operation may not have been wholly successful, as payment had to be made to the friars for the mending of the roof which had been 'rent' during the casting of a gun (TA i 65). It is not clear who was in charge of this gun foundry, but an Edinburgh burgess, William Goldsmith, was paid in April of 1473 for making a gun for the king and a Frenchman, Rannald the gunner, was paid for making a gun in February 1474 (TA i 48-9, 68). Dunkeld and the burghs of Haddington and Perth were scoured for suitable metal, and Perth also provided clay for the mould (TA i 54).

The casting of guns continued only sporadically at Edinburgh Castle during the last quarter of the fifteenth century. There is, for instance, a record of the purchase of fuel for the making of bombard moulds in the Castle during the 1480s (ER ix 434). However, at least some of the gunmaking there and at Stirling Castle during the latter part of the fifteenth century would appear to have been of wrought-iron serpentines and guns (ER ix 218n). Some of the purchases of iron, lead and timber for this

work were made in Perth (ER ix 291). Serpentes were a smaller form of wrought-iron guns, popular in Scotland until late in the sixteenth century. They were mostly of the breech loading type, with separate wrought-iron chambers which could be loaded with powder, or powder and shot, and then clamped onto the open-ended breech. Four breech blocks and a small breech loading gun are preserved in the Royal Museum of Scotland (fig. 25) (Caldwell 1981a 75-6 fig. 32). Of the iron purchased by the treasury during the 1490s much of it was described as 'Spanish' and destined 'for the artillery' (TA i passim). Smiths from the burghs who were associated with the artillery during these years worked on closed carts to carry the gunpowder and shot, gun carriages and the serpentes themselves. John Lamb, a smith in Leith, received many royal commissions. Between 1496 and 1497 his workshop provided, amongst other supplies, gun chambers for guns on the ship Flour and three serpentes with two chambers each for Dunbar Castle (TA i 281, 334).

Documentary evidence for the casting of guns at Edinburgh and Stirling Castles recommenced in 1507 (TA iv 105, 111). Again the burghs provided almost all the necessary metals, tallow, clay, wire and fuel for the two foundries and much of the work was carried out by burgh craftsmen such as the potter Alexander Bow, of Edinburgh. (TA iv 109-13, 116, 132, 133-6, 139). Overall supervision of the artillery would seem, however, to have rested with foreign gunners (TA iv 117, 118, 123-7). By 1511 the Stirling Castle foundry had been largely abandoned and gun casting was

concentrated at Edinburgh Castle (TA iv lxx 276-7). The Edinburgh Castle foundry was worked during these years by a new party of French gunners, but a Scotsman, Robert Borthwick was appointed in overall charge of this work as master melter of the king's guns - a position he was to hold with great success for the next twenty years (TA iv 261, 329, 372, 378, 422, 438; RSS i No 2374).

The king's armoury was undoubtedly the most important source of home produced artillery in fifteenth- and sixteenth-century Scotland. However, the armoury relied heavily on the work of skilled burgesses and inevitably these burgesses marketed their knowledge to other customers (Caldwell 1981a 74-5). Indeed, in 1455, 1471 and 1473, James II encouraged his greater barons to purchase gun carts (APS ii 45, 99-100, 105). During the late fifteenth and sixteenth centuries the nobility, prelates and many burghs equipped themselves with artillery. In 1497 the burgesses of Aberdeen had a considerable number of guns and were able to field 19 carts of war while artillery, carts of war, and other weapons were ordered to be made ready in 1512 and 1514 (Abdn. Counc. i 61, 63-4, 83, 92-3). Between 1545 and 1547 the burgesses of Ayr purchased various pieces of artillery including, one iron 'stang' and two 'cutthrottis' with bullets and powder as well as a great piece of artillery called a 'heidstik' and two more 'cutthrottis' with chambers and bullets (Ayr Burgh Accts. 102). Moreover, the burghs were not averse to hiring their artillery out either to other burghs or to the nobility. Aberdeen lent theirs to the Earl of Bothwell in 1539 (Abdn.

Counc. i 166) and Edinburgh to Kirkcaldy of Grange in 1567 and to Jedburgh in 1570 (Edinburgh Burgh Recs. iii 240, 275).

The origin of most of these guns is unfortunately unclear, and some artillery may have been imported from abroad. The guns bought by the burgesses of Ayr would, however, appear to have been made by local smiths, and there is also mention of the town's own gunner, 'Francy' (Ayr Burgh Accts. 96). It is likely that there were smiths in Aberdeen capable of manufacturing wrought-iron guns and at least some of Edinburgh's guns may have been made by some of the smiths in Leith and Edinburgh who manufactured serpentines for the king. Edinburgh is also likely to have been the source of the three serpentines and powder purchased by the bishop of Dunkeld for his castle at Cluny, near Dunkeld in 1512. The guns were paid for with a mixture of wine and cash, and then shipped from Cramond to Dunkeld by a Perth merchant (Dunkeld Rent. 262-4).

In addition to the manufacturing of cannons the king and his burghs took a lively interest in handguns. Probably the first documented use of handguns in Scotland is a late fifteenth-century reference to 'culverins' got from Stirling. The term 'culverin' is normally associated with light field artillery, but in Scotland the term appears to be used for both handguns of the 'hackbut' type, and light field guns (Caldwell 1981a 80). The latter are usually further described as 'gros', 'moyane' or 'pikmoyane' culverins (TA iv lxxvi). During the first half of the

sixteenth century, there are repeated references to the use of culverins in Scotland, many of which are likely to have been imported (TA vii 498; viii 120). By 1508 James IV had extended his interest in the manufacture of larger pieces of artillery to culverins. In that year the priest, 'Sir' James Pettigrew, who had been involved in the gun foundry at Stirling Castle and had devised a clock for Stirling, was paid for making a culverin for the king. This may have been a large piece as the price, £10, was the about the same, if not more, as would be paid for a serpentine. Pettigrew went on to be one of the main prospectors for gold at Crawfordmuir (TA ii 159; iv 101, 112). That the ability to at least repair these hand guns extended to the burghs is indicated by another royal purchase in 1508 of two locks for one of the king's culverins from the lorimer, George Bell (TA iv 121). By the mid sixteenth century an Edinburgh metalworker, David Rowan, had succeeded his father, a French gunner, as the king's master melter. Several of the culverins that survive from this period are thought to have been made by Rowan in 1553 (fig. 26). Other work by Rowan includes a number of standard weights and measures for Edinburgh and St Andrews (Caldwell 1981a 78-80).

By the second half of the sixteenth century handguns had become a more common weapon amongst foreign mercenaries and the more prosperous Scots. These guns came increasingly from Scottish handgun or 'dag' makers working in the burghs (Caldwell 1981a 82). By the end of the sixteenth century there were gunsmiths or dagmakers in Aberdeen, Ayr, Dundee,

Edinburgh (including Cannongate), Glasgow, Perth, St Andrews and Stirling. Of these burghs by far the most important for gunmakers were Edinburgh, with thirty, Dundee with eighteen and Cannongate, with fifteen (Whitelaw 1977 passim). The quality of their work could clearly be very high indeed and many of the royal handguns were gilded and inlaid. A few late sixteenth-century gun barrels decorated with inlaid metals survive (Blair 1975 61-101; Caldwell 1981a n58).

Chapter 3

Part 3 Mineral Based Industries

Gold and Silver Working

(fig. 27)

The considerable value attached to gold and silver meant that in medieval Scotland, as elsewhere, their acquisition and working attracted more concentrated resources and technology than any of the other metals. Indeed, the constant need to supply the royal mints with silver stimulated new mining ventures and innumerable pieces of legislation to ensure that Scottish merchants returned with bullion as well as goods. More than any other category of metalwork, the availability and working of gold and silver is an important guide to the success and growth of Scottish trade and technology.

Although small quantities of gold do occur along with silver in veins of galena and other lead ores, its recovery from these sources could only rarely have been commercially viable. It is more likely that the majority of native gold came from working alluvial deposits. The earliest documented source of native gold appears in a grant by David I to the Abbey of Dunfermline, in 1153, of a tithe of all the gold which should accrue to the king from Fife and Fotherif (ESC No 78). There is some suggestion that gold was discovered near Durness in Sutherland before 1245 (Gordon 1813 32). Certainly alluvial gold has been, and in

small quantities still is, found in eastern Sutherland in the Strath of Kildonan (fig. 31) (Macgregor 1940 23-4).

It is likely that gold and silver had been recovered from the lead mines around Crawford, in Lanarkshire, from at least the thirteenth century, and probably much earlier. Mines are known to have existed in the area from 1239 and Crawford lead was being worked for the king twenty-five years later (Newbattle Reg. No 146; ER i 30).

Nevertheless, it^{is} not until the last years of James IV's reign (1488-1513) that the gold workings of Crawford Muir appear in the royal accounts and it would seem likely that the mines were put on a more 'industrial' footing at around this time. There are numerous payments to the priest 'Sir' James Pettigrew for working the gold mines and also wages for Sebald Northberge the master finer, Andrew Ireland finer, and Gerard Essemer the melter (TA iv passim). In 1513 John Damiane, Abbot of Tongland, received a sum of money from the king to visit mines at Crawford Muir (HMC iv 517). There may have been a lapse of activity after Flodden, but by 1515 the Queen Regent paid for an officer 'to pas to Crawford Mure and thare to sett workmen and mak ordinance for the gold myne' (TA v 19). In 1539 miners from Lorraine with interpreters were sent to work the mines at Crawford on behalf of the king. These miners were placed in the charge of John Mossman, goldsmith, and a considerable quantity of gold appears to have been found by them. Mossman himself was commissioned on numerous occasions to work this gold into decorations for the court including the Scottish crown of 1540 (Patrick 1878 xv; Reid

1889 71; TA vii passim). Crawford Muir was clearly the most important source of Scottish gold during the sixteenth century and the source of much of the country's gold coinage at this time (Patrick 1878 xiv). However, there also survive from the mid sixteenth century lists of other sources of metal ores in Scotland. From these it is clear that gold had been recovered from stream beds, estuaries, quarries and mines in many other parts of the country, but unfortunately few of these sites are now accurately identifiable (Patrick 1878 xxii-xxviii).

A number of veins of lead ore in Scotland contained sufficient silver to have been commercially viable sources of that metal. Amongst the more important that are known to have been worked in post-medieval times are the veins of galena at Hilderstone in the Bathgate Hills, and near Alva in the Ochil Hills (Macgregor 1940 24). While some of the earlier medieval lead mines of Scotland are documented virtually nothing is heard of their silver content (see section on lead and pewter below). It is not until 1424, when Parliament confirmed that all gold mines and all mines in which one and a half pennies of silver could be refined from one pound of lead belonged to the king, that there is clear evidence of silver mining north of what is now the Border (APS ii 5 c13). Yet from the twelfth century the Scots were able to regularly consider substantial payments of silver as a method of settling foreign disputes. In the space of twenty years between 1190 and 1209, Scotland sent tens of thousands of marks of silver to England as the price for the cancellation of the treaty of Falaise, in

1190, as a contribution towards the ransom of Richard I, in 1193 and, after 1209, to meet the terms of the treaty of Norham (Duncan 1975a 235, 238, 245, 248-9). It is by no means clear whether such large amounts of silver were the result of early royal taxation of foreign trade or of an early Scottish mining industry. Yet to produce such sums of money either one or both of these sources must already have been active, and relatively successful, by the late twelfth century.

The introduction of a Scottish silver coinage during the second half of the twelfth century would appear to confirm that the skills to mine and refine Scottish silver were now available. The silver mines at Alston in Cumbria, had been governed by the king of Scots from 1136 or 1138 until 1157. David I and his son Earl Henry granted the canons of Nostell Priory three marks of silver annually from this mine which they administered from Carlisle (RRS i Nos 39 & 40). These mines were worked by Carlisle burgesses and provided the mainstay of the Carlisle mint. In the confusion of the Stephen war years David I and his son Henry were able to control the Carlisle mint and also to employ the moneyers from there to produce their own coinage at Edinburgh, Berwick and Roxburgh, as well as Carlisle and Corbridge. The search for and working of silver mines must have been doubly encouraged by the minting of sterlings. Not only was there a new and important use for Scottish silver but there were moneyers such as Erebald working and travelling in Scotland who were familiar with the proven metallurgical and mining technology of Carlisle (Stewart

1971 191-202).

The early documentary evidence of the importation of foreign gold and silver is almost wholly restricted to decorative metalwork. This must, however, be an incomplete picture as it is highly unlikely that the taxation of exports was being paid for entirely out of silver mined in Scotland. Moreover as the records fill out in the fifteenth and sixteenth centuries references to the importation of bullion do occur. In several of the early entries it is difficult to determine whether the metalwork was of Scottish or foreign workmanship. The silver salt-cellars, ewer, plate, spoons and other quality metalwork, including gauntlets (serothicarum) which Roger of Irvine provided for the king in 1330 may well have been imported, for amongst these goods were a type of backing screen (dorsario) of Saracen manufacture and a Roman Psalter (ER i 323). Equally there is no indication as to the origin of the mitre and crozier bought for the Royal Chapel in 1329 from Bishop William of St Andrews (ER i 211). Occasionally, though, foreign metalwork is described as such along with their method of purchase. In 1328 a silver cup was bought abroad from an English merchant, while in the following year some twenty-three cups, two ewers and two plain mitres were bought from Thomas of Charteris (ER i 98, 235). By the fifteenth century there appear items such as the references to Cypriot and Venetian gold and silver imported for the king and the servants of his chamber in 1448-49 (ER v 312, 315, 346). It is not unfortunately clear exactly what form this gold and silver took.

Halyburton also records several cases of non-artefactual silver being imported into Scotland at the turn of the fifteenth and sixteenth centuries (Halyburton's Ledger 25, 69, 162, 206, 210). In fact the value of these imports of bullion well exceeds that of the many chalices, saltpots, and rings of precious-metal that he was called upon to purchase for his Scottish clients (Halyburton's Ledger passim). Moreover, by this stage exports of Scottish lead and lead ore were growing rapidly. Through the sale of this lead, either on its own account or for its silver content, considerable amounts of silver accrued to the king (see lead and pewter working section below).

Whatever the origins of the gold and silver which circulated around medieval Scotland there were numerous urban goldsmiths ready to work and rework it. Goldsmiths appear both as principals and witnesses in a variety of charters and were clearly individuals of some status. Among the earliest of these craftsmen to be named were Pagan the goldsmith of Edinburgh and Henry Bald goldsmith in Perth, both of whom received grants of land in their respective burghs from William I shortly before 1200 (Inchcolm Chrs. No 8; RRS ii No 570; Scone Liber Nos 45, 90, 97; RRS ii No 415). It is not, however, until the fourteenth century that there is good documentary evidence of the type of work being undertaken by Scottish goldsmiths. In 1331, Copyn the Goldsmith was paid 120s by the Exchequer for making a small sceptre to be used at David II's coronation and was provided with six gold florins with which to gild it (ER i 376, 382, 399). John

the Goldsmith, who was a bailie of Edinburgh between 1342/3 and 1361, appears not only to have made a number of maces and ornaments for the king but also to have regularly assisted in the minting of coins (ER i 489, 521, 607, 616-7, 623; ii 6, 58, 65, 160, 243). Such commissions must, however, have been the exception rather than the rule, and most goldsmiths would have spent their time on the manufacture and repair of plate and jewellery.

Nevertheless, even in the production of plate exceptional orders were possible, as in 1381 when the Exchequer paid £149 13s 4d for silver and the working of it into what must have been a considerable quantity of plate for the king (ER iii 78).

It is not clear whether the gold figure made by an unnamed Scottish goldsmith for the king in 1459 was a cast or gilt figure (ER vi 493). However, documentary sources make it clear that gold leafing and perhaps gilding was being carried out. The earliest reference to the use of gold leaf in the royal accounts comes in 1329, when 106 sheets of bipartite gold leaf were bought outwith the kingdom in Newcastle and York. Ironically the leaf was for the decoration of Robert Bruce's tomb (ER i 221). Fragments of this edifice survive in the Royal Museum of Scotland (Registered:KG 65-8, 70-1, 74) and traces of gilding still remain on some of them (Jardine 1822 435-55; Caldwell 1982 32 C15). Three-quarters of a book of silver and half a book of gold leaf were purchased in 1496 for the decoration of the 'Duke of York's' (that is the pretender Perkin Warbeck's) standard, while a book of gold leaf was bought

to decorate the king's coat of arms (TA i 294). The origin of this latter leaf is unknown but it is likely that gold leaf was now available in the kingdom. A considerable amount of ad hoc 'gilding' of silver and other metalwork, especially table ware, took place at this time. The gold for this work was usually supplied directly to the goldsmith in the form of coinage or jewellery. For instance in 1488 Gylbert Fyche was provided by the king with two gold nobles with which to 'gilt' a basin, ewer and saltfat (TA i 99, 101). It is not clear whether or not this was what would now be understood as gilding, using mercury amalgams, or decoration with gold leaf. However, the technology for gilding with mercury amalgams was certainly well understood and had been practiced in Scotland from early historic times (Stevenson 1985 239). Indeed where it was silver or even copper-based alloys that were being decorated the use of mercury amalgams was recommended by Theophilus and others (Dodwell 1961 86-92, 126-7). There are several references to the purchase of mercury, and related substances such as cinnabar and vermilion, substantial quantities of which were for the work of goldsmiths involved in gilding and assaying or refining (TA ii 62-3, 359-60, 362, 403; Halyburton's Ledger xxxviii, xxxix, 117).

Very little medieval precious metalwork has survived, and what there is, is difficult to date and to provenance. One of the earliest and finest pieces, the Bannatyne or Bute mazer (fig. 28), is of multi-period construction and demonstrates something of the difficulties involved in

interpreting such unique pieces. The central print or boss of the mazer which has been dated to between 1314 and 1318 incorporates both French and Scottish workmanship, while the lip band is believed to be of Scottish manufacture and date to the early sixteenth century (Stevenson 1931 217-55). Another remarkable survival is the Mace of the Faculty of Cannon Law, University of St Andrews, is thought to have been made in Scotland in the mid fifteenth century (Brook 1892 444-74). By 1457 the goldsmiths of Edinburgh were being encouraged to use set standards of metal and to mark their work (APS ii 48 c8). However, it is by no means certain that they did indeed start to mark their ware from this date. The earliest surviving marked Scottish metalwork only dates to the mid sixteenth century, most notably in the form of standing mazers such as the Galloway mazer made by James Gray of the Canongate (fig. 29).

Unlike plate and specially commissioned pieces of metalwork, Scottish gold and silver jewellery receives little attention in the documentary record. Indeed documentary sources tend to emphasise purchases of foreign rather than Scottish workmanship. Nevertheless, a range of brooches, finger rings and spoons which have come from excavation or survived as family heirlooms may well be the work of Scottish urban goldsmiths (Caldwell 1983; Findlay 1956). The identification of such pieces as Scottish is necessarily based on art-historical grounds as the earliest marked pieces, such as the Ballochyle brooch which is enigmatically marked but has an assay score, once again date to the second half of the sixteenth century

(fig. 30).

That the work of goldsmiths was extremely varied and potentially of the highest quality is further confirmed by the many fine brass and even silver seal matrices, made in Scotland for both institutions and individuals. One of the most striking brass seals to survive intact is that of the Cathedral chapter of Brechin made during the first half of the thirteenth century (Henderson 1983 399-415; Caldwell 1982 45-6 fig. C50; Stevenson & Wood 1940 i 133). Moreover the ability of Scottish craftsmen in this field was even recognised abroad, for Andrew the Goldsmith was paid 49s 6d by Henry III of England for making a great seal with 2 leaves for Alexander III's new queen, his daughter Margaret, in 1252 (CDS i No 1903). Likewise commissions for the privy and great seals of Robert II, in 1371, and the silver seal of the Duke of Albany as Governor of the kingdom, in 1408, were given to Scottish craftsmen (ER ii 365; iv 69, 87; Stevenson & Wood 1940 i 9, 26; Birch 1905 Plates 28-9; 34-5).

During the last quarter of the fifteenth century a number of goldsmiths undertook a range of military and fine metalwork for the king. William Goldsmith (alias Halfpenny) is specifically noted in 1474 as being the person that made the 'gun' (TA i 48, 49). John Pennycuke also makes his appearance in 1474 when he was at Haddington to procure gun metal for the king (TA i 54). Some years later, in 1494, he sold a gold belt to the crown and two years after that was commissioned to provide a silver case

for the shrine of St Duthac at Tain (TA i 230, 322). The prominent Edinburgh goldsmith Henry Foulis made the actual reliquary for St Duthac and he too was connected with the artillery which he accompanied to Coldingham and Norham in 1496-97 (TA i 326, 338, 346, 350). It would seem that these specialist craftsmen, or at least their workshops, were involved in a wide range of technically developed non-ferrous and ferrous metalworking.

The little that can be gleaned about the distribution of this work amongst the burghs would strongly suggest that Edinburgh was the centre of at least the later goldsmithing commissioned by the king. Indeed in 1486 a gold casket of the king's was sent from Stirling to Edinburgh for repair (TA i 393). However, other households such as the bishop of Dunkeld's made use of more local goldsmiths. In 1514/5 the bishop's officer in Perth paid Findlay Goldsmith for making four silver chalices for the mensal churches of Little Dunkeld, Alyth, Cargill and Strathmiglo of total weight sixty-three and a half ounces. The metal was provided by the bishop in the form of five tassies (cups or goblets). Findlay was paid 2s 4d for each ounce worked and later a further 7s for engraving arms on the chalices (Dunkeld Rent. 233-49, 242-44). That goldsmiths undertook work away from their burghs is also indicated by the bishop's accounts as subsistence payments were made to the smith working on the bishop's mitre and staff at Dunkeld in 1509 (Dunkeld Rent. 109).

These occasional documentary confirmations that certain

goldsmiths were associated with particular burghs and mints are unfortunately mainly to be found in fifteenth- and sixteenth-century sources. An important supplementary source of information on the distribution of precious-metal working among the Scottish towns is therefore the mints named on Scottish coins. Moreover, as prior to c 1280 all coins bore the moneyer's name and most a mint name, it is also possible, to identify the moneyers established at Berwick, Roxburgh, Edinburgh and Perth. The use of goldsmiths as moneyers in the later medieval period would strongly suggest that these were not only short-cross mint towns but also centres of fine metal working.

During Alexander III's reign the number of mint towns was significantly increased. However, several of these were short lived, being employed in the recoinage of 1250 and not, it seems, in the major recoinage of 1279/80 (Mayhew 1977 85-8). Nevertheless, the additional use of Aberdeen, Ayr, Dumfries, Forfar, Glasgow, Inverness, Kinghorn, Lanark, Montrose, Renfrew, St Andrews and Stirling for the siting of mints would suggest a far wider availability of goldsmiths and potential moneyers than the mintings of other reigns indicate. However, there are instances in Alexander III's reign where the same obverse dies were used with more than one place-named reverse, the implication being that lesser centres, such as Dumfries (Dun, Fres), Glasgow and Montrose were serviced by itinerant moneyers. Unfortunately the practice of naming mints was largely abandoned from the 1279/80 recoinage until 1357, but it appears that after Alexander III the number of mint towns

was considerably reduced. During the next century and a half, minting became concentrated in Edinburgh, although Aberdeen, Perth and occasionally other burghs do also figure as mints until the reign of James IV (Stewart 1971 178-91). This pattern tends to confirm the impression of later documentary sources, that precious-metal working became more and more confined to the larger towns.

Chapter 3

Part 3 Mineral Based Industries

Lead and Pewter Working

(fig. 37)

Veins of lead ore occur in most parts of Scotland and many of them have been worked in at least a superficial way at sometime in the past. The locations of many of the more important lead sources have been identified by the Geological Survey and a compilation of their distribution is indicated on the map illustrated in fig. 31 (Wilson & Flett 1921 1). Few of these sources would today be described as sufficiently argentiferous to be of commercial interest, although this is not to say that they were not worked for silver in the past. Indeed it is highly likely that a proportion of the lead used in medieval Scotland was a by-product of the search for silver. However, the majority of early Scottish lead workings were small and probably only used to satisfy local requirements for window, roofing and other building lead. Most workings are likely, therefore, to be post-medieval except where town-houses, religious buildings and fortifications would have created an earlier demand for lead. The level of technical competence required and the extent of urban involvement in this type of work is likely to have been fairly basic. To judge from the lead working areas discovered at Threave Castle, Galloway and at some of the Border Abbeys, galena was transported to the building site where it was smelted

in shallow pits with the lead being extracted through liquation (Tabraham 1984 374-77 Fig 7; Good & Tabraham 1981 104-5).

In a different league from these ad hoc quarryings was a number of larger workings where the objective was the extraction of precious metals and/or the large scale trading of lead. Lack of archaeological investigation into early Scottish mining means that more complete information on the industry only begins to appear in the sixteenth century as documentary sources become more detailed. That there is an earlier story to tell is clear from the involvement of the king, burgesses and major religious houses in lead mining, working and trading throughout the medieval period. Ores around Crawford in Lanarkshire and Dumfriesshire are known to have been worked from at least the thirteenth century. In 1239 there is mention of a mine at 'Glengoner' on Crawford Muir (Newbattle Reg. No 146). An early urban and royal involvement in the Crawford workings is suggested by the royal accounts for 1264 in which appears a payment to the Sheriff of Lanark for the carriage of seven cart-loads of lead from Crawford to the burgh of Rutherglen (ER i 30). There is no explanation as to why the lead was needed in Rutherglen. The lead may have been taken there to be worked for its silver content or, perhaps more likely, to have been for use in royal building work. It is likely, but not confirmed by these documents, that the lead ore being worked at this date included the large argentiferous deposits at Leadhills and Wanlock just west of Crawford.

That at least one of the lead mines in Argyll was being worked by 1326 is clear from the royal accounts of that year in which the Constable of Tarbert Loch Fyne was allowed the cost of coals and labour in providing mined and smelted lead (ER i 57). Which of the many possible Argyll mines were being investigated here is unfortunately unclear but if, as appears to be the case, this is a reference to some form of assaying it is worth noting that twelve miles further up Loch Fyne, near Ardrishaig, there were veins of workable auriferous and argentiferous lead (Wilson & Flett 1921 7). However, it is not until 1424 that the separation of silver from lead was explicitly documented when the Scottish parliament confirmed that all gold mines and lead mines which could produce three halfpennies worth of silver from a pound of lead belonged to the crown (APS ii 5 c13). One source of Argyll lead which is known to have been worked by the end of this period is the lands of 'Moychaolis' on Islay which Munro, in 1545, reports to have been rich in lead ore (Munro, Western Isles 55). These lands are known to have belonged to the monks of Iona and may well have been worked for sometime before Munro heard of them (RCAHM Argyll iv 274 No 200; v 322 No 436). Any early workings at the other major post-medieval sources of Scottish lead, such as around Newton Stewart in Kircudbrightshire, Tyndrum in Perthshire, and Strontian in Argyll are unfortunately undocumented (Macgregor 1940 21-2). Archaeological survey of the Strontian mines has not indicated any features of medieval appearance (RCAHM Argyll iii No 392).

These occasional references to the quarrying, mining and refining of lead ores during the medieval period are far outweighed by the many references to trade in lead. During the thirteenth and fourteenth centuries the royal accounts contain frequent references to the purchase of lead for building projects such as the repair of the king's house at Forfar in 1264/6 (ER i 8), or Robert Bruce's new manor house at Cardross, near Dumbarton in 1327/8 (ER i 88). Except at times of war the building trade was clearly the main consumer of lead, but as the English records show, the accumulated lead of major buildings was soon removed when lead was required by the military. In 1305 the English crown paid to replace the lead they had removed from various cathedrals and abbeys, five wagon loads of lead for Brechin, twenty two wagon loads for St Andrews and fifty three for the Abbey of Dunfermline (CDS ii No 1687).

Other than from the generally urban location of these buildings, there is little direct documentary evidence at this date of burghal involvement in the lead trade. However, given the equipment and financial resources involved, as well as the retailing requirements of the lead trade, considerable urban involvement must have been the case. If the second name of one Thomas Ledbeter is indicative of his trade, then it would seem that it was possible for those dealing in lead to achieve considerable status as Thomas was Custumar and then Provost of Linlithgow between 1328 and 1332 (ER i 100, 174, 280, 314, 357, 373, 420). Archaeological remains of medieval lead

working in the towns include a large open furnace from Castle Street, Inverness (fig. 38) (Spearman 1982a 352). Scrap sheet lead and lengths of lead piping from many urban contexts testify to the widespread availability and working of lead in Scottish towns. Lead and pewter were also used in the manufacture of cheaper types of jewellery particularly pilgrim badges. A stone mould for the casting of pilgrim badges and also ring brooches with thistle headed pins of a fourteenth century form was discovered at North Berwick (Richardson 1907 431; Caldwell 1982 45).

By the fifteenth century more detailed accounting entries record a greater number of uses for lead, and also something of the craftsmen who worked it. Both traditional and new weapons required lead. In 1474-5 lead was needed for the manufacture of various maces, while twenty two years later lead was being cast into shot for the artillery (TA i 65, 293, 295-6). Some red lead was also purchased for work on the artillery in 1466 (ER vii 422). In 1434, Edinburgh castle was provided with a great lead vat on which work was carried out by one Nicholas Plummer (ER iv 576). The following year Nicholas was paid for further work, probably at Stirling (ER iv 605). Another great lead vat (magno plumbo fiendo) was built in Inverness in 1460. It would seem that insufficient lead was available in Inverness and half the lead for this vat had to be purchased in Perth and then transported to Inverness (ER vi 656). The purpose of these vats is unknown but the most likely explanation would be for water storage and perhaps brewing and cooking. Other incidences of craftsmen being

brought in for specific tasks are a 'lede man' who was employed at Edinburgh Castle, and another man working at Drummyne (a residence in the sheriffdom of Forres) who was paid for beaten (coblit) lead (TA i 282, 350). At the start of the sixteenth century the bishop of Dunkeld paid one firlot of meal to six men who came from Dundee with lead for his residence at Cluny (Dunkeld Rent, 178). The lead was probably for the repair of the stables which was taking place at this time. It is not clear whether the men merely transported the lead or worked it as well, but the acquisition of this lead from a town rather than the nearest vein of ore at Kenmore, would seem to confirm that an urbanization of the lead trade had been taking place.

Some indication as to the organisation of the mining and smelting of this lead in the fifteenth century comes from a legal dispute in 1466 between the Abbot of Newbattle and Lord Hamilton. It was alleged that Lord Hamilton had organised the removal of a thousand stones of lead from the mine in Friar's Moor (near Crawford, Lanarkshire) which belonged by ancient right to the Abbey (Acts of Lords Auditors 6). From the sixteenth century many more details of the mining and metal trading industries become available. It is apparent that the Leadhills area was the centre of a substantial mining industry which the crown hoped to promote and gain further profit from issuing various privileges. Attempts were made to attract foreign prospecting and mining technology by leasing mineral rights to groups such as the German and Dutch party who in 1526 gained a forty-three year monopoly of metal mines in

Scotland (APS ii 310).

A number of the great burgesses of Edinburgh were also involved in the mining and trading of lead either as manager/traders or as underwriters. In 1562 John Acheson the king's Master Minter and John Aslowan a burghess of Edinburgh purchased permission to mine lead in Glengonar and Wanlock and to transport 20,000 stones weight of lead to Flanders. They had to pay 45 ounces of fine silver for every thousand stones of lead exported, which they did until 1565 when the mines were forcibly acquired by the Earl of Atholl who employed two other Edinburgh burgesses to supervise the work (Reg. Privy Council i 232, 343, 483). A similar agreement was struck between the crown and a consortium of Edinburgh burgesses in 1565 whereby at least 40,000 stones weight of lead from other mines in the kingdom could be exported to Flanders or elsewhere (Reg. Privy Council ii 400). The highly influential Foulis family of Edinburgh goldsmiths are noted as actually owning lead mines in Lanarkshire. Indeed they hired the mining engineer Bevis Bulmer to work their lead mines. At the end of the century the Foulis family took over what had been Newbattle Abbey's mines on Friar Muir with a 21 year lease at an annual rental to the crown of a thousand merks (Patrick 1878 xviii, 98-100).

The large scale mining and exporting of Scottish lead would seem therefore to be largely based on metals from the Leadhills area passing through Edinburgh/Leith to the Low Countries. Foreign trade was certainly well established by

the start of the sixteenth century, but lead working had clearly been an important part of the Scottish market for sometime. Most of the sixteenth century and earlier references are to metallic lead rather than lead ore. Export of the latter, however, became common in the seventeenth century and was already the case in the Earl of Atholl's agreement with the crown in 1565 (Halyburton's Ledger xcvi, ci, cii, cviii; Patrick 1878 7-8). The Earl's agreement involved, however, both a slightly higher rate of silver, 50 ounces per thousand stones of lead, and for the value of the silver to be underwritten by a consortium of Edinburgh burgesses. Through its refining in Scotland, or more probably abroad, the lead was an important earner of silver for the crown and many of the officers of the Scottish mint participated in the trade to their own, sometimes illegal, profit (Patrick 1878 85-6).

The commercial requirement for lead in the Low Countries was not simply as a source of silver, the bulk of which would already have been removed or would find its way back to Scotland. Instead the lead was blended with German and Cornish tin to form part of the Low Countries pewter trade. There are several references in Halyburton's accounts of the export to Scotland of pewter plate, candle sticks, pots, mortars, pestles and basins totalling several thousand pounds (Halyburton's Ledger 87, 88, 108, 114, 254, 272). Many of the imported pewter vessels were for great households such as the Duke of Ross's in 1495. However, considerable quantities were being imported by general merchants.

Something of the greater availability and Scottish working of pewter in sixteenth century Scotland is also apparent from the household accounts such as those of the bishop of Dunkeld. Pewter plates, dishes, chargers and saucers were standard in all of the bishop's residences. Such plate was readily purchased in Edinburgh and there are several references to old pewter plate being put in the hands of Edinburgh and Perth pewterers for reworking or in part exchange for new plate (Dunkeld Rent. 211-2, 222-7, 245-7, 262-4, 272). Virtually all of this locally worked pewter was in the form of plate and there is no mention of any ewers or jugs. The only exception to this are references to pewter chalices for the parish churches of Bonkle in Lanarkshire and Aberlady in East Lothian. The Bonkle chalice was a replacement for a previous pewter chalice which was given to the pewterer in part payment for the new one. The other was a new purchase that was perhaps intended for ordinary use as the church's gold chalice is noted as being enlarged and repaired a few years later (Dunkeld Rent. 245-7, 251-3). The implication is, therefore, that pewter vessels were for the use of the second or third rank of retainers and occasions. Given the limited range of forms mentioned it is likely that pewter plate was all beaten rather than turned, and the low social standing of the metal may well explain why it does not appear in the less detailed accounts of the great and powerful.

Chapter 3

Part 3 Mineral Based Industries

Copper-Based Alloy Working

(fig. 33)

Until the nineteenth century there was no formal distinction in Western Europe between brass and bronze in that all types of copper-based alloy were normally described as 'brass'. The term copper-based alloy has therefore been adopted here, and in other archaeological texts, to describe the many different pieces of scrap and artefactual metal recovered from excavation which, on the basis of visual identification, are thought to be alloys of copper. This apparent absence of historic precision should not be taken to reflect any lack of metallurgical skill. Technical treatises from the ninth century onwards make it clear that Roman methods of producing zinc-rich copper-based alloys, through the cementation of copper with zinc carbonate ores called calamine, continued throughout the middle ages (Smith & Hawthorne 1974 38; Dodwell 1961 124-5). These same treatises also describe the production of a wide range of tin- and lead-rich copper-based alloys that had widely differing properties and purposes (Smith & Hawthorne 1974 39, 61; Dodwell 1961 124-5; Smith & Gnudi 1942 210).

The principal constituent metals of copper-based alloys, copper, tin, lead and zinc, were derived from both Scottish

and foreign sources. Various sources of copper are known to have been worked in the post-medieval period near Ardrishaig on Loch Fyne, Port Askaig on Islay, and Alva in the Ochil Hills, as well as certain veins on the north side of Wigtown Bay, in the Lead Hills, Sandlodge in the Shetlands, and Burray in the Orkney Isles (Wilson & Flett 1921 passim). The main sources of accessible copper ore in Scotland are indicated on the map illustrated in fig. 31, while early workings at a copper mine near Whithorn are illustrated in fig. 32. It is likely that at least some of these sources were worked in the medieval period, although, as with the many veins of low grade copper ore which occur in other parts of Scotland, there is no firm evidence of this (Macgregor 1940 22). Unfortunately none of these sources has been the subject of recent archaeological excavation, and even with field walking it is often impossible to determine whether or not they have been worked in medieval and earlier times. However, many of the better sources of copper occur in combination with, or close proximity to, lead and zinc ores, the former of which are known to have been widely worked during the middle ages (see lead and pewter working section below). The ready availability of zinc and lead contrasts markedly with the very small quantities of tin available in Scotland. Some tin occurs within quartzite veins in various parts of Scotland but these are unlikely to have ever been of commercial value. It is, therefore, more likely that tin was being imported into Scotland from the Continent or Cornwall, and certainly tin was reaching Scotland in the form of tin and pewter plate during the medieval period (ER

ii 305, 484).

Given the variety of possible sources and the widespread use of scrap metal, which may in any case have been of mixed parentage, it is virtually impossible to use analytical techniques to determine the origin of the alloys employed in medieval Scotland. However, there is no reason to believe that Scottish coppersmiths were unable to control, when necessary, the qualities and composition of their alloys. While the compositional requirements of day-to-day work of urban coppersmiths may not have been too exacting, smiths undertaking specialised castings, such as of bells or guns, required reasonable accuracy in the quality and composition of their metal. This may have been achieved either through the production of an alloy from its constituent parts or perhaps through the addition of copper, lead, tin, zinc (through cementation) or zinc-rich leads to alter already available alloys. However, of the specialist castings which can be positively identified as of Scottish workmanship, few have had their composition analysed. That highly competent work was being carried out is, however, clear from archaeological and documentary sources. Surviving Scottish decorative work is mainly of religious objects and accoutrements such as a range of copper-based alloy crucifixes and censers dating from the twelfth century (Caldwell 1982 22-6). There are also a few cast bells surviving from as early as the twelfth century which are believed to have been made in Scotland, notably the St Fillan's quadrangular hand-bell and the Kersmains tower-bell (fig. 34) (Forbes 1870 265-76; Clouston 1976

275-8; Caldwell 1982 10-11, 19). Recent excavations in St Andrews have uncovered pieces of medieval clay mould from the casting of a bell (Hall pers. com.) and there are a number of late fifteenth- and early sixteenth-century bells all marked "Xt" from West Lothian which confirm the activities of at least one successful founder (Eeles, 1913, 66-71; Caldwell 1981b 74-8). By the end of the fifteenth century metal suitable for the casting of guns was available in Perth, Dunkeld and Haddington (TA i 54).

The urban manufacture of smaller objects, ranging from dress fittings to plate and vessels, is attested in the archaeological rather than the documentary record, although seal impressions attached to charters obviously provide a rich source of information on ^{the} range of seal matrices that were being manufactured in Scotland and elsewhere (above p 199). It is clear from the archaeological record that coppersmiths were active in many of the larger burghs with various fragments of debris including droplets of metal, small crucibles and a wide range of clay and occasionally stone moulds having been recovered from urban excavations. The clay mould fragments from thirteenth-century contexts in the Gallowgate, Aberdeen indicate the local production of a variety of copper-based alloy vessels, platters and dress-pins (Spearman 1984a Fiche 3:G7-12). From thirteenth-century contexts in Elgin have come composite and two-piece clay moulds for the casting of copper-based alloy dress-pins (fig. 35) and decorative fittings (Spearman forthcoming a). Clay moulds from fifteenth-century layers at Canal Street, Perth indicate that a range

of cauldrons and ewers had been cast near the site, while carefully folded pieces of copper-based alloy sheet were clearly from the repair of such vessels. At least some of the raw material of this workshop consisted of broken pieces of vessels, of which fragments were found (Spearman 1988:157-58; Ford 1988 128-29).

Of common occurrence on urban sites are pieces of artefactual or scrap copper-based alloy sheet. Some pieces, such as the decorative boss from a workman's trench in Perth, retain sufficient artistic detail to suggest a well developed local craft (Ford 1988 122-23). However, the majority are small pieces of plain sheet metal which only indicate a general availability of beaten copper-based alloy in the towns. The origin of many of these fragments of sheet alloy is, therefore, unknown and they do not in themselves confirm that copper-based alloy was beaten in the towns or even in Scotland. Repair of such metalwork is, however, indicated by the folded repair patches from Canal Street, Perth and it is likely copper-based alloy smithing had been taking place in Perth at least (Ford 1988 128-29). Hence, while the likelihood is that copperbeating was a common craft in the Scottish burghs there is, as yet, little archaeological confirmation of this.

The archaeological record has, therefore, demonstrated that home-produced copper-based alloy goods ranged from plain stick pins to church bells (fig. 36). The documentary sources, in contrast, record almost exclusively purchases of major, and often foreign, items of metalwork. In 1328

the king's officers purchased in Flanders four great brass (ereis) vessels, three great cauldrons, seven great pots, and three great grates along with considerable quantities of cloth and spice (ER i 119). Such purchases of foreign metalwork occur intermittently in the royal accounts of the fourteenth century. In a few cases, such as in 1368 and 1375, it is clear that it was wool fells and hides that were being used to purchase Flemish and perhaps other foreign metalwork (ER ii 305, 484). There are, however, a number of entries, such as the 1331 purchase of two brass pots weighing 44 pounds and three cauldrons, where the place of manufacture is unrecorded and their position in the accounts is purely domestic. There is, therefore, every reason to believe that these vessels were bought within Scotland. Although there is no way of telling if these vessels had also been made in Scotland, the fact that the weight of brass needed for the two pots is given, would suggest that at least some of them might have been (ER i 375). Whatever their origin it would seem that such goods were widely available in late fourteenth-century Scotland, for in 1396 a burgess of Irvine was able to provide the king with divers goods including several vessels which, to judge from their price, were of metal (ER iii 400).

During the fifteenth and sixteenth centuries purchases of copper-based alloy plate, vessels and cauldrons of both Scottish, foreign and unspecified origin became more commonplace in the royal and other accounts. Moreover some details of their use began to be recorded in these accounts. In the 1490s one cauldron was bought for the

king's retainers in Dumbarton, while another was bought in Ayr as part of the provisions of a ship (TA i 249, 344). There are also occasional references to the Scottish 'potters' who were producing some of these castings. One such 'potter' working in Stirling provided the king with sheaves (pulley wheels) and pulleys in 1497 (TA i 358). It is clear, however, from the late fifteenth and early sixteenth-century accounts of Andrew Halyburton that those who could afford to, the Duke of Ross, the Archdeacon of St Andrews and the Dean of Dunkeld, continued to import considerable numbers of copper-based alloy pots, pans, pillars, and candlesticks from the Low Countries (Halyburton's Ledger 87, 88, 160, 162, 249, 254). Documentary sources also record the occasional importation of specialised pieces of work such as the copper-based alloy tabernacles for the High Altars of Dunkeld and Dundee (Dunkeld Rent. 1-3). This influx of metal need not have been entirely to the disadvantage of local craftsmen, for the end result was the presence of a greater volume and variety of copper-based alloy in Scotland. The repair and reworking of these imports must have led to more work for local smiths and the occasional chance to see and copy Continental work.

Chapter 3

Part 3 Mineral Based Industries

Salt

(fig. 39)

Until the advent of refrigeration and modern chemistry common salt was, by its ability to dehydrate bacteria, the basic mineral preservative for almost all animal foodstuffs and produce. In the medieval period an adequate supply of good quality salt was, therefore, an essential for the majority of households, large and small. Virtually all attempts to preserve the year's meat, cheese, and butter depended on salt. Likewise the preservation of fish was heavily dependent on the use of salt, for although drying and smoking were also used to preserve fish and meat these two processes were normally carried out in conjunction with salting (Samuel 1918 34-40). Moreover salting and drying would have been a standard methods of preserving one of Scotland's staple exports, hide (Waterer 1956 149). A reliable supply of salt was, then, a prerequisite for the planned production, preservation, and trading of what were otherwise highly perishable commodities. Not only did salt allow for seasonal surpluses to be stored against periods of famine, it transformed surplus agricultural and fishery produce into highly marketable foodstuffs.

There have been no excavations of any medieval saltpans in Scotland and, in stark contrast with their extensive study

in England, there has been little survey work to identify the sites of early salt works in Scotland. The substantial remains of an eighteenth century saltpan have, however, been identified by C. Morris at St Monans, Fife, beside which are the scant remains of earlier salt works (D & E 1979 10). Much of the evidence for the use and production of salt in Scotland is therefore documentary.

Given the importance of salt it is not surprising that the earliest surviving references to salt production in Scotland indicate an industry largely controlled by the king, his earls, and senior churches. During his reign David I endowed many of Scotland's major abbeys with saltpans. The known examples include saltpans at Airth, given to Holyrood Abbey (ESC No 92), in the Sheriffdom of Stirling, given to Dunfermline Abbey (ESC No 127), at Callandar (ie. Park College near Falkirk) and the unknown site of Blankeland, given to Newbattle Abbey (ESC Nos 146, 147, 149) and in the Carse of Stirling, given to Kelso Abbey (ESC No 159). Jedburgh Abbey also gained a saltpan near Stirling (ESC Nos 189 & 190), while the Abbey of Cambuskenneth was provided with a saltpan at an unknown location (ESC No 179).

All of these saltpans seem to have belonged previously to the king and to have been located on the carse around Stirling. In the late 1170s yet another royal saltpan, which was specifically described as being located amongst the king's saltpans on the Carse of Stirling, was given to the newly founded Abbey of Arbroath (RRS ii No 197). The

royal saltpans, or at least those that are documented, seem therefore, to have been concentrated on the Carse at Stirling. There are also a few saltpans recorded in other areas of Scotland between 1153 and 1161 through Malcolm IV's confirmations of the gift of a saltpan near Hartside in Eastlothian by Earl Cospatric to Melrose Abbey (RRS i No 132) and St Andrew's long-standing right to a saltpan at Balgove by St Andrews (RRS i No 174).

Something of the size of these grants is recorded in the case of the grant to Holyrood Abbey where the saltpan at Airth came with 26 or 27 acres of land. This, however, may have been exceptional as only five acres of land were provided for Arbroath Abbey's saltpan (RRS ii No 226). That some land was normally attached to these saltpans is, however, confirmed by the grant to Cambuskenneth where their saltpan was to have as much land as 'one of the king's own saltpans'. The function of this land was clearly in part to provide an agricultural supplement and also wood for the tenants of the saltpans. There is mention of rights to wood and common pasture at the saltpans of the Abbeys of Newbattle (in the wood at Callander), Holyrood (at Airth) and Arbroath (on the Carse). In no case is there any suggestion that the fuel used at the saltpans was anything other than wood or peat. There are a few early references to coal in the hands of certain of these religious houses, notably Dunfermline and Holyrood (ESC Nos 74 & 206) but there is no indication that the coal was being used to heat these early saltpans. Without coal as a fuel the production of salt directly from

sea water, with a saline content of only around 3% by weight, is unlikely to have been a commercial proposition. Instead it is likely that, especially on the Carse of Stirling, more concentrated brines were derived from those soils which had become impregnated with salt through the tidal action of the sea, or that sea water trapped in natural or artificial ponds was used once it had become at least partially concentrated through evaporation. Where peats had become impregnated with salt it is likely that the same method as was employed in the Low Countries would have been used. There the peat was cut and dried in the usual manner for fuel, and these turfs were then transported to the saltpans where they were burnt. The ash containing the marine salts (and now potash etc.) were dissolved with sea water and the resulting solution evaporated over further turf fires to produce a fine white salt of good quality (Bridbury 1955 10-12).

Whatever the processes involved these early saltpans must have been seasonal in their production, although the cutting and gathering of salt-impregnated peat and soil need not have been tied to the high summer. Nevertheless, the size and apparent concentration of saltpans on the Carse of Stirling would indicate a well developed system of manufacture. Indeed it would seem from the wording of the charters that what were being granted to these various religious houses were established and productive saltpans. Evidence also survives to indicate that at least one of the abbeys involved, Newbattle, took a fairly commercial attitude to these saltpans. They took a lease on

Dunfermline Abbey's saltpan, adjacent croft and all associated pertinents for 20s each year. Dunfermline Abbey's saltpan lay between those of the monks of Kelso and the canons of Cambuskenneth, the former of which the monks of Newbattle also leased for 15s each year along with the Abbey of Holyrood's two saltpans on the Carse which they leased from Walter Olyfard and Sir David Cumyn. Moreover they were granted by David de Lindsay the saltpan and adjacent lands that William I had gifted to his grandfather William. Nicholas de Sules gave them his saltpan in the Carse of Callendar which had been given to him by Walter fitz Alan (Newbattle Reg. Nos 167-71; ESC No 149). By the mid thirteenth century Newbattle Abbey was, after the king, almost certainly the largest refiner of salt in Scotland. The extent to which the king's saltpans were organised towards the end of the thirteenth century is indicated by an aside in the Chronicle of Lanercost. Alexander III upon reaching North Queensferry on the night of 19th March 1286 is related as having asked the Master of the Royal Saltpans to provide him with two bondmen to guide him from there to Kinghorn, with, of course, disastrous results (Chron. Lanercost 116).

That burghesses were involved in the salt trade is clear from burgh regulations of the twelfth and thirteenth centuries. The importance of salt to burgh trade was not so much in its manufacture as in its use and in the marketing of preserved produce. The Burgh Laws emphasises this point by exempting salt and herring from the otherwise all important principle that goods brought by ship for sale

in burghs had to be unloaded and traded openly (Leges Burgorum ch9). If goods, and especially herring, were to be preserved then it had to be done swiftly. Commercial trade in salt, especially in the coastal burghs, was nevertheless subject to royal taxation (Assisa de Tolloneis ch3; Custuma Portuum ch1). Although the exact date of these tolls is uncertain, it would seem that having gifted various saltpans to the abbey David maintained his own profit by taxing the salt as it reached its place of use. That this had been going on is made clear when William I exempted the Abbey of Arbroath from paying all tolls on their salt wherever they transported it within the king's land (RRS ii No 285). That a part of these movements of salt involved non-local merchant 'strangers' is indicated by an additional tax on strangers trading in salt of 1d per chalder (Custuma Portuum ch1). These merchant strangers need not have been foreign and, as the European trade in salt was not yet extensive, it is likely that most of the salt being taxed was of Scottish or perhaps English manufacture (Bridbury 1955 24-6).

Something of the trade in salt for both the industrial and household preservation of foodstuffs and hides is recorded in the royal accounts of the late thirteenth and fourteenth centuries. The majority of these references are concerned with the purchasing of salt for the provisioning of the king's residences and castles. They are, therefore, likely to be typical of the requirements and purchases of other great households in Scotland, for which unfortunately very few accounts survive. The purchases of salt were almost

invariably made in the burghs and there is even some suggestion that specific burgesses were specialising in providing salt and other supplies. In the year 1360-1 it was a Dundee burgess, Hugh de Leyis, who provided the kitchens of Stirling castle with salt and other goods (ER ii 78). Although these entries are not normally explicit about the use to which the salt was put, they underline the importance of burgh markets for the agricultural community. Purchases of both salmon and salt were a regular feature of the accounts of Aberdeen, Berwick, and Perth, while Crail was the centre of a substantial herring industry and as such a major consumer of salt (ER i; ii passim). The sheriff of Lanark purchased 3 chalders of salt in the year 1328-9 of which 1 chalder and 8 bolls of salt were used to cure 51 marts and the hides thereof (ER i 135). Salt was purchased in Berwick during the years 1330-1 and 1331-2 for the curing of game from the king's forest (ER i 313, 362).

There is some indication of a variety in the quality of salt being purchased, as it could be variously described as 'salt', 'great salt', and 'white salt'. Most of the references are simply to 'salt', the price of which varies considerably from around 14s 7d to 26s per chalder, although the higher prices may have included additional labour and transport (ER i 219, 505). The 'great salt' appears to have been the same as or slightly more expensive than the best ordinary salt (ER i 313, 505). An early reference to 'white salt', in 1366/7, is not, unfortunately, accompanied by a specific price (ER i 294). The true significance of these prices is in any case

difficult to assess, as it is not always clear what labour, transportation and other on-costs of the salt were included in the bill. However, it seems likely that, particularly with ordinary 'salt', there was a very wide range in quality. There is no indication in these records of any of this salt being imported but it is clear from English sources that Poitou salt was being shipped to Perth during the first quarter of the fourteenth century (Bridbury 1955 46).

By the start of the fifteenth century information on the range of salt being traded becomes slightly fuller and it is also clear that Scottish salt was being regularly exported to Newcastle, Scarborough, and Yarmouth as well as the Continent (Bridbury 1955 105n, 119). The majority of the salt being traded now appears in the records as 'white salt', which could be of either foreign or domestic manufacture. Customs accounts for the year 1437-8 record the importing into the kingdom of some 100 chalders of white salt through Leith and over 200 chalders of the same through the port of Haddington (Aberlady) (ER v 23, 30). In the same year it is also made clear that white salt was being produced at Tranent (ER v 52-3). By at least the mid fifteenth century there was an officer of the king, David Boyis, collecting custom on some 50-60 chalders of salt exported from Dysart and Ravenscraig, while Edinburgh/Leith was annually exporting 50-100 chalders of salt (ER vii 36, 212, 286, 503, 591). There is far less information on the salt trade on the west coast, although Dumbarton appears, during the mid fifteenth century, as a centre for salting

and the purchase of salt (ER v 211; vi 591).

The majority of the Tranent salt was priced at between 14s and 18s the chalder and was used, at least in part, for salting fish at Leith. However, the very best Tranent salt, priced at 21s 4d per chalder, was of a quality suitable for even the king's table (ER v 52-3). The method of salt production at Tranent is not recorded in the accounts, but the area had a long history of coal mining, and the references to salt being produced there include payments to the king's creditors of both coal and salt from Tranent. It is almost certain, therefore, that the Tranent salt was being produced by means of coal fired boilers. The picture of the quality, trading and use of Scottish salt as demonstrated by the royal accounts is quite different from that suggested by Grant and others who state that home-made salt was not suitable for curing fish and that foreign salt had to be brought in (Grant 1930 316). Grant's interpretation is based on the knowledge that large quantities of Bay salt were reaching Scotland, but also on modern chemical knowledge of sea salts and on the political statements accompanying grants of royal patents to the owners of saltpans in the second half of the sixteenth century. In fact this interpretation is something of an over-simplification of the very complex and sophisticated trade in salt that developed in Scotland and the rest of north-west Europe during the later middle ages.

That Bay salt was being imported into Scotland during the late sixteenth century is clear from the Dundee shipping

lists of the 1580s. In these it is recorded that each year between five and six vessels from La Rochelle berthed at Dundee alone (Lythe 1960 175-6). Indeed this seasonal influx of cheap salt had been a feature of the European salt trade since at least the mid fourteenth century and is known to have been reaching Scotland since the early part of that century (Bridbury 1955 46 76). The crucial fact about this salt was not its greater chemical purity or strength, indeed it was often discoloured and contaminated by mud and vegetable matter, but its cheap production by solar energy (fig. 39). Significantly the Dutch developed a process known as 'salt upon salt' in which this Bay salt was the principal raw material of a quality refined salt (Brownrigg 1748 140; Bridbury 1955 99). It was presumably this high quality salt which ^{was} being bought at some expense through the office of Andrew Halyburton in the Low Countries (Halyburton's Ledger 178, 181, 194, 195, 223, 227). It may well have been an attempt to encourage the production of this doubly-refined salt in Scotland that patents were issued to certain entrepreneurs and the owners of saltpans by the Scottish Parliament in 1563 and 1564 (APS ii 538 c7; RSS v (i) No 1426). However, it was not until 1587 that a patent was granted to Lady Burleigh wherein 'salt upon salt' was to be produced as an alternative to the 'great salt' of Spain and Brittany for which the normal Scottish 'small salt' was supposedly not a substitute (APS iii 494 c101).

The relative merits of one type of salt or another for the task of preserving perishables are as much a matter of

personal taste and political preference as they are a question of chemical suitability. Ideally different foodstuffs and methods of preparation required different types of salt, but as the quality of the salt could vary considerably depending on the degree of skill is used in their preparation, this may have been an ideal which was rarely achieved. The chemical reality of that skill was, in the case of sea-water salts, the extraction of the maximum amounts of sodium chloride and as little calcium sulphate and magnesium chloride as possible. These last two salts are not only bitter to the taste, making the salt unsuitable for the dairy or table, but they also retard the rate at which the curing salt penetrates the flesh, thus allowing the centre of the foodstuff to rot. In the case of salted fish, however, a small amount of magnesium chloride may have been desirable as it gave the scales an attractive shine (van Oss 1968 425). The calcium sulphate was readily removed as a scum during the boiling of the sea-water, but considerable skill was required to separate sodium chloride from the magnesium chloride which was deposited at only a slightly greater specific gravity (Bridbury 1955 8-9). There is, however, considerable evidence that the Scottish salt industry was able to produce salt of an acceptable quality throughout its long history and by the start of the seventeenth century Scottish salt was being refined in substantial quantities especially for the Dutch and Baltic markets (Lythe 1960, 51, 240; Brown 1891 136).

Chapter 3

Part 3 Mineral Based Industries

Glass Working

With the exception of a small number of perhaps low prestige items such as linen smoothers, four of which were found from late fourteenth-century levels during the Perth High Street Excavations, glass tended throughout the medieval period to have been used as a medium for luxury items (PHSE glass). This was not in any way a result of any scarcity of the two or three basic constituents of glass. Silica, the main 'former' of glass, was and is widely available as sand and in some areas as flint or quartz. However, the temperature needed to fuse silica is in excess of 1700° C and it is also necessary to add a metal oxide or 'modifier' to act as a fluxing agent for the silica, which reduces the melting point of the glass to 700-900° C. Two highly acceptable modifiers, potash and soda, were widely known and readily available during the medieval period. Potash was mainly made from the ashes of wood which are rich in potassium and calcium, while soda, which is rich in sodium as well as potassium, magnesium and calcium, was made from the ashes of seaweed (Goffer 1980 136-40; Sanderson & Hunter 1981 27-30). The addition of a modifier also affected the chemical durability of the glass through its reaction with water. The durability of the glass was improved by the presence of calcium, but while sufficient quantities of calcium are present in a number of

pieces of medieval glass it is not known whether it had been added deliberately. The scarcity of glass and its use for luxury items resulted not, therefore, from the cost of its component materials. Although some coloured or painted glasses did require expensive additives, the main restriction on the availability of glass was the high degree of both practical skill and theoretical knowledge required by the glass makers, formers, painters, cutters, fitters and traders.

Another feature of the glass industry was the very clear divisions in technology and resources that existed between the manufacture of the glass itself, hot working of the glass into suitable forms, and any decoration and fitting of the glass. The first of these stages was undoubtedly the most difficult. Substantial furnaces and large quantities of fuel were required to make glass. The temperature of the raw materials or frit had to be kept well above the melting point of glass for as much as twenty-four hours before it was truly homogeneous. The temperature of the glass could then be allowed to fall until it either became sufficiently viscous to be worked into artefacts or completely solid at which stage it could be stored as raw glass or cullet for future work or traded for others to work. Although the duration of the fritting process could be slightly reduced by the addition of fragments of previously formed glass it was always a difficult process, not least because the molten glass was highly caustic. The crucibles used to contain the frit had to be particularly robust and durable.

Although there are sometimes problems in identifying the type of modifier used in ancient glass, Roman and early medieval glass appears to have been soda based while later potash glass became the norm (Hunter 1981 145; Harden 1978 1-24). Theophilus, writing in the early twelfth century, described the production of potash glass from a mixture of two parts beechwood ashes to one part clean sand (Dodwell 1961 39). However, a small number of Mediterranean centres, including Venice, continued to specialise in high quality soda glass. Whatever the alkali, the use of different sand or ash would have required careful quality control to insure the basic durability and colour of the glass. By the end of the medieval period the practice, as described by both Agricola and Biringuccio, was to use more refined potash, produced through the crystallisation of wood-ash lyes (Smith & Gnudi 1942 126-34, Hoover & Hoover 1912 586-59).

The main use for later medieval glass was the covering and decoration of church windows, although from at least the early fourteenth century the windows of major Scottish secular buildings, such as the king's palace at Cardross, were also glazed (ER i 125). There were two techniques employed for the production of window glass at this time. The muff or cylinder method involved the blowing and forming of a large cylindrical bubble of glass which was then opened out flat. Waste fragments from the edges of sheet-glass made by this method have been found amongst the fifteenth century debris from the repair of a window or

Although there are sometimes problems in identifying the type of modifier used in ancient glass, Roman and early medieval glass appears to have been soda based while later potash glass became the norm (Hunter 1981 145; Harden 1978 1-24). Theophilus, writing in the early twelfth century, described the production of potash glass from a mixture of two parts beechwood ashes to one part clean sand (Dodwell 1961 39). However, a small number of Mediterranean centres, including Venice, continued to specialise in high quality soda glass. Whatever the alkali, the use of different sand or ash would have required careful quality control to insure the basic durability and colour of the glass. By the end of the medieval period the practice, as described by both Agricola and Biringuccio, was to use more refined potash, produced through the crystallisation of wood-ash lyes (Smith & Gnudi 1942 126-34, Hoover & Hoover 1912 586-59).

The main use for later medieval glass was the covering and decoration of church windows, although from at least the early fourteenth century the windows of major Scottish secular buildings, such as the king's palace at Cardross, were also glazed (ER i 125). There were two techniques employed for the production of window glass at this time. The muff or cylinder method involved the blowing and forming of a large cylindrical bubble of glass which was then opened out flat. Waste fragments from the edges of sheet-glass made by this method have been found amongst the fifteenth century debris from the repair of a window or

windows at Elgin Cathedral (plate 40) (Lindsay forthcoming). The other form of window glass is known as crown or spun glass. A large spherical bubble of glass was first blown and then transferred to an iron rod. By spinning the glass on the axis of this rod the centrifugal force of the glass itself forced the bubble to open out into a disc. The concentric lines left by this form of manufacture survive in a number of fragments of thirteenth to fourteenth-century glass, which are also from Elgin Cathedral and the adjacent excavation (Graves 1985 130). Whatever the technique used to create the desired form of glass it was then necessary to anneal the glass by reheating it for a short time in an enclosed furnace to slightly below its melting point. The glass was then allowed to cool gently so removing any faults or stress lines in the glass.

The colour decoration of glass could be achieved in a number of different ways. Solid coloured glass was made by adding pigments during the initial fritting of the glass, or during subsequent melting of broken glass or cullet. Use of this technique was therefore restricted to the makers and formers of glass. Alternatively, pre-formed glass, especially window glass, could be dusted or painted with colouring agents which were then fixed by low-temperature heating in furnaces similar to those used for annealing. The decoration of glass in this way allowed a far greater number of craftsmen to work in the medium while at the same time permitting more intricate decorations to be undertaken.

With such a high degree of professional skill required before any quality or quantity of glass could be produced or worked, the glass industry is a useful indicator of the general technical ability of early communities. Glass manufacture and glass working could be, and frequently were, carried out at different locations. The bulk manufacture of potash glass took place in the woods which provided potash for the glass and fuel for the glasshouses. Indeed an alternative name for potash glass is 'forest' glass. The woodland glassmakers were not, however, an integrated part of rural communities. They were regularly on the move and often came into conflict with rural communities as a result of their pursuit of new supplies of fuel and ash (Hunter 1981 147). The glassmakers may therefore have felt themselves to be a group apart, with perhaps stronger links with the urban craftsmen and traders who worked and marketed their glass.

The potentially complex structure of the glass industry makes it extremely difficult to identify the extent to which medieval Scottish 'glass-wrights' were actually involved in the making, forming and decoration of glass as opposed to its trading and, in the case of window glass, mounting. What evidence there is suggests that in Scotland, as elsewhere, there was a relatively small market in vessel glass which existed alongside a much larger trade in window glass. The latter trade seems to have resulted in a lively Scottish tradition in the decoration and use of window glass. Unfortunately most of the detailed evidence

for the origin and use of window glass in Scotland is of quite late date. During the fifteenth century many hundreds of vitri, presumably sheets of glass, were purchased for the king's buildings (ER iv 619, 621; v 274). The source of the glass is not normally specified although it is known that quantities of sheets of glass were imported. Some window glass may, however, have been made locally from either imported glass cullet, old glass or occasionally sand and ashes. One possible early example of the making of window glass was in the construction of Dornoch Cathedral during the second quarter of the thirteenth century. Writing about this work in the seventeenth century Sir Robert Gordon commented that 'all the glass which served the church (Dornoch Cathedral) was made by St Gilbert his appoyntment besyd Sideray two miles by west Dornoch' (MacGibbon & Ross V 1892 523). There is no indication as to the source of Gordon's knowledge although he may well have seen charters and other papers which are now lost. Forest glass was certainly being made in England from the fourteenth century onwards. Much of this glass was made in the Weald around Chiddingfold and then sent to London for export to other parts of England and perhaps Scotland (Vose 1980 104-5). Curiously glass was not amongst the materials imported into Scotland through the offices of Andrew Halyburton in the Low Countries. Flanders is, however, known to have been one of the chief sources of coloured and clear 'white' glass (Salzman 1952 183-5).

Medieval window glass has traditionally been studied under

the two broad headings of ecclesiastical and secular. However, in Scotland at least, it is far from clear that there was any marked division between the workers of ecclesiastical and secular glass. Unfortunately references to individual glasswrights only become common in the sixteenth century, by which time most prominent glasswrights seem to have been based in the burghs. For instance Robert Wischart, a glasswright and burghess of Aberdeen, was commissioned in 1541/2 to repair and maintain the windows of St Nicholas Kirk in Aberdeen (Abdn. Counc. i 165, 174). Another sixteenth-century glasswright, Thomas Peblis, who may have been an Edinburgh burghess, was engaged by the king to measure and 'mak the glas' for the Kirk at Steil, thought to be the parish church of Ladykirk in Berwickshire (TA ii lxxxiii-iv, 277, 436). Peblis also worked on the glass for the Queen's oratory at Holyrood as well as at the palaces of Falkland and Linlithgow (TA iii passim; iv 375). The glass made or supplied by Peblis for both the chapel and the Lyon Chamber at Linlithgow was 'paynttit werk' (Works Accts. i 128).

There is very little evidence for the organisation of the earlier glass industry in Scotland. One rare thirteenth-century reference to a probable glasswright, Willelmi Vitreaii, establishes that he sold his land in the burgh of Elgin to the canons of the Cathedral there (Moray Reg. 146). There is no indication that William was in any religious order and, as William held land in or by the burgh, it is likely that he was a secular tradesman. However, many major religious orders and establishments

trained some of their own members in the skills of glassworking. This must have been especially necessary before the development of a more active secular industry in the fifteenth and sixteenth centuries. An early sixteenth-century instance of this was the Franciscan friars whose convents at Perth, Ayr, Elgin and Aberdeen were glazed by one of their brethren, John Strang (Milne 1911 83).

Alternatively some diocese retained professional painters to decorate and maintain the windows of their churches and chapels, as in the case of William Wallanch who was waged by the Bishop of Dunkeld during the early sixteenth century (Dunkeld Rent. 146-97, 227-8).

The surviving produce of these glasswrights is overwhelmingly in the form of ecclesiastical window glass. Where chemical analysis of the glass has been undertaken the samples have indicated the use of potash glasses (Tennent et al 1984). It has been possible to suggest the method of manufacture of a number of pieces of Scottish ecclesiastical glass, most of which would appear to be of the muff or cylinder type rather than spun glass. The decoration is mainly of the grisaille type, grey foliage painted and fired onto the clear glass, with little in the way of figure painting or coloured glass (Graves 1985).

While this preponderance of ecclesiastical glass undoubtedly reflects the Church's large scale use of glass, there are a number of reasons why secular window glass should be under-represented. The single most important reason must be that secular windows did not suffer the in

situ destruction caused to church glass during the Reformation. Indeed, unlike church windows, the casements of secular buildings were normally made to be portable. This permitted them to be transported from building to building as required for use, storage or repair (Turner & Parker 1877 122). As a result even when important secular buildings have been excavated, window glass remains a rare find. A few sixteenth-century fortified house sites have produced window glass, as at Skirling Castle, Peeblesshire and Black Jack Castle, Angus (Dunbar 1964 244; Wilson & Wilson 1966 252). Urban excavations have produced a further selection of plain window glass with some of the earliest coming from the Perth High Street excavations which produced seven fragments from late thirteenth-century levels (PHSE glass).

Seven fragments of vessel glass were recovered from thirteenth- and fourteenth-century levels on the Perth High Street excavations, confirming the early availability of both stemmed glasses and flasks (PHSE glass). Three fragments of a blue-green ribbed vessel have also been recovered from fourteenth/fifteenth-century levels on the Bank Street/Townhall Street site in Inverkeithing, Fife (Wordsworth 1983 545). However, it is only with the excavation of sixteenth and especially seventeenth-century contexts, such as at Skirling Castle, Peeblesshire that vessel glass became at all commonplace (Dunbar 1964 244). The documentary sources for the sixteenth century also begin to reveal more about the range of vessels that were available. James IV's alchemists, including 'Master John

the French Leech' and Mossman the Apothecary, were well provided with glass flaggons, flasks and urinals, several of which were apparently for the distillation of 'wateres an othir stuf'. One merchant, Simon Umphrayson, also appears to have been a regular importer of glasses and other glassware for the king's table (TA ii 430; iii 180). The country of origin of this glass is unfortunately not recorded. The responsibility for supplying the royal household with many of these vessels lay with the king's Master Cook who had charge of the king's table glass, plate and cooking vessels. Sand-glasses also make their appearance in the documentary sources at this time (TA iii 180, 337). Amongst the most likely sources of table and other fine glassware are Venice and the more northerly centres of Burgundy, Flanders, Lorraine and Normandy (Salzman 1952 183-5).

In terms of the development of local glassworking industries, trade in vessel glass was of secondary importance to the large scale production of window glass and cullet that was based in the English Weald and various other Continental centres. For the first time since the decline of the Roman glass industry, there was in the fourteenth and fifteenth centuries a major increase in the availability of glass. Despite its fragility, glass was in fact an ideal commodity for trade. The ingredients of glass were relatively cheap, yet through skilled working the finished products could realise a considerable profit. Much of the profit must have lain with the forest manufacturers and the producers of fine tableware, but

clearly there existed in Scottish and other towns, glass wrights whose task it was to tailor and decorate sheets of glass to fit specific windows, and latterly to produce their own panes and vessels.

Chapter 4

The Industrial Economy

In its widest sense any work which results in a useful product or service may be seen as industrial. In practice, industrial activity has come to be equated more with the professional manufacture of marketable goods than, for instance, ecclesiastical, military or even mercantile services. The processes and materials used by the urban craftsmen of medieval Scotland have been reviewed in the previous chapter. However, the economic and social organisation of medieval industry was a far more complex affair than the previous, industry by industry presentation might suggest. A great many factors affected the success or failure of industrial production in the burghs, not least the extent to which ostensibly independent crafts relied on one another for markets and materials. Although the medieval evidence can be more than usually difficult, the importance of the interaction of raw materials, manufacturing resources and product demand on industrial activity has long been recognised by economists (Reekie & Allen 1983). The nature of raw materials and the range of manufacturing resources required to process these materials have therefore been considered here in some detail. Just how product demand manifested itself and was controlled are considered in the next and final chapter.

Part 1 Raw Materials

The nature, sources and availability of raw materials all had an important influence on the organisational structure of medieval industry. Fortunately it is a fairly simple task, compared to investigating other aspects of manufacturing, to identify the main materials used by urban tradesmen to produce or preserve the goods they marketed. There are, however, a variety of ways in which the range of materials used may be reviewed and interpreted. The first method adopted here is to draw a distinction between main and secondary raw materials. Main raw materials may be defined as the principal materials from which retailed goods were made, while secondary raw materials comprise any substances which were used during production processes. Hence the hides and skins processed by a skinner for retail or further working were main raw materials, while the water, bark and lime which were also needed were all secondary materials consumed or discarded during the course of tanning. Once the nature of the various raw materials has been established it is then possible to consider how the origin and availability of the materials they used influenced the structure of medieval industry.

The recognition of main and secondary materials highlights not only the relative importance of different raw materials but also helps to explain the different status of the craftsmen who used or prepared these materials. Craftsmen, such as skimmers, who controlled the preparation and production of a range of goods from their main raw materials tended to hold a more prominent position in the contemporary hierarchy of medieval industries than did

tradesmen, such as barkers, who made their living from the collection and preparation of specific secondary raw materials. The varied commercial and technical value of secondary materials means that there were always exceptions, but in general those who provided secondary raw materials had a far lower public profile and conceivably less influence than those who, with their help, turned main materials into a range of marketable goods.

The availability of imported main and secondary raw materials in port burghs must have made these towns particularly attractive to goldsmiths, dyers, glaziers and others who required imported raw materials in order to practice their trades. What is less well appreciated is the extent to which locally available materials, especially the waste products of other manufacturers, encouraged diverse industries to be located together. Bronze-smiths are not normally connected with tanners or cloth nappers and yet Biringuccio, in that part of his treatise which dealt with bronze casting, recommended that these smiths temper the clay for their moulds with hair discarded during the preparation of skins for tanning or nap shearings produced during the finishing of cloth (Smith & Gnudi 1942: 219). Hair has been identified as one of the materials used to temper clay moulds found in Scottish burghs (Spearman forthcoming a). Materials such as fuel and water might be more freely available in the countryside, but the practicalities of ensuring reliable access to traded and also discarded main or secondary materials gave urban craftsmen one of their major advantages over rural

competitors.

The wider industrial relationships which may be identified from the availability and nature of main and to a lesser extent secondary raw materials, were essentially the same as those by which medieval craftsmen came to describe and organise themselves. In effect, all the major medieval crafts, tailors, fleshers and skinners, wrights, maltmen and baxters, masons and hammermen were party to an interactive structure which was firmly rooted in the traditional tripartite animal, vegetable or mineral classification of materials. Although craftsmen frequently made use of a range of secondary raw materials, they tended not, except in an ad hoc manner, to acquire and manipulate more than one class of main raw material. With a few notable exceptions, for instance weavers who could produce cloth from either vegetable or animal fibers, the professional trades were organised so that only fleshers butchered animals, only maltmen malted grain and only hammermen beat metals. The main points of professional contact between craftsmen working in each of the broad, animal, vegetable or mineral industrial categories were the purchase of tools and equipment from smiths and, where their produce had an export market, the use of merchants.

This gross tripartite division was not, however, the level at which the majority of industries were established or are even now distinguishable. Within both the animal and vegetable categories it was not unusual for more or less distinct manufacturing processes to be based on the use of

a specific class or group of plant or animal main raw materials. Each industry might then consist of small number of crafts each of which specialised in a particular part of the manufacturing chain. Some of these industrial groupings are more obvious than others, but all centre on specific classes of raw material. For instance, because of its reliance upon a specific non-domestic portion of the animal kingdom, fishing and fish processing formed a readily identified industry. The wool and textile trades formed another fairly distinct industrial group for, unlike the majority of other animal produce users, they were not wholly reliant on the butchered remains of animals for their wool. Nevertheless, the wool trade could never be completely divorced from the work of fleshers, for even sheep kept for wool were eventually butchered and conversely all butchered sheep produced wool fells.

Animal Remains

The interaction of the seemingly independent industries which made use of animal raw materials is most clearly seen amongst the various users of animal carcasses. Domestic animal carcasses provided a rich source of main and secondary raw materials, but it has to be said that most of these animals were being slaughtered for only two items, their flesh and hides (above pp 63-67). As a result it is often difficult to be certain that tradesmen such as bone and horn workers were ever financially or structurally independent of fleshers and skimmers. It is, nevertheless, a mark of the versatility and economic importance of animal carcasses that two such major industries as fleshing and

skinning could develop from what was in effect a single raw material source. Something of the artificial nature of dividing a single source of raw materials is, however, demonstrated by the need for early legislation to ensure that the purchase, preparation and marketing of skins and hides was the preserve of skinners, not fleshers (Statuta Gilde ch30).

Skeletal and other animal remains are an important indicator of the regional relationship between pastoral farming and the supply of animal food-stuffs and/or raw materials to burgh communities (Hodgson 1983). Further evidence for the management of animal based raw materials as well as the commercial exploitation of animal food-stuffs, comes from a wide range of documentary sources, not least because of the customs imposed on the export of hides and wool (above pp.76-88, 108-11). Unfortunately, both archaeological and documentary sources can be difficult to interpret as they have been influenced by a wide range of chronological, political and economic factors and are in any case fairly sporadic in their survival. Custom returns, nevertheless, point to a much higher proportion of hides and marts than wool being marketed in burghs such as Dumbarton, Stirling and Inverness which border the highland massif, while the converse is documented for such lowland towns as, Edinburgh, Haddington and Berwick (ER ii lxxxviii-xcii). Insufficient excavation and skeletal analysis has so far been carried out to do more than confirm the economic dominance of cattle in the northern towns. South of the Firth of Forth there are even fewer

good skeletal assemblages from urban sites, but it is interesting to note that where skeletal remains have been found, as at the High Street in Edinburgh, a much higher proportion of sheep remains, as compared that found elsewhere, has been reported (Chaplin & Barnetson 1976 234).

Vegetable Remains

A great variety of goods were produced from vegetable raw materials and much of the work, for instance basketry or heather thatching, could be undertaken with a minimum of specialist equipment or training. As a result it is sometimes difficult to distinguish between professional and domestic manufacturing. Plants did, however, provide such important and diverse main raw material as cereals, flax, and wood each of which supported a range of major urban industries (above pp 123-56). Although quantities of vegetable raw materials, including at various times cereal, flax and timber, were imported into Scotland, local agricultural and woodland produce must have accounted for a substantial proportion of the vegetable raw materials needed by urban industry. It is likely, therefore, that the urban manufacturers of food-stuffs and artefacts from vegetable raw materials were not only influenced by, but also influenced, farming practice in and around the burghs. The distribution of the main burghs coincides with that of prime arable land and it is clear, from royal, monastic and later burgh records, that burgesses were heavily involved in the transportation, storage, processing and marketing of cereals (Dawson 1975 1-5; Duncan 1975b 31-32). The feuing

of milling rights alone came to provide over half the total annual resources of most burgh councils (Ayr Burgh Accts. xxix). What is less certain is the influence, if any, that the burghs had on the pattern of arable farming.

Documentary and archaeological evidence for medieval agriculture in Scotland is extremely sparse and there is, as yet, insufficient evidence to confirm any difference between cereal farming in urbanized and rural areas (Coupar Angus Rental xxvi-xxxi). There are, however, indications from both documentary and archaeological sources that the technology being employed to process cereals was the same in both town and country (above pp 130-36; Pollock 1985: 363-70). In other areas of farming there may not have been such standardisation. For instance there seems to have been a degree of specialisation in the cultivation of plant fibres, seeds, bulbs and seed-grain in some urban areas (above pp 137-41), while woodlands may also have been more intensively managed nearer the towns (above pp 143-44).

Mineral Remains

The metals worked in medieval Scotland were derived from a wide range of different sources. A sizeable proportion, perhaps the majority, of ores and metal used came from rural mines and smelters within Scotland, but a range of metals, especially of precious metals, is known to have been imported (above pp 193-95). Much of this imported metal came in as artefacts, and artefactual metal is likely to have formed the largest single source of metal used by medieval smiths in Scotland. The practice of customers presenting smiths with tools for repair or objects and

scrap metal for re-working is well documented (Dunkeld Rent. 146-49, 178, 222-27, 233-39, 242-44, 262-64) and the re-cycling of metal in this way may well account for the wide range of mixed ferrous and non-ferrous workshops that have been found on both rural and urban sites in Scotland and elsewhere (above pp 163). It is quite clear that many smiths did not need to get overly involved in the supply of their principal raw material and, while considerable specialisation was possible, much of the equipment and skill used to smith iron were crudely applicable to non-ferrous metal smithing, although not perhaps complex casting. It was, however, the production and repair of iron tools and farming equipment that formed the mainstay of the smelting and metalworking industries. Properly maintained ironwork was essential to the economies of both urban and rural communities and 'repair and maintenance', smiddies could be found in most settlements from the larger burghs such as Edinburgh/Leith, Perth or Aberdeen to the larger towns and residences such as Cluny to the east of Dunkeld and Glenisla and Kinloch in Angus (Dunkeld Rent. 178; Coupar Angus Rental i 226; ER ix 369, 509).

It is not clear to what extent urban smiths were directly involved in the extraction of metals from rural ore sources. The location of many of the more specialised metalworkers in towns, such as Aberdeen, Dundee, Perth, Stirling and Edinburgh, would suggest, however, that they valued having reliable access to both foreign and regionally traded metals. Moreover, some burghs were better-positioned than others to combine foreign imports with the

mineral resources of their own hinterland. For instance, Perth smiths would have been ideally placed to make use of both imported metals and the products of domestic sources such as the Loch Tay copper and lead ores (MacGregor 1940 22). It is perhaps not surprising then that one of the few workshops excavated so far which is thought to have specialised in bronze casting and beating is in Perth (Spearman 1988c 65-68).

The extraction of coal, the refining of salt and the working of glass were all of considerable industrial significance during the medieval period. However, as the majority of these industries were located outwith the towns, near appropriate sources of fuel and raw materials, the involvement of urban craftsmen in these industries tended to be as consumers rather than producers. The availability of these materials nevertheless had a profound influence on the course of urban industrialisation. Most of the major Scottish estu^aries were the scene of important fisheries, but the concentration of Scottish fishing ports around the Forth and north along the coast to the Tay, particularly before the trade in foreign salt became established in the fourteenth century, may have owed much to the availability of salt produced on the Carse of Stirling (above pp 220-21). The reverse may of course also be true, but it is impossible to know whether the salt industry developed to the extent it did because of the plentiful herring or whether the herring could only be so successfully exploited because of the salt. Virtually the only non-metallic substance which provided the main raw

material for an urban industry in Scotland was glass. However, as has been discussed above (pp 230-32) almost all the glass used in Scotland during the medieval period was imported from abroad in the form of cullet or as panes of glass. Scottish glaziers who cut and decorated these panes or shaped imported cullet into vessels were therefore dependent on urban trading contacts for their main raw material, and documentary sources indicate that glaziers were either attached to religious houses or as burgesses conducted a large part of their work from the towns.

As secondary raw materials were consumed during various manufacturing processes, they have tended to be under represented in both the documentary and archaeological record. To some extent this state of affairs reflects the fact that the collection and preparation of secondary raw materials rarely achieved the same economic prominence as did the manufacture of retail goods. In many cases the collection, preparation and use of secondary materials goes almost completely unrecorded. The refining of salt and the cutting or mining of fuel are the exceptions which prove the rule. The vast quantity of bark needed by tanners is scarcely mentioned in documentary sources, appearing only in street and personal names and latterly as an excisable commodity (Custom Rates 1612 288). Although by definition consumables, secondary raw materials were essential to industrial development and it is worth dwelling upon their uses and availability for a moment.

Much of what is known about secondary raw materials comes

from contemporary and later descriptions and illustrations of the industries in question. However, as discussed in chapter one, the quality of these technical treatises is as varied as their authors' experience and purpose and it is normally necessary to confirm from other sources that the manufacturing processes described in them are relevant to those actually practised in medieval Scotland.

Archaeological excavation has provided a certain amount of direct evidence for the use of bark and other consumable raw materials in Scotland and it is often possible to verify indirectly the use of other secondary materials by analysing the construction of finished products. For instance, chemical analysis has indicated that mercury and probably alum were being used in Scotland from the early historic period to apply gilt to the surface of brooches and other pieces of jewelry (Stevenson 1985 236).

Fortunately the core manufacturing processes and materials appear from such evidence to have been fairly standard throughout north-west Europe and in a number of instances it is reasonable to infer the use of commonly available raw materials. For instance, human urine was widely known to have been a source of ammonia, and was used as such by dyers, metalworkers, tanners and others. Hence, even though the only documentary and archaeological evidence for the collection of urine in Scotland is the existence of ceramic and glass urinals, it is extremely likely that urine was used by some Scottish industries (above pp 239). In much the same way it is almost certainly the case that soft soap was produced in Scotland from potash-lye and

animal fat, although there is no firm archaeological or documentary evidence to this effect. Such soap would have been needed for the cleaning of fleeces and other main raw materials. Indeed, some of the soap bought in the Low Countries by Andrew Halyburton, conservator for Scottish merchants in the Netherlands at the end of the fifteenth century, for clients in Scotland may also have been used for this purpose (Halyburton's Ledger 43, 53, 59, 63, 65, 67, 76, 83, 91, 168, 179, 191).

The production and use of chemicals features strongly in many medieval and post-medieval medical, alchemical and technical treatises, several of which are believed to have found their way to early Scottish libraries (Comrie 1932 64; Durkan & Ross 1961). The more exotic and valuable of these materials tend to be better documented than commodities such as urine, and it is clear that many imported chemicals would have required additional preparation before they could have been used. References to the importation of such chemicals and the presence of apothecaries would imply the existence of alchemical skills within Scotland (Comrie 1932 58-60). The considerable cost of such chemicals resulted in their main use being either medicinal or as secondary materials in high value industries such as decorative metalwork and the dyeing of quality cloth. Indeed in a few cases the same chemicals were used for several purposes. Alum, for instance, was used by apothecaries as well as being required as an astringent fluxing agent in metalwork, a mordant for certain dyes and for the tawing of furs and other delicate

leather goods. Until the production of alum from schists near Whitby in Yorkshire, at the end of the medieval period, the majority of the alum reaching the British Isles came from Italy and the Eastern Mediterranean via France and the Low Countries (Singer 1948; Halyburton's Ledger 57-58, 72, 181, 201). Before it was suitable for use it was recommended that the alum be dissolved in urine and then refined through crystallisation (Smith & Gnudi 1942 98-105; Hoover & Hoover 1912 564-71).

Another important specialist material imported into Scotland from the Continent was mercury. Mercury was mainly used by goldsmiths both to collect and refine gold and in gilding. The mercury was imported as cinnabar (mercuric sulphide), and in its metallic form as quicksilver (TA ii 62, 63, 359, 360, 362, 403). Mercury would have been extracted from the cinnabar by sublimation or distillation by descent in sealed containers. Vermilion, another form of mercuric sulphide, was also imported into Scotland, but this was almost certainly used as a pigment rather than as a source of mercury (TA ii 63; Halyburton's Ledger 117). Technological treatises also indicate that goldsmiths normally made use of aqua regia and other mixtures of hydrochloric and nitric acids for the separation of silver and gold, although corroborative evidence for the use of such acids in Scotland is lacking until the sixteenth century (Comrie 1932 158). It is likely, however, that alchemists employed by James IV, such as the 'French Leech', the Abbot of Tunland and others would have been familiar with the use of acids and

alkalies, and a wide range of materials and equipment, including numerous drugs, aqua vitae, salt, eggs, mercury, bellows, glass flasks and urinals, were certainly purchased for them (TA ii lxxvi, 446).

Dyes and pigments were a frequent feature of both local and international trading accounts and technical treatises. Woad, madder and saffron were regularly imported by dyers and merchants while painters were provided with various pigments (Halyburton's Ledger passim; Apted & Hannabus 1978 131-49). By the end of the medieval period in Scotland documentary evidence for the range of secondary raw materials which were available is greatly extended by the taxation of a wide range of imports including: dyer's ashes and lime, soap and soap ashes, tar, bark, even cuttle bones for goldsmiths as well as innumerable drugs and dyes (Custom Rates 1612 passim).

It is a virtually impossible task to identify all the different and multiple uses to which imported and locally available chemical substances were put. Some of the more practical technical treatises, such as the twelfth century De Diversis Artibus by the monk Theophilus, do however provide an invaluable insight into the uses of secondary raw materials. For instance, the use of pitch or horn to blacken hot smithed iron in order to restrict corrosion is recorded by Theophilus, while Biringuccio notes the use of oil, herbal water, vinegar or urine to change the composition of liquids used for the tempering of iron. Soap and horn were also used to bring out the colour ranges

in the hot iron as it was being tempered so as to provide the smith with a clearer indication of the condition of the metal he was working (Dodwell 1961 165-8; Smith & Gnudi 1942 369-73). Likewise few in the West would today consider the use of maturing dung as a cheap and reliable source of steady heat as was advocated by Albertus Magnus and some time later by Biringuccio (Heinze 1958 23; Smith & Gnudi 1942 345-46). Unfortunately, because of the nature of the materials involved, very few of these processes can ever be confirmed as having been definitely carried out in Scotland.

Part 2 Manufacturing Resources

There can be little doubt that availability of manufacturing resources had a major effect on the distribution and organisation of medieval industry. The problem is how to evaluate the scale of the investments being made and how they changed with time. Surviving examples of the accounts kept by Scottish merchants are few and far between, and there are no known records documenting the finances of craftsmen burgesses. Creative accountancy, such as 'cost benefit analysis', had in any case no place in this period and it is debatable how much such records, if any had been made and survived, would have reflected the resources involved. There is, in short, no possibility of being able to price properly all the resources required by a particular industry, or of producing a series of annual balance sheets to show how individual businesses or industries fared. The best that can be hoped for is that

the relative value of a standard range of resources can be established and that this will allow at least some of the major changes in the use of resources to be identified. It may then be possible to begin looking at the underlying economic and political forces behind the interaction of industrialisation and urbanisation.

The standard range of resources examined here includes: the relative value of the raw materials used, the skill level of the craftsmen involved, the relative amounts of capital invested in tools and equipment and the time expended before the products reached the market place. One further factor which has to be considered is how the marketing of products influenced the distribution and development of industries and this has been dealt with in more detail in chapter five. However, this assessment of commercial industrial resources can not be totally divorced from the effects of the market place, nor can the 'return' on investment provided by an industrial process be judged purely in terms of cash raised through sales. Upsets in the price of commercially prepared materials and products provide a useful guide to more fundamental changes in the nature of industrial investment. Some of the available evidence for the cost of materials and products has, therefore, also been considered in this section.

The Relative Value of Raw Materials

For many of the materials used by urban industries there are no known prices or marketing patterns. The main problem is that, although various financial records show

the price of a great range of commodities, few records are sufficiently repetitive or consistent over a restricted period for the normal trading values of raw materials to be established. An additional problem is undoubtedly the fact that the quality and quantity of the materials involved are more often than not only imperfectly known. In particular, the units of measurement used are known to have varied from period to period and place to place (Henderson 1926).

Even when using contemporary sources it can be difficult to draw any useful comparisons between what, at first sight, appear to be the same materials and related measures. For instance, the detailed accounts of Andrew Halyburton, make it clear that in the Netherlands he expected to pay between 3s 6d and 4s 6d for 100lbs of iron (Halyburton's Ledger 43, 47, 57, 58, 69, 75, 116, 191, 208, 232. 272). Attempts to compare this price with the average cost of iron used in Scotland are however fraught with difficulties as these two countries employed different units of weight. French, Spanish and local iron bought in Scotland was, at this time, fetching in the order of £1 10s per waw (TA i 249-52, 287, 290-92). In the reign of Robert III (1390-1406), one waw had equalled twelve stone and each stone was eight pounds, ie. 96lbs (APS ii 52 c7). It might be assumed, therefore, that iron was very considerably more expensive in Scotland than in the Netherlands, but unfortunately there is no guarantee that at the end of the fifteenth century a waw of iron weighed 96lbs, or that the iron bought in the Netherlands was in fact at the same stage of refinement or quality as that bought in Scotland.

Documentary evidence about the value of raw materials from abroad and within Scotland only began to become sufficiently reliable for the estimation of foreign and local values during the sixteenth and seventeenth centuries. This may in part be due to the introduction of customs charged upon the value of goods imported and exported, which required the listing of official valuations on a far wider range of goods than ever before. Even in these valuations it is clear that some of these figures were set artificially low to reduce the burden on desirable imports. Nevertheless, it is interesting to note that in 1612 iron for export was valued at the same price as imported iron. Greater standardisation in weights and measures must have been a requirement of this taxation system, although there still seems to have been some variability in the interpretation of measures. For instance, a stone of imported Spanish, Swedish or Osmund iron was valued at 13s 4d, but a 'ship pound' of imported iron was expected to cost £10 13s 4d (Rates of Custom, 1612 316, 337).

One result of these difficulties is that the study of commodity prices in medieval Scotland has never received close attention. However, while it is certainly true that any detailed economic analysis of the whole of Scottish medieval manufacturing is impossible, there is sufficient documentary evidence for the relative value of certain foodstuffs, as well as more costly regionally and internationally traded materials, to be established. It is

certainly possible to establish the relative price of different cereals, different livestock and different metals and hence to begin to discover something of how contemporary suppliers and users valued their basic industrial commodities. Without searching out such relative values it would be virtually impossible to put any meaningful brake on the application (by default) of modern values and attitudes towards raw materials and commodity prices.

The earliest available Scottish source with a diversity of valuations, the thirteenth-century Exchequer Rolls, provides a unique guide to the relative value of a number of industrial raw materials in medieval Scotland. The figures involved need to be used with caution, for members of a modern, refrigerated, consumer society it is particular easy to underestimate the essential importance and considerable commercial value of preservation and packaging. For instance, without documentary sources economic historians would be hard put to price a chalder of sea-coals (in the order of 15 to 30cwt) at 3s in the late thirteenth century, let alone recognise that at that date a chalder of coal cost the same as such preserved foods as a hundred eels or a single cheese (ER i 27, 45, 49, 50). Such figures have more than just anecdotal interest, for they establish the relative value of goods and provide one of the best indications available of the economics of industrial processes. For instance, a boll of barley (of the order of 1.5 to 3cwt) cost, staying in the late thirteenth century, around 6d, while if it were malted for

brewing a further 1.5d to 2d was added to its value (ER i 2, 15-17, 25, 40, 42, 49). At the same time, milling of oats raised the average price per boll from 6d to 10d (ER i 5, 25, 36, 39-40, 46). The apparently small sums involved should not obscure the fact that the value of the goods was being radically altered. Thus while roughly three quarters of the price of malt went to the rural community who farmed the barley, the remaining quarter had been added by, and went to, the maltman.

The prices paid for medieval livestock must to some extent reflect contemporary tastes as well as the relative size and meat content of the different species butchered. Just how livestock prices are set is, and no doubt was, a complex affair, but where medieval prices are known they undoubtedly provide a useful indication as to how livestock were regarded and used. In the second half of the thirteenth century the average price per head for sheep bought for slaughter was 10d, while pigs fetched 1s 6d and cows 5s (ER i 4, 5, 8, 9, 11, 15, 16, 19, 20, 26, 30, 33, 49). In other words the three main domestic food animals were valued roughly in the ratio of 1:2:6; which indeed corresponds to what is known about their meat carrying capacity from skeletal examination (Hodgson 1983 8). Changes in taste and modern farming practices, in particular improvements through breeding and intensive pig farming, have changed the ratio somewhat, with sheep currently fetching in the order of £50, pigs £75, and cattle £500. The modern ratio per head before slaughter is therefore approximately 1:1.5:10, although pound for pound

mutton is actually by far the most expensive at on average 190p, while beef fetches 110p and pork only 70p per pound. It should be borne in mind, therefore, that, although agriculturally and industrially important, the price per head of livestock intended for slaughter reflects the value of all parts of a carcass and not just its meat content.

It is not possible to get a clear valuation for the cost of butchered marts in thirteenth-century Scotland, because the term 'mart' was used for both live and dead beasts. More detailed references in the early fourteenth century indicate that butchering added about 2s 4d to the price of a 5s mart and about 1s 2d to the price of a 1s 6d sheep (ER i 118, 126, 197, 267, 289). Bacons, perhaps because of the cost of fattening the pig, butchering and curing the meat, increased the value of a 10d pig by as much as 5s 2d (ER i 289). The value of sheep, cattle and pig carcasses would also have been increased through the sales of non-meat products. Unfortunately there are no thirteenth-century figures for the price of raw materials such as horn and bone, but it is clear that the sale of hides and offal added considerably to the value of animals which were slaughtered either within towns or within easy reach of the markets the towns provided. As with marts, there are difficulties in being certain about what was meant by a hide, but it would appear that when hide and mart parted company, in the late thirteenth and early fourteenth centuries, the former was worth between 4d and 6.5d (ER i 33, 201, 206, 380, 396). Perhaps surprisingly the price of offal, about 4.5d for that of cattle, appears to have been

about the same as the untreated hide (ER i 33, 124, 135, 333, 375). Very crudely then it would seem that from a beast costing 5s, in the late thirteenth and early fourteenth centuries, a flesher was able to market 8s 4d of meat, 4.5d of offal and between 4d and 6.5d of hide. With the sale of horn and other materials it would seem that he had in fact almost doubled the value of the original beast. This very considerable increase in value is even more dramatic when the work of the tanners was taken into account. Thirteenth and early fourteenth-century tanners buying hides for 4d or even 6.5d each could expect to selling the resulting leather for as much as 1s 6d, having effectively tripled or quadrupled the price of their primary raw material (ER i 201, 206, 380, 396).

Such figures are far from complete and provide no indication of the costs incurred in labour and secondary raw materials, and thus the absolute or indeed the relative profits enjoyed by farmers and manufacturers in preparing these raw materials. What is perfectly clear, even from these admittedly sketchy figures, is that the value of agricultural produce brought to the towns for sale by rural communities could be increased by anything from 33 to 100% as a result of basic preparatory work by urban tradesmen.

The necessity of keeping body and soul together would imply that retail manufacturers, such as bakers and cobblers must have continued this process of adding to the value of their prepared raw materials. Unfortunately, there is no real possibility of providing even guideline figures for the

additional value generated by such manufacturers of retail artefacts during this period. Even were it possible to establish the quality and value of a pair of shoes, the quantities and values of the raw materials involved are almost impossible to assess. All that can be said is that from the prices being paid for manufactured goods in the first half of the fourteenth century, such as the 7s saddle in 1342 for Andrew of Meldrum or the two pairs of large knives bought in 1331 for 35s, and what is known about the prices of primary raw materials it would seem that the mark up for manufactured goods could be considerable (ER i 481-82, 381). Later sources provide further examples of the high cost of both locally made and imported manufactured goods, although as before there is still no possibility of calculating the true levels of profitability and wealth creation.

Even when they are known, the prices paid for mineral raw materials, especially secondary raw materials, are particularly difficult to interpret. For instance, although ^{it} is known that at the start of the sixteenth century a pound of alum could be bought in Scotland for about 7d there is no way of determining the purity of this alum or the amounts needed by dyers, leather tawers and others (TA ii 393). Only in a few instances is it possible to identify what proportion of the over all costs such mineral raw materials represented. A remarkably complete record has survived from the first half of the fourteenth century of the costs and commodities involved in the salting of two batches of salmon at Berwick. Five hundred

and six hundred salmon were preserved with 2 chalders 6 bolls & 3 firlots and 2 chalders & 12 bolls of salt respectively. The breakdown of these figures would suggest that to process 100 salmon, which at this time would have cost about 50s, a further 7s 4d in salt and 1s 6d in labour was required (ER i 313, 362). It is, however, by no means clear what further packaging, if any, was involved in the preservation of these fish, how long the salting process took, or indeed the length of time that the salt was required to prevent decay.

Some of the other difficulties in identifying the levels of resources needed by users of mineral raw materials have already been touched on, as in the case of the price of such a widely used primary raw material as iron. However, it is also clear that many smiths managed to avoid, or were never expected to layout, the cost of their primary raw material. As has been discussed, there are repeated instances of the metal to be used being provided by the customer in the form of ingots, scrap or even serviceable artefacts. Precious metals, non-ferrous and ferrous metals were all provided in this way and, although it was sometimes the case that smiths provided all or part of the metal used from their own stocks, the frequent provision of metal by customers undoubtedly reduced the level of investment metalworkers had to make in their primary raw material. The recycleable nature of metals worked to the smith's advantage in this respect, and it is clear that the basic concept of providing a craftsman with his raw materials, both main and secondary, was widespread, for

instance, both iron and coals were provided by the king for the smith working at Tarbet in 1326 (ER i 57). This also happened in other industries and it was particularly common for tailors to be provided with the material they were to make up. Much, however, must have depended on the resources and circumstances of the individual customer as well as the proximity of both craftsmen and customers to suitable markets.

Availability of Craftsmen

A wide range of skills are perceived today as prerequisites for successful commercial manufacturing: accountancy, stock control, technical competence, personnel management, marketing ability, professional contacts, the list is almost endless. Modern managers and their teachers have tended to make such skills appear aggressively new, but these skills were as much a prerequisite of business success in the medieval period as they are today.

A very great deal has been made in the past of the differences between merchants and craftsmen, and also of the absence of multi-process craftsmen (Dickinson 1965 232-37). The plain fact is that they were all involved in trade. They all had to buy and they all had to sell. They all had to know their markets. In short they were all traders and in all probability they would have had considerably less regard for paper demarcations between those who laboured and traded and those who merely traded than historians have today. They were certainly perceived as traders first and specialists second in the charters of

David I and his immediate successors. At that time the Scottish kings pursued a policy of trying to attract foreign craft- and merchant-burgesses of standing first to their larger burghs and later to the smaller ones. Malcolm IV did not excuse the Flemish lorimer Baldwin all secular service except watch and ward, and permit him the exceptional freedom of being able to sell up and leave Perth whenever he wanted, simply to attract a minor artisan (RRS i Nos 121, 171). Baldwin was already established in Berwick and would have brought to Perth a whole range of skills and commercial contacts, attributes which would have benefited both burgh and realm. A similar purpose was served when Mainard the Fleming was moved from Berwick to St Andrews with what appears to have been the intention of providing that town and its bishop with additional mercantile skills (ESC No 169).

There is, to say the least, a qualitative difference between Baldwin's rights to move and what for Mainard and others appears to have been 'Hobson's choice'. This may reflect some difference between the legal status of Baldwin and Mainard, but as their rights were, at least in Baldwin's case, negotiated, their different status may equally well be the product of their professional ability and requirements. What is clear, however, is that these were both individuals of far greater social and professional standing than many their fellow burgesses. The status and occupation of the other Flemish and English burgesses who established themselves in the Scottish burghs at this time is less easily identified. To judge from

those burgesses whose names are known, a large proportion of Scotland's urban population were of Lowland Scottish, English or Flemish stock. Few, however, sport any craft-name and the majority are simply identified by their legal status of 'burgess'. Perhaps because of the status of the better documented immigrants, it is generally assumed that all incomers were useful, indeed deliberately encouraged, additions to existing communities. However, as the background of most of them is entirely undocumented, it would probably be more correct to see them as settlers who helped boost urban rents through a mixed bag of farming, craft and mercantile skills.

Legislation on the rights of a serf (rusticus) dwelling outside the burgh, but owning a burgage plot, would suggest that there was also a movement by part of the indigenous rural community to the towns (Leges Burgorum ch 11). Other than the fact that they held land in both town and country, the social status of these serfs or rustici is uncertain. Whatever their social status, however, the legislation indicates that there was a need to deal with the legal rights of those who wished to keep a foot in both worlds, urban and rural, and that some were men of at least local substance. There is unfortunately no indication as to whether they were farmers or craftsmen or both.

Further up the social scale there are indications of a similar interaction between Flemings who came to Scotland to trade as burgesses and those who were enfeoffed-to provide the king with mounted military service. Berowald

the Fleming managed to link a toft in Elgin with sufficient lands outwith the burgh for him to be required to provide the service of one knight at Elgin castle (RRS i No 175). Another indication of the commercial interaction of town and country was the very considerable number of urban properties held by rural religious houses. The surviving evidence is no doubt incomplete, but by the end of William I's reign, in 1214, the number of urban properties known to have been held by religious houses was as follows:

Berwick	with 14
Haddington and Roxburgh	with 10 each
Forfar, Inverkeithing and Perth	with 8 each
Edinburgh, Renfrew and Stirling	with 7 each
Crail	with 6
Linlithgow and Montrose	with 4 each
Aberdeen, Dundee, Elgin, Forres, Glasgow ...	with 3 each
Auldearn, Ayr, Banff, Dunfermline, Inverness, Jedburgh, Lanark, St Andrews	with 2 each
Arbroath, Cullen, Dumfries, Dunbar, Inverurie, Kelso, Kinghorn, Kintor, Peebles, Rutherglen and Canongate	with 1 each

(Based on Stevenson 1981 109-113)

The reasons behind the acquisition of urban properties by religious houses, and presumably the use they made of them, were undoubtedly very varied. However, Scone's charter from the king granting the monks the right to have a tanner, a shoemaker and a wright, all with the same

privileges as the burgesses of Perth, makes it clear that these religious houses had more than just a passing interest in acquiring and maintaining marketing and manufacturing privileges in the towns (Scone Liber Nos 5 & 18). Like other institutions with large estates, religious houses need reliable outlets for their produce, and sources of luxury and practical goods for themselves and their farmers. The monastic orders provided both rural and urban economies with more than just considerable financial resources. At the point of their foundation brethren transferred from distant houses brought with them knowledge of new technology. It was not by chance that the first fulling mill known in Scotland was owned by the Premonstratensians of Dryburgh Abbey, or that the Scottish glass industry in large part grew out of the glazing requirements of the Church (Dryburgh Liber No 161; above pp 113; pp 232-37).

For most of the medieval period it is impossible to establish the size of burgh populations, let alone the full range of their ethnic or professional composition. Nevertheless, it is quite clear that in the twelfth and thirteenth centuries the burghs provided a unique melting pot of resources, cultures, and technical ability. Fortunately indications of the professional background of burgesses become more common for the later thirteenth and fourteenth centuries. However, it also becomes increasingly difficult to distinguish between individuals whose craft-names are purely patronymic and those who still maintained a connection with their named craft. This

problem may in part be traced to the rather hazy line which was drawn between direct and managerial involvement in certain crafts. The principle that certain craftsmen who engaged in heavy manual work, such as fullers and weavers, should be excluded from the guild was established as early as the start of the thirteenth century (RRS ii No 467). This exclusion was then extended, but also significantly altered, so that litsters, fleshers and souters were also precluded from becoming guild members for as long as they were directly involved in the manual labour of their craft (Leges Burgorum ch 94).

In theory, the principle of excluding from guild membership those engaged in manual labour was extended to include virtually all crafts, guildry records suggest that these regulations were only loosely applied and that many guild members remained directly involved in craft work (APS ii 86; Torrie 1986; Stavert forthcoming). Nevertheless, it is clear that the social division these laws sought to uphold was the same as that recognised by the first burgesses: that there was a qualitative difference between traders and artisans. From the guild's point of view, it was irrelevant whether or not their brethren were merchants or craftsmen, membership was on the basis of mercantile association. Certainly many of those who are known to have held the offices of provost, baillie or collector during the first half of the fourteenth century had second names suggestive of a craft background. Along with a number of clerks, burgh officials included tailors in Coupar, Forfar, Peebles and Rutherglen, armourers in Forfar and Peebles,

bakers in Banff and Linlithgow, dyers in Linlithgow and Banff, a leadbeater in Linlithgow, a souter in Cullen, and a goldsmith in Edinburgh (ER i passim).

Even by the later thirteenth century, it is extremely difficult to assess how many of these names were patronymic rather than professionally derived. Moreover, it became far more common for senior members of burgh communities, when they acted in any legal capacity, to give their name and then identify themselves as burgesses of a particular town. Their professional occupation was rarely thought to be of sufficient importance to merit recording. This was undoubtedly the situation found in the names of those prominent members of both rural and urban Scotland who swore oaths of fealty to Edward I in 1291, when he acted as judge in the Scottish succession, and again in 1296 after his subjugation of Balliol. Out of the 254 burgesses recorded in these Rolls there are only fourteen craft-names, viz: five tailors (two from Jedburgh and one each from Perth, Stirling and Edinburgh), four tanners (two from Berwick and two from Haddington), three bakers (all from Perth), a goldsmith and a 'cornbyr' (from Berwick), a carpenter (from Perth) and a 'lardiner' (from Linlithgow) (Instrumenta Publica passim). It seems highly improbable that all the other burgesses who appear were merchants, and a more likely explanation seems to be that these men, who were the senior members, both merchants and craftsmen, of their communities, saw themselves first and foremost as burgesses.

There are significant differences between these two lists of landholders in Scotland, not least because only burgesses from Berwick, with a total of 75, and Perth, with a total of 70, appear in the earlier Rolls. There are also substantial gaps in the Ragman Rolls of 1296, although they do provide a slightly better indication of the distribution of some of the more important manufacturers and traders in Scotland, viz:

Perth	with 15 burgesses
Roxburgh	with 13 burgesses
Jedburgh, Montrose and Stirling	with 12 burgesses each
Edinburgh, Haddington & Inverkeithing.....	with 10 burgesses each
Linlithgow	with 8 burgesses
Peebles	with 7 burgesses.

An unknown number of Aberdeen burgess also swore allegiance. (Instrumenta Publica part II passim).

This distribution of burgesses in these rolls fits fairly well with what is known about the number of burgh tenements held by religious houses in 1214, described above, and also the burgh custom returns of 1327-31 and 1362-6 when the top burghs were, in descending order, Berwick, Edinburgh, Aberdeen, Perth, Dundee, Linlithgow, Haddington, Montrose, Inverness, Inverkeithing, and Stirling (Duncan 1975b 63-4, 174-75). All these sources provide only a crude indication of the economic status of the late twelfth to mid fourteenth century burghs, but cumulatively they do

point to those burghs that are likely to have had the greatest range of skilled manufacturers.

Exactly what skills these craftsmen had has been addressed in some detail in chapter three of this study, but it may be useful here just to note a selection of the crafts recorded in the vernacular in documents dating from before 1400 viz. armourers, barbers, barkers, baxters, bowmakers, caldroners, carpenters, carters, chapmen, coalmen, cooks, coopers, cutlers, farriers, fishermen, fleshers, fish-hewers, foresters, furbishers, girdlers, goldsmiths, hatters, locksmiths, masons, millers, napers, painters, porters, saddlers, shearers, skinners, souters, spearmen, tailors, taverners, waulkers and wrights (after Craigie 1925 65).

The range and quality of burgh documentation as a whole improves dramatically during the fifteenth and sixteenth centuries. Perhaps related to this vast increase in clerical activity there appear to have been a shift towards the tighter definition of the rights and privileges of those burgesses who continued to practise their craft personally. For whatever reason, there is from the fifteenth century far more documentary information available not only about individual craftsmen but also the associations they formed together, most of which came to be recognised by their burghs as incorporations under a Seal of Cause. The history of these trade incorporations is a substantial and complex topic which can only be touched upon here in so far as it helps indicate the availability

of urban craftsmen at the end of the medieval period in Scotland. The constant subdivision and amalgamation of the different crafts within each of the trade incorporations makes it difficult to gain any more than a crude idea of the range of skills that were actually being represented by the incorporations. However, the general pattern of where and when the main trade incorporations were established is informative.

The pre-eminent positions of Aberdeen and Edinburgh/Leith as the main ports and manufacturing centres of Scotland from the later fifteenth century is clearly demonstrated by the number of early charters of incorporation that these burghs issued to their various craftsmen. Aberdeen had seven craft incorporations established as early as 1442, the dyers, smiths and hammermen, tailors, skimmers, weavers and waulkers, cordiners, and fleshers. By 1527 Aberdeen council had gone on to grant Seals of Cause to the wrights, coopers and masons. Between 1456 and 1533 Edinburgh's council granted Seals of Cause to the burgh's bakers, hatmakers, masons and wrights, websters, hammermen, coopers, fleshers, waulkers and shearers, tailors, surgeons and barbers, cordiners, candlemakers, bonnetmakers, and skimmers and furriers (Marwick 1886 passim). Although relatively few burghs established incorporated trades before the Reformation it is noticeable that, with the exception of Aberdeen and Edinburgh, there is a great deal of uniformity over the type of trades being incorporated. Of the ten main burghs with pre-Reformation incorporations (Aberdeen, Arbroath, Dundee, Dunfermline, Edinburgh,

Glasgow, Haddington, Linlithgow, Perth and Stirling) all had issued Seals of Cause to their hammermen, weavers, tailors, skinners and or cordiners, while the overwhelming majority also had also issued Seals of Cause to their baxters, wrights and fleshers. A few other trades such as glovers, masons, waulkers and dyers were also recognised by a small number of burghs (see the table at the end of this chapter for details and references). These trade incorporations acted for a far wider range of crafts than the name of their principal members might suggest. The hammermen's incorporation of Edinburgh appears to have included, during the fifteenth century, not only metalworkers such as blacksmiths, goldsmiths, cutlers, armourers and pewterers, but also related crafts such as lorimers and saddlers (Marwick 1886 21). However, as the composition of their subsidiary craft associations varied considerably, it is not possible in the present context to indicate the full diversity of these incorporations.

An important function of these crafts was the monitoring of apprenticeships, and in effect the licensing of skilled craftsmen. Perhaps as a result of this very marked trend towards the demarcation of labour, this same period saw a considerable enhancement of the public status of master craftsmen. By the later fifteenth century the king's 'household' included named master craftsmen who were retained to provide basic facilities such as butchering, carpentry or tailoring. In addition specific contracts were normally issued to named senior craftsmen, such as Sandy Balfoure the shearer, or Jok of Stirling for

crossbows (TA i 17, 92, 105, 138-9, 175, 181, 194. The burghs did not, however, have a monopoly on skilled craftsmen. The Church continued to provide a number of highly skilled specialists such as the priest, 'Sir' John Pettigrew, whose skills at clockmaking, gun casting and mining were engaged by the king (TA ii 159; iv 101, 112). The Scottish government also continued to encourage foreign craftsmen, notably French, Dutch and German miners and gunfounders, but also glaziers and others, to move to Scotland. The case of one such immigrant, the French alchemist John Damiane, will perhaps also help to explain part of the reason for the connection between the church and certain craftsmen, for Damiane was as a result of the king's intervention appointed Abbot of Tunland, even though his religious inclination was apparently minimal (TA ii xxxvi).

As has been demonstrated in the preceding discussion, documentary sources are one of the main indicators of where and when professional craftsmen were available. However, as the history of the trade incorporations indicates, even the more diverse records of the fifteenth and sixteenth centuries only provide information about a restricted range of manufacturers. For much of the medieval period, and especially for the availability of humbler craftsmen, the archaeological excavations detailed in chapter three of this study remain an important main source of information. There are, however, problems of distinguishing between domestic and professional manufacturing purely on the basis of the archaeological evidence. Whether an object is seen

as the product of professional, or indeed even Scottish, craftsmanship often depends upon a subjective analysis of the workmanship involved. Fortunately the quantities and ratios of waste debris are normally indicative of the scale and professional organisation of particular manufacturing processes, and for this reason industrial debris can often be a better indicator of the availability of craftsmen than their products. It seems reasonable to assume, for instance, that where thousands of horn cores have been recovered they were the remains of industrial rather than domestic hornworking. In other instances the skeletal debris may indicate that there was a high level of control over the age of the animals slaughtered, or perhaps, as in the case of the fish bone assemblage from the High Street in Edinburgh, that many of the fish were off-shore species and therefore the product of an organised sea fishing industry (Chaplin & Barnetson 1976 229-33).

As discussed above, the principal differences between agricultural produce prepared in the country and that prepared in the towns relate to the scale and greater concentration of urban processing, and the potentially higher profits that were available to those who could bring their farm produce to market. While there is likely to have been a corresponding concentration of craftsmen in the towns, it is quite clear that normally the burghs could not and did not have a monopoly over the processing of foodstuffs and their by-products. A major exception to this state of affairs was tanning and leatherworking which undoubtedly were heavily urbanized industries. In stark

contrast to the distribution of craftsmen involved in the processing of foodstuffs, the burghs did provide a focus for craftsmen using specialised raw materials. From their earliest charters of privilege, several burghs maintained a legalised monopoly over the specialised finishing of cloth by dyeing and or shearing (RRS ii Nos 467, 475). In the majority of cases, however, there was no need for the urbanisation of specialist craftsmen to be upheld by the law. The lack of excavation on medieval rural sites makes it difficult to come to a quantitative or even qualitative assessment of the scale of this concentration of craft skill. However, it does appear that, for instance, metalworking furnaces and metalworking debris are far more common on urban than rural sites. Moreover, where metalworking debris has been found on rural sites it is often associated with specific building phases as at Castlehill of Strachan (Spearman 1984b 350). The available archaeological evidence for the prosecution of other technically accomplished manufacturing processes in the burghs has been laid out in chapter three, and documentary sources make it clear that by the thirteenth century the burghs were the natural habitat of specialised manufacturers such as locksmiths, armourers and bowmakers. Some craftsmen certainly did survive outwith the burghs through the patronage of individuals and institutions, or, as in the case of masons, because of the peripatetic nature of their work, but the majority were well suited to the communal pattern of manufacturing and trading that characterised the burghs.

The urbanisation of specialised labour should not, however, be equated merely with the manufacture of high value goods. Documentary sources in particular can give this impression, but a craftsman involved in bulk production in hornwork might have required the concentrated supply of raw materials and clients that the towns provided every bit as much as did a goldsmith producing unique works of art. In terms of their manufactured goods the burghs had two advantages over rural producers, the quantity and quality of their goods, although perhaps these attributes were not always present at the same time. This is most clearly exemplified by the work of the urban smiths who, in competition with farriers and other smiths on the large estates, were regularly commissioned to undertake large scale or technically difficult work in ferrous or non-ferrous metals. In the largest burghs there even seems to have been an early distinction between ferrous and non-ferrous metalworkers. However, any distinction between goldsmiths, pewterers, coppersmiths and other non-ferrous metalworkers does not appear to have been based simply on the materials used. Much depended upon the level of technical competence of the craftsman, his products and the markets in which he bought and sold (above pp 199).

Capital investment in tools and equipment

Considering the range of manufacturing that took place in the medieval towns of Scotland, the level of investment in tools and equipment was remarkably low. Raw materials, both main and secondary, and apprenticeship training were almost invariably the main areas of expense for craft

industries. A major reason for this distribution of the costs involved in establishing manufacturing industry was that many craftsmen were able to reduce the level of their investment in structural and hand-tools by making their own from naturally occurring materials or even the waste products of their own trade. For instance, antler-working tools from Aberdeen include a mallet made from an antler burr and wedges made from antler tines (fig. 3) (Macgregor 1982 180-84; Ibid 1985 57). The iron cutting tools, such as a saw, drill-bit or awl and perhaps a knife, which are known from finished artefacts to have been used by antler-workers, represent virtually the only items of capital investment that an antler-worker would have had to make before being able to set up in trade. Along with many other tradesmen, antler-workers needed no specialist structural equipment or buildings and could, if necessary, conduct their domestic and industrial lives from the same quarters. The same pattern of joint industrial and domestic housing was undoubtedly also possible for some of the more up-market trades, such as tailoring or glovemaking. However, the practicalities of marketing meant that many of the more prestigious craftsmen maintained permanent booths. These shops were primarily needed for trading purposes, but as burgh legislation and contemporary illustrations from Europe show they often doubled as workshops (see figs.) (Treue et al 1965 passim).

Only a fairly restricted number of industries needed a substantial investment in structural and hand tools or building space, and of these, many could start at a very

lowly level. Tanners, for instance, would have had to purchase their cutting tools from cutlers or blacksmiths, but the level of their capital expenditure on the construction of a beam-house, the digging and lining of tanning pits and, where necessary, the digging of lades to provide adequate supplies of water could vary enormously. At its most basic, a pit and a shack were not major items of expenditure, and the tanning industry remains a prime example of how relatively low cost raw materials could be turned into valuable goods with only a minimum of expenditure on equipment. Hence, even in the case of such an important industry as tanning the main investment was in time, land, raw materials and training, not tools and equipment.

The drying of cereals for milling, or to terminate germination during malting, again falls within the general run of fairly basic investment in simple structures made from simple materials. Corn drying kilns were built to a variety of standards, with some late and post-medieval examples being built as very solid constructions indeed (Scott 1951 196-208). However, medieval kilns were normally constructed below, or at least partially below, ground level. The earthen sides of the kiln then being lined with wattle or rubble. Latterly kilns were also constructed or enclosed within buildings, but many excavated medieval examples appear to have been in the open and at best only lightly screened (McGavin et al forthcoming). Buildings for grain storage had presumably to be close by, but these may again have doubled as

sleeping quarters. In any case, as excavation has shown, the main specialist piece of equipment, the furnace, could be constructed from low cost materials and fuelled with wood shavings and other cheap fuels (McGavin et al forthcoming). Moreover, documentary sources suggest that in some instances the grain being dried by maltman was not owned by them, and that in effect they were hiring out their equipment and time (ER x 208, 474, 595). Even the amount of specialist training required would have been small as the process would have been familiar to members of both rural and urban communities. This fairly low key level of investment was in stark contrast to that required of those maltmen who were also involved in brewing ale. In their case the level of capital invested rose dramatically. Wells would have had to have been dug to provide clean water, malting barns and boilers constructed to prepare the malt and heat the brew, metal vats and other containers bought or made, and a large tool-kit assembled.

The costs of the equipment to dry corn or malt, were dwarfed by the investment needed to construct the watermills of the burghs. The milling of cereals was one of the very few medieval industrial processes that required considerable amounts of capital to be invested in buildings and equipment before any return could be realised. These mills varied in construction and size so that it is difficult to estimate the costs involved, but it is highly significant that of all the industrial processes conducted in the burghs, only the mills were centrally owned. Thirteenth and fourteenth-century charters and Exchequer

Rolls indicate that these mills, such as the pair constructed at Perth in 1343, were normally built and owned by the king or his tenant and that the income they generated was disposed of as king or laird saw fit (ER i 524). During the later fourteenth and fifteenth centuries, control of burgh mills came to be transferred to their burgh community in return for annual rentals (Edinburgh City Chrs. 16). Burgh councils in their turn farmed their mills out to burgesses and others willing to manage their operation (Edinburgh Burgh Recs. i 20-21). It was most unusual for individual burgesses to have control of burgh mills until after the Reformation (Shaw 1984: 22-44).

There were undoubtedly a whole host of reasons for the ownership of burgh mills to be first royal or baronial and then communal. Baronial ownership was after all the normal arrangement in rural communities and it would have been logical to continue and extend the practice as towns and the number of their mills expanded. There is also little doubt that, once constructed and provided with a local monopoly over the milling of cereals, mills were profitable concerns. However, large amounts of capital were needed for their construction, and without an imposed monopoly the return on that investment would have been uncertain. Mills were highly vulnerable to commercial and political competition from other mills and their owners. As a result, even if burgesses could have found the necessary cash to build their first mills, only those who could enforce a monopoly were likely to risk the investment.

A somewhat different pattern of investment emerges for most of the mineral processing industries. A certain amount of non-ferrous metalworking, such as cold metal beating or wire drawing, could always be carried out with a minimum of structural equipment, but for most urban smiths the construction of smiddy buildings, furnaces, bellows and tools represented a major investment even when much of this equipment was made by the smith himself. However, most metalworkers had a major advantage over other craftsmen, such as tanners or dyers. Not only were they able to conduct much of their work on a commission basis and would therefore have seen a rapid return on any investment they made in raw materials, but it was common for those who commissioned work to provide the necessary metal they normally had only to maintain stocks of charcoal and coal. Salt producers had essentially the same pattern of investment as metalworkers, albeit for different reasons. The construction of tidal saltpans, boilers and hand-tools represented a considerable investment in capital equipment. Moreover, the controlled sequence of crystallisation must also have required a fair degree of training. However, once the pans were constructed, there would have been little additional cost in acquiring the necessary sea water. As with metalworking, most of the ongoing expense of the process would have been the collection or purchase of fuel. Glass manufacturers, although not perhaps glassworkers, appear to have had a very similar pattern of investment. The capital needed to construct the elaborate furnace structures, crucibles and tools needed to make glass would have been considerable. Moreover, because of

the corrosive nature of molten glass, maintenance costs are likely to have been high. Very specialised training would also have been needed by both glass makers and users. For those who made their own glass from main raw materials investment in materials could, be relatively low provided transport costs were kept to a minimum. Apart from maintenance work, the only other item of ongoing expense is likely to have been fuel. Most glaziers in Scotland and elsewhere, however, relied upon being able to purchase ready-made glass in the form of cullet or panes. These glaziers would have had to make a considerable additional investment in their main raw material, unless as was sometimes the case, the cost of the glass was covered by the customer.

Textile manufacturing is frequently put forward as one, if not the, most important of urban industries (Reynolds 1977 60-61). In practice the spinning, weaving and dyeing that was carried out in the burghs did not require a more substantial investment in equipment than any of the other urban industries described here. The main attribute of the textile industry was rather that it was extremely labour-intensive and that, particularly when weaving and finishing quality cloth, the craftsmen had to be highly skilled. The basic equipment, spindle and distaff, carding combs, horizontal or vertical loom, fulling troughs, even dyeing vats were not exceptionally expensive pieces and most of them, including horizontal looms, could have been made by the craftsmen or women who used them. What was exceptional was the way that this particular industry came to be at the

forefront of the mechanisation of manufacturing equipment. There were repeated efforts to harness the mainly manually-powered mechanical movement in order to speed up the laborious tasks of spinning, weaving and fulling. The advent of the muckle wheel and the multiple heddled horizontal loom certainly did effect a gradual change in the way cloth manufacturing was funded (above pp 114-15). Greater training and more capital investment was undoubtedly required to make use of these machines, but the central plank of the urban cloth industry, its monopoly over the finishing of good quality cloth, was largely unaffected. Moreover, the cost of these new tools were as nothing to that of constructing a fulling mill. By comparison with the number of corn mills, fulling mills were far from common, and from the thirteenth century on, those with the capital and the certainty of having considerable quantities of cloth to full could now invest in more centralised bulk processing. As with the corn mills, the only parties interested in or capable of making such a large capital investment were the major rural estates. It is noticeable that it was the monastic orders, which had access to the necessary technical expertise and which had already invested heavily in sheep farming and the wool trade, that were particularly active in the construction of fulling mills (above pp 116-17). The urban textile industry with its highly skilled dyers and shearers, but relatively small levels of capital investment undoubtedly continued. However, the distribution and ownership of fulling mills strongly suggest that the production and fulling, at least of the coarser cloths,

was, as elsewhere in Britain, conducted in and under the control of certain major rural estates (Carus-Wilson 1932 39-60). This move to the country may in part be explained by a need to find more suitable mill sites, but it probably also reflects the interests of those who were putting up the capital.

A consistent element in the pattern of investment that has been outlined above is the way in which the different sources of power used by manufacturers influenced the amount of capital equipment required. As has been pointed out, the majority of trades had no need for any significant amounts of energy and most craftsmen seem to have relied upon their brawn and manual dexterity rather than the application of heat or mechanical power. With the possible exception of tanners, these particular urban trades had, as a consequence, little need for structural tools or specialist buildings and they could work more or less where they pleased. Of those trades that did make use of organic and fossil fuels, the levels of investment in capital equipment may be crudely described as proportional to the temperatures and duration of firing that their furnaces were required to achieve. However, by far the greatest levels of capital investment that were made are associated with use of non-thermal power. This was very largely because these industries made use of expensive mechanical equipment to convert human, animal, wind and water power into serviceable movement. Thermal energy had not, of course, yet been harnessed in this way.

It is extremely difficult to be certain about how the establishment and running costs of medieval manufacturing were covered. As has just been described, different tradesmen presumably found different ways of minimising the amount of capital they had to invest to set up and run their businesses. It is also apparent that major capital projects such as mills had to be financed from common sources, or more normally by outside agencies such as the king or religious houses. How they did this does, however, lie near the heart of the structure of medieval industry and the difference between rural and urban manufacturing. There can be little doubt, for instance, that a significant distinction was made between those workers who provided their own tools and raw materials and those who had the latter or both provided. Aberdeen fish curers who were provided with both salmon and salt were in effect only marketing their labour. They were clearly not in the same league as burgess fishermen who maintained their own nets and boats and cured their own fish. The distinction is even more noticeable if urban and rural fishermen are compared. Almost without exception the nets and boats used by rural fishermen were their lords' property, as indeed were the fishings they worked and the lion's share of the fish they caught. Where documentary sources provide sufficient details, much the same seems to have been true of the status of rural blacksmiths. Although they could be paid a salary or some other form of retainer, they generally had their buildings, furnaces, tools and raw materials provided for them, with the result that when the old smith died his family had to give up the smiddy to his

successor (Dunkeld Rent. 107, 116-7).

Such arrangements were the norm on Scottish medieval estates, and it is one of the most striking feature of life in the burghs that in the majority of cases the cost of financing manufacturing was borne directly by the burgesses. The fact that for most burgesses the level of investment in equipment and materials was, initially at least, strikingly low, only highlights how difficult it was to bring about this remarkable and fundamental change. The establishment of burgh monopolies over, for instance, the keeping of taverns or the finishing of cloth and especially marketplace trading, takes on a slightly different hue when the costs to craftsmen burgesses of setting up their workshops are considered to be exceptional rather than the norm.

It was some time before responsibility for the construction of expensive pieces of equipment, such as watermills of the under- or over-shot type, could be transferred from the burgh's feudal superior to the burgesses themselves. What is perhaps more surprising is that the main item of capital investment needed by merchant burgesses appears to have been funded in almost exactly the same way. That is, the construction of sea-going ships was undertaken for most of this period by the landed nobility not merchants. It is often difficult to identify the name and captain of a ship let alone its owner, but where the evidence survives it was normally the nobility that actually put up the cash. It was, for instance, the Count of St Pol, not a merchant

consortium, who commissioned a ship to be built in Inverness in the mid thirteenth century (Anderson, Scottish Annals 295n). From at least the fourteenth century Robert I and other Scottish kings were likewise commissioning and buying ships and there is little doubt that the king was amongst the foremost Scottish ship owners (ER i cxxi, 6, 32, 57; TA i ccxxvi-ccxxviii, 125, 286, 388). Even by the fifteenth century the majority of shipowners were powerful members of the church or the nobility. There were, for instance, the Bishop of St Andrews' barge the "St Salvator" and Lord Seton's "Eagle", while at his death Sir David Sinclair's estate included his 'English ship', the "Carvel", his 'little ship', and at least one other (ER xiii clxxvii-clxxxvi; TA ii 422; Crawford 1977 92, 100). Just how widespread the nobility's investment in shipping was is hard to say, but in the west coast there was certainly a long tradition of the great families constructing and maintaining ships, and it was this tradition that led to the act of 1429 which instructed them to build and man galleys (APS ii 18 c17). It is not until the sixteenth centuries that there are any indications of merchants, such as the Leith captains Andrew Wood, the Bartons, or William Brounhill, actually owning ships which in any case tend to be small vessels or part shares (Halyburton's Ledger passim; ER xiii clxxvi-clxxviii; TA ii lxxxv-lxxxix, 448; iii lxvi-lxx; iv xxxviii-lxiii). By the late sixteenth century more merchants owned their ships, but even then the majority of merchants who took part in coastal or foreign trade only leased ships, sharing the cost of cargoes and crews with their guild brethren just as

they had in the fourteenth century (Wedderburne Compt Bk.

passim; RRS v No126 forthcoming).

Table of the most common Scottish Trade Incorporations established before the Reformation

	H	B	C	S	G	W	A	R	F	T	D	M	
Aberdeen	x		x		x	x&x	x	x	x			x	(Marwick 1886)
Arbroath	x	x	x		x	x		x		x			(Hay 1876 284)
Dundee	x	x		x&x	x					x	x		(Maxwell 1891 324-42)
Dunfermline	x	x	x			x		x	x	x		x	(Chalmers 1844 389)
Edinburgh	x	x	x	x		x	x	x	x	x		x	(Marwick 1886)
Glasgow	x	x	x	x		x		x	x	x			(Murray 1924 361-64)
Haddington	x	x	x	x		x		x	x	x		x	(Gray et al 1944 107)
Linlithgow	x	x	x			x		x	x	x			(Beveridge 1914 42)
Perth	x	x	x		x	x		x	x	x		x	(Cowan 1904 376)
Stirling	x	x	x	x		x				x	x		(Morris 1919 79)

H = Hammermen; B = Baxters; C = Cordiners;
 S = Skinners; G = Glovers; W = Websters;
 WA = Waulkers; WR = Wrights; F = Fleshers;
 T = Tailors; D = Dyers; M = Masons.

Chapter 5

The Market Economy

It is clearly insufficient to study the growth of manufacturing purely in terms of how raw materials and technical resources came together and were best used in the towns. Burghs were also seats of government and, perhaps more importantly, as much centres of human self-interest and aspiration as of goods and services. Craftsmen did not just move to and stay in towns because of the trading opportunities that the burghs provided, they clearly also valued the legal privileges that came with being a burghess, and the right to pass their special status onto their children (Leges Burgorum ch 14). Indeed so interwoven are the political, social and economic aspects of urban life that it is virtually impossible to disentangle the cause and effect of urbanization process. It is, for instance, far from clear to what extent the economic advantages of urban manufacturing were perceived and encouraged by the controllers and rulers of Scotland. Nor is it clear how much the concentration of agricultural produce on centrally placed and politically important settlements, and the consequent improvement of manufacturing capacity that took place at these settlements, did itself stimulate the development of the Scottish state.

A number of studies of the emergence of states and the function of towns in England and on the Continent have certainly seen control of manufacturing and trading as a

prerequisite of royal ambition (Sawyer 1977 139-58; Hodges 1982 185-98). Likewise recent work on the development Dalriada has emphasised the importance of agricultural resources, manufacturing and trade in the creation of one of the early historic kingdoms of Scotland (Neike & Duncan 1988 11-21). In considering the development of a state controlled market economy in medieval Scotland it is necessary, therefore, to begin with a review of the rural society and economy from which both towns and states emerged and depended. Only then is it possible to deal with the trading innovations of twelfth century Scotland, the formal recognition of markets (and marketers) and the introduction of the king's coin. The final part of this chapter looks in detail at the way in which wealth was generated in this new and fragile market economy and attempts to identify the main economic, as opposed to political, forces that were acting in its favour.

Part 1 The Rural Base

Something of the settlement pattern that existed in Scotland during the later Iron Age has already been briefly touched upon in chapter two. However, although the political and economic origins of the medieval Scottish state undoubtedly extend into earlier history and pre-history, the disruption caused by the Roman occupation of Scotland, and the subsequent collapse of that occupation throughout Britain, was considerable. It is, therefore, to the various ninth-and tenth-century kingdoms and communities of the Picts, Scotti, Angles, British and Norse

that the medieval kingdom and estates of Scotland can be most directly traced.

A major feature of these centuries was Scandinavian immigration, raiding and trading along much of the Atlantic seaboard of Europe, including Scotland. The warrior reputation of these incomers is assured but, particularly because of their association with towns elsewhere in Europe, it is worth briefly reviewing their contribution to trade and trading settlements in Scotland (Sawyer 1982 65-77). In Scotland the Northern and Western Isles became, in effect, stepping stones for traffic between Scandinavia and the Viking towns of Ireland: Dublin, Cork, Limerick, Waterford and Wexford. The wealth generated by that trade is well attested in the archaeological record by sites such as the Brough of Birsay in Orkney (Curle 1982; Hunter 1986). On the Scottish mainland place-name evidence indicates that there was extensive Norse settlement of Caithness and Sutherland, with numerous small havens or beaching points such as that at Freswick in Caithness (Batey 1987). It is very noticeable, however, that the areas of Norse influence were well away from the rich farm lands, and later burghs, of the east coast. For the moment the conclusion has to be that the Norse were not involved in any major manufacturing and trading settlements in Scotland of the type they established in Ireland. For instance, excavation at Dumbarton Rock has refuted any suggestion that the Norse settled there after they had managed to wrest the Rock from the kingdom of Strathclyde in 870 (Alcock 1976 109; Alcock et al forthcoming).

Appearances may of course be deceptive, and excavations at Whithorn in Wigtownshire and in some of the older parts of other early towns may yet reveal Norse trading and manufacturing communities.

Of potentially greater importance for settlement patterns in the heartlands of Scotland during these centuries was the amalgamation of the kingdoms of the Scottic Dalriada and the southern Picts. Although there had been a variety of joint rulers in the past, Kenneth son of Alpin was the first to establish, between 840 and his death in 852 a well defined dynasty with control of both kingdoms (Smyth 1984 177-85). By the end of the ninth century these two kingdoms became jointly referred to in the king lists as 'Albania' and in the annals as 'Alba' (Anderson 1973 198-200). It was this kingdom which came gradually to dominate and then, in the early eleventh century, to absorb the other kingdoms of Scotland. One result of the creation of these larger kingdoms must have been the further distancing of a ruler from personal control of even his most profitable lands and greatest strongholds. To supervise their enlarged kingdom it is likely that, as with other successful rulers, Kenneth son of Alpin and his successors spent an ever increasing part of their time on the move. Even then they must have had to rely heavily upon local officials who, in the king's absence, led the army and ensured that the wealth of the land was collected, processed, stored and marketed.

Unfortunately, direct evidence of the settlements and

communities involved in such an organisation is lacking. However, Professor Barrow has noted that the names of multiple estates north of the Forth, recorded in eleventh- and twelfth-century documents, often incorporate the place-name element Aber-, while the names of many of the townships on these estates include the element Pit-. As both the Aber and Pit elements are believed to be of P-Celtic origin, Barrow has suggested that the multiple estates with these place-names may have originated before the ninth century when P-Celtic began to be superseded by Gaelic as the dominant language (Barrow 1973 58). It is not until the eleventh and twelfth centuries that there is substantial documentary evidence to indicate how the wealth of these lands was organised and supervised. The political and settlement terminology employed in these documents was, however, predominantly that of the Anglo-Saxon thane, thanedom and shire. Such terms are likely only to have been original in the Anglian districts of south-east Scotland, as for example in Berwickshire and Coldinghamshire, both of which were established by the time of King Edgar's grant to the monks of Durham in 1095 (ESC No 15) and their use outwith the south-east appears a matter of administrative shorthand applied to a range of other land units. It is difficult to date the introduction north of the Forth of these terms. They may in part have been the result of Malcolm III and his Queen Margaret's encouragement of Anglo-Saxon institutions, while the chronicler Fordun attributed this form of land tenure to Malcolm II (Chron. Fordun i 186). It is not, however, until David I's reign that there are surviving references

to Falkland and Kellie in Fife, the first two known thanages north of the Forth. In all, some seventy thanages are known before the term itself was replaced in the years following the Wars of Independence by the knight's fee (Skene 1890 251-9; Muir 1975 27-8, 126).

Whatever the terminology, there does seem to have been a broad uniformity in the way in which agricultural communities, outwith the Highlands, were organised and led, and it is clear that political and economic forces were already determining what were to be the principal settlements of the land. Of the various estate settlements or touns within a shire, one or two would normally have achieved special significance. These were the sites of the thane's residence and the principal church of the shire. These two elements in the community may have been adjoining, as in the cases of Dunfermline and Culross, or sited in two quite separate towns, as at Kinghorn where the main church is thought to have been a mile farther north at Aden (Barrow 1973 42-3). In origin the principal toun of a shire or thanedom is likely to be at least as old as the office of thane and is probably as old as its ancient equivalents of toiseach and mair (Jackson 1972 102-12; Fife Court Bk. lxiii-lxiv).

The thane's toun was the legal hub of the shire's or thanage's estates, and its name was usually given to them as an administrative district. The origin and identification of kirk-touns is more problematic. -
Documentary evidence of local churches before the twelfth

century is so scarce that it appears churches were regarded as appurtenances which did not need to be specifically mentioned in land grants. The main sources for the identification of early kirktouns are therefore place-names and archaeology. The east coast and central belt touns with eccles- as an element in their place-name have been suggested as the sites of potentially early kirktouns which may even be P-Celtic in origin (Barrow 1973 60-3). A more common place-name element which is indicative of medieval kirktouns is the Gaelic Cell or Cill, resulting in the familiar Scottish Kil-and Kyl-names (Nicolaisen 1976 128-130). Archaeological dating of church fabric, crosses and funerary monuments has largely been based on art-historical grounds rather than excavation. Recently several church buildings, including the round towers at Brechin in Angus and Abernethy in Perthshire, and a number of rectangular church towers, have been re-dated to the late eleventh or early twelfth centuries (Ferne 1986 393-411). Various other cemeteries and monuments continue to be dated to the ninth and tenth centuries or earlier and, in their various ways, are suggestive of early religious sites and communities (Thomas 1971; Smyth 1984 116-140).

Thanetouns and kirktouns, in addition to their respective legal and religious functions, were also of considerable economic importance. They were the collection points for the ancient dues payable by the estates of a thanedom or shire. The Gaelic entries in The Book of Deer make frequent reference to the king's, mormaer's and toisech's 'cuit', which was clearly their share of the land's produce

and probably also included labour service. In these references the king or officer concerned either donated their cuit to the community at Deer or quenched, literally 'waived', their cuit which was owed to them from lands held by the community (Jackson 1972 119-21). These payments may be equated with what came to be known as 'cain' and 'conveth', or, in southern Scottish and Anglo-Saxon areas, 'cornage' and 'waiting'. One of the clearest indications of what was involved concerns the king's revenues from Moray, as in 1172x 74 a teind of the king's revenues from pleas and cain in cows, swine, wheat, malt, oats, cheese and butter had been given over to the bishop of Moray (RRS ii No 139). Conveth was a specialised and probably separately rendered form of these payments which originated as the obligatory provision of hospitality. Conveth from the Kirkton of Arbuthnot in Mearns was the subject of a legal dispute in 1206. Conveth was claimed by both the bishop of St Andrews and the local thane. Local memory attested that for some forty-seven years conveth had been rendered to the bishop. This practice was, therefore, enforced by the ecclesiastical court, so that conveth plus two cows and half the bladwis (corn) and merchets (perhaps payments by unfree tenants) from the Kirkton were paid to the bishop of St Andrews. The thane retained cain of the Kirkton along with ten cheeses from each house and certain labour services from the men of the toun (Spalding Misc. v 209-13).

Part 2 Royal Markets and Coins

It is apparent from such sources that there was, by the start of the twelfth century, a very considerable organisation and centralisation of Scotland's agricultural produce. In each case agricultural and wild produce were being channelled from well-established districts and estates into specific kirktouns. The diversion of so much wealth from the secular economy did not always go unchallenged, as the Arbuthnot case shows, and the king's confirmation of both old and new dues was often sought by religious communities. The processing and marketing of this produce also led to trade rivalries, and the king's recognition of manufacturing and trading rights comparable to those of craftsmen and merchants in other market touns were also sought by religious houses. Alternatively, equality was achieved by religious communities gaining for their markets the same status as the king's market touns, or by their securing trading and manufacturing rights which allowed them favourable use of the king's markets. The ecclesiastical communities of St Andrews, which date back to at least the ninth century when it was known as 'Kilremonth', accumulated over the years a considerable income from numerous shire churches, kirktouns and teinds. Given the range of produce which by the early twelfth century must have been channelled through St Andrews it is not surprising that prior to 1144 the bishop of St Andrews received David I's recognition that the toun of St Andrews was an acceptable burgh (ESC No 169). The bishop of Glasgow's rights to a portion of the king's pleas and cain must pre-date David I's instruction to all his sheriffs and mairs in that diocese to ensure their payment to the bishop

and church of Glasgow (RRS I No 242). The bishop of Glasgow went on to gain recognition of his principal town as a burgh in 1175-78 (RRS ii No 190). Likewise, the Tironensians of Selkirk gained considerable economic resources and privileges from Earl David, which as king he confirmed in 1120 (ESC No 35). Then, by 1237, once they had moved to Kelso, these monks gained burgh status for their new town of residence.

A more complicated example of a well-endowed religious centre gaining burgh status is that of the Abbey lands at Dunfermline. By the time of David I's confirmation charter to Dunfermline Abbey in 1128, the monks of Dunfermline already controlled many shire churches with their associated kirktowns. Among the Abbey's other sources of income by 1128 there came from the king's revenues: an eighth part of all pleas and suits along with a teind of all food renders from Fife and Fothrif; a teind of the cain of Dunfermline; a teind of venison, hides, lard and tallow from all the beasts at Stirling fair and also between the Forth and Tay; one ship free of cain; seals from Kinghorn and wood and iron from the king's supplies (ESC No 74). Despite a very considerable income the presence of the king's town, and from 1124-27 burgh, of Dunfermline prevented the monks from gaining independent burgh status for their kirktown of Dunfermline until 1303 (Pryde 1965 43). Instead, they had their port town of Inveresk Major (later Musselburgh) accepted in 1184 as a burgh (Pryde 1965 44). The fate of Dunfermline was unusual and in most other cases where there was a direct clash of interests between

kirkton and kingstoun, it was the latter which survived as the principal or only burgh. At Old Aberdeen and Aberdeen, Scone and Perth or Cambuskenneth and Stirling, it was the king's burgh that came to be used as the adjacent religious communities' trading centre. In many cases the rights of these religious houses were ensured by their holding of tofts within the king's toun. One of the clearest examples of this close connection between the processing of produce and trading rights is David I's confirmation charter to Holyrood Abbey of about 1142 (ESC No 153). This is a complex document which appears to be a summary and confirmation of several earlier charters. Included were gifts of land in a number of king's touns which were to be, or had already become, known as burghs: Stirling, Edinburgh, Berwick and Renfrew. Amongst the agricultural produce they received were various payments of grain, a seventh part of all the grease and skins of animals slaughtered at Edinburgh, a teind of all the skins of sheep, goats and lambs slaughtered at the Castle and Linlithgow, and a teind of all the whales and sea-beasts due to the king between the Avon and Cockburnpath. The free working and marketing of this produce was then ensured in the final part of the charter in which the Abbey was given the right to establish a burgh in the Canongate between their church of Holyrood and the king's burgh of Edinburgh.

The better survival of evidence for the management of ecclesiastical estates during these years has produced such a wealth of evidence about the income of religious houses,

that it is easy to forget that the agricultural produce which has been recorded was only a part of that being channelled into the king's and other secular market towns. The economy of medieval Scotland, including that of the king's burghs, was dominated by the produce of agricultural estate and their need to convert that produce into alternative goods, marketable credit or cash. This task of conversion can hardly be described as a new problem, but it does seem that the burghs were part of an up-turn in the processing and marketing of agricultural produce which, during the twelfth and thirteenth centuries, came to affect not only Scotland, but most of Europe. The formation of more powerful states and the protection they extended to their burgesses was undoubtedly one of the elements in this up-turn, but quite clearly another was the increasing availability and acceptance of silver sterlings and the mark as standard units of coinage in Europe (Nightingale 1985 192-209). The close association of all three elements; states, burghs and the money economy underlines once more the interaction of political and social change and economic development.

Finds of Anglo-Saxon, continental and even oriental coins indicate that a wide range of coins had been reaching Scotland during the ninth and tenth centuries. It is difficult to assess whether these coins were being used as money or bullion. From the end of the tenth century and during the early eleventh, the more dispersed distribution of Anglo-Saxon coins in the Norse west and north and the Northumbrian south-east has been seen as indicative of

their use as money (Stevenson 1966 xvi-xvii). The high proportion of ring-money and other bullion as opposed to coins in hoards would suggest, however, that most trade involving units of silver was being conducted on the basis of bullion value (Graham-Campbell 1976 127). Whatever the use of these coins there is at the moment a dearth of numismatic evidence for the hundred years following several finds of coins from the 1030s (Metcalf 1977 8-9). The documentary sources discussed below make it clear, however, that when David I minted his first coinage, around 1136, he did so to fill a need within the context of an existing, albeit restricted, money economy.

As has been noted, Scotland was not well endowed with its own sources of workable silver, and the availability of silver coins in Scotland both before and after 1136 owed much to the sale of raw materials such as hides and wool for foreign sterlings and bullion. The amount of coin circulating in Scotland or with Scottish merchants abroad was, therefore, largely dependent on the processors of these goods and the merchants who shipped them. Regardless of whose wool it was, control of the traders and ports was essential to control of the coinage. It comes as no surprise, therefore, to discover that the king controlled not only the majority of ports but also rights to tax shipping. The extent of the king's control over the movement and taxation of the shipping is clear from such charters as Alexander I's gift to the canons of Scone of the cain of a ship in 1124 and a grant made by David I, around 1130, to the monks of Dunfermline (ESC Nos 48, 71,

87). In the latter charter the monks were given all of David's rights over ships landing at the port of Inveresk except for his own tolls on any merchants from these ships that broke bulk and started to trade.

Exports were not, however, the only source of the cash reaching Scotland in the twelfth century. Many of those with estates in England tried to have their rents from these lands paid in cash and then use the resulting credit or capital in the north. Even before he became king David agreed to give Glasgow cathedral 100s per year from his lands at Hardingstone in Northamptonshire (ESC No 46). About the same time David also gave ten librates of land at Hardingstone to the monks of Selkirk who in order to gain any direct benefit would have had to take their income in the form of a money rent (ESC No 35). A few years later, in 1124x28, David went on to grant Dunfermline Abbey 100s annually from lands in England (ESC No 74). These grants were mainly replaced at a later date with income from lands more conveniently situated for the houses in question, and this has led to the suggestion that these were not intended to be permanent arrangements (Barrow 1973 165-87). Such grants do, however, indicate the way in which profits from estates held at a distance by absent land owners could be managed to provide cash rather than services or goods.

David I's decision to undertake a coinage in 1136 may well have been prompted by a combination of necessity and opportunity - the lack of English sterlings during Stephen's reign and his own acquisition of the Cumbrian

silver mines and the Carlisle, Corbridge and Bamburgh mints. In a sense, therefore, this first coinage may be seen as David acting to fill a vacuum but, as he went on to establish additional mints at Berwick, Edinburgh, Perth and Roxburgh, he presumably saw the minting of coins in Scotland as important for his own prestige and the Scottish economy. His policy was clearly successful for, when control over the north of England was lost, William I and Alexander II were able to continue to undertake Scottish coinages from Roxburgh, with temporary additional mints in some other burghs, especially Berwick. By 1250 it was possible for Alexander III not only to undertake a major recoinage but to carry out the introduction of long-cross pennies from mints established in some sixteen Scottish burghs (Stewart 1971 171-173, 180; Mayhew, 1977 85-100).

Following the introduction of a Scottish coinage, the number of references to taxation and other payments being made in the form of silver coin increases. However, the evidence of coin hoards confirms that only a small proportion of the coin that was in circulation was Scottish (Metcalf 1977 10-11). It is significant, then, that much of the cash revenue that the king felt free to gift continued to come from his burghs. In the 1140s the king used his coin from ships landing at Perth, Edinburgh and Stirling to provide Holyrood Abbey with 100s per year, the Priory of St Andrews with 40s each year and the monks of Dunfermline five marks each year (ESC Nos 153, 163, 209). Dunfermline was also allowed to land a ship free of coin at Inverkeithing (ESC No 209). Cambuskenneth Abbey had the

same right of a cain-free ship but exchanged this for 50s from the cain of ships at Perth (ESC 179; RRS i No 260). Initially, grants from the cash rents paid by burgesses were usually smaller than those made from the cain of ships, even when including additional funds from mills or fishings associated with the burghs. From his various burgh rents David I was able to give several religious houses annuals of 20s. The monks of Urquhart received theirs from the firma and fishings of Elgin, the canons of Scone from the firma of Perth (along with 10s from the mills there) and the church of Restenneth received 20s from the firma of Montrose (ESC No 110; RRS i Nos 57, 78). Other arrangements were also entered into for Robert, bishop of St Andrews, was able in 1144 to divert a mark due to him from the king's ferma of Perth to the Priory at St Andrews (ESC No 162).

This picture, which is once again mainly derived from monastic sources, of the burghs being the only places in Scotland operating a money economy in the twelfth century is almost certainly simplistic, some would say misleading (Scott 1979 105-31). The port burghs were undoubtedly crucial to the flow of bullion and coin into Scotland through trade, and as centres of the king's authority they were the natural choice for the location of Scottish mints. However, by accident or design, urban mints were automatically provided through their burgh's market with an established mechanism for the dissemination of coins into rural communities. There is certainly good evidence that coins were reaching and being used either directly or

indirectly as a means of assessing the market value of goods by Scottish estates from the twelfth century on. Perhaps because of their previous use of Anglo-Saxon sterlings, estates in south-east Scotland seem to have been particularly well integrated into the emerging cash economy. For instance, around 1136 a toft at Ednam, Roxburghshire, was granted to Coldingham Priory which included an annual rental of 2s (ESC No 113). Some twenty years later Dryburgh Abbey was given the rent of two marks a year from Ednam (RRS i No 129). In a confirmation charter of 1147 David I noted that lands in Edrom and Nisbet in Berwickshire owed him an annual of 30s (ESC No 178). The port burghs, in particular Berwick, were undoubtedly the centres of this expanding cash economy but they did not exist in isolation from the rural communities they served. The extent to which the cash economy had been adopted by rural communities is discussed below, but it is clear from the number of teinds leased for annual payments during the late twelfth century that money was being used ever more widely as a means of assessing and perhaps paying rural rents. In 1173 Melrose Abbey and the parson of Dunbar agreed to a yearly payment of 30s in lieu of teind from two of the abbey's granges (Melrose Liber i Nos 50 & 129). A similar agreement was made between Dryburgh and Jedburgh for 2 marks yearly from the church of Lessudden (St Boswels) (Dryburgh Liber No 62, 63). Perhaps the best indicator of the value of the burghs in spreading the cash economy was the fact that teinds from estates north of the Forth were also being commuted to cash payments. From 1199 the bishop of Moray could expect at

least a proportion of his teind from the king's tenants to be paid or assessed in cash (RRS ii No 422).

The foregoing discussion about the introduction of a money economy into both urban and rural Scotland should not be allowed to obscure the continued vitality of the cashless or 'natural' economy. Barter in goods and labour with all its various permutations was by no means replaced by the introduction of coinage. Coins simply added a further dimension to how payments and exchanges could be organised. As has been demonstrated, payments of teinds, rents, hospitality and labour service by rural communities included from the twelfth century an ever increasing element of cash, but payment in kind or a mixture of cash and kind remained commonplace throughout the mediæval period. Even within the burghs, rents initially included a mixture of cash and services, such as watch and ward or maintenance of burgh boundaries. In a number of cases burgesses were also organised to provide an annual render of the goods they manufactured, as in 1212 when William the Helmetmaker was given a place in Perth in return for an annual rent of a pair of iron helmets (RRS ii No 523). Conversely estate officials and employees could receive their wages as a mixture of land, cash and food. For instance, in 1497 a mason and his son employed by Cupar Abbey for life received a two and a half acre croft, six marks per year and a daily allowance of food consisting of meat or fish, five short white cakes, and a half gallon of convent ale (Coupar Angus Rental ii 309-10).

All manner and complexity of conditions and privileges of service were possible in both town and country. Even the trend towards the commuting of renders in kind for cash could be reversed. Renders of a rose or a blackbird were perhaps more symbolic than commercial, but the introduction of payments in spices, wax or manufactured goods smack of attempts to avoid the affects of inflation. The availability or otherwise of suitable currency must certainly have been a factor in the continuity of a natural economy, but the preference of the seller for a means of payment other than money should also be borne in mind. In commercial transactions barter might have been untidy and difficult to document, but it had the advantage of being an immediate and, wherever coins were suspect, a safe means of exchange. In the case of rents, payment in kind avoided the problem of inflation and minimised the need for individual tenants to market their own small surplusses. The great disadvantage of the natural economy was that it lacked the auditing check of goods being valued in cash before they were disposed of. The money economy came into its own when accountability through book-keeping was required. Wherever middlemen were involved or trade was being conducted at a distance then, as demonstrated by the accounts of Andrew Halyburton, the conservator of Scottish trade in the Netherlands between 1492 and 1503, cash provided an immediate and accurate summary of the status of trading parties (Halyburton's Ledger passim). Complex trading agreements were certainly possible in a natural economy, but paper transfers of credit and international banking depended upon, and developed out of, the use of

money.

The increasing use of cash by the merchant community is likely to have had an effect on the way bargains within the so called 'natural economy' were struck. The relative value of the goods to be bartered might first be assessed in terms of their monetary value and their final exchange might well involve a mixed payment in cash and kind. However, given that most barter agreements would have been sealed with no more than a hand shake and a notch on a tally stick, there is virtually no documentary evidence as to the frequency and organisation of the one-off commercial transactions which must have comprised the bulk of both rural and urban trade. Only where an exchange was likely to be the subject of a later audit was there any need for commercial transactions to be recorded on paper, and, as has been noted, in such circumstances cash transactions appear to have been the norm.

As will be apparent from the earlier part of this discussion most of the available documentary evidence for what was happening within the natural economy in fact relates to quite a specific type of transaction, the composition of longterm rents and teinds. These fixed agreements were themselves exceptional most rents were agreed on a short-term basis and never committed to parchment. It is not until the fifteenth century, when five or seven year contracts had become common and were being written down, that the more general pattern of annual rents becomes clear (Coupar Angus Rentals xxvi-xxviii) As a

result, although the arrangement and payment of perpetual renders would undoubtedly have been a far less common event than ordinary rents and commercial transactions, it has been these agricultural renders which have dominated historical interpretation of the natural economy. The assumption that there was a natural rural economy and a monetary urban economy almost certainly owes something to this biased recording of the use of money in documentary sources, and for much of this period the true situation was probably never as starkly divided as the documentary sources suggest. However, by the start of the sixteenth century, there can be little doubt that the divide between the way cash was used by urban and rural communities was very great indeed. The early sixteenth-century accounts of burghs such as Ayr make it quite clear that money was the normal method of payment for almost all goods and services in the towns, whereas the management of the Bishop of Dunkeld's various rural estates was based on a complex blend of cash and kind (Ayr Burgh Accts.; Dunkeld Rent.).

Wherever it has been introduced coinage has tended to be not only a vehicle for exchange but also a statement of authority. Medieval coins were no exception for, like the burgesses and estate-owners who were their principal users, their prestige depended, at least in part, upon the authority of the person whose name they bore. A significant element in the decision of Scottish kings from David I on to produce their own coinage was the desire to make a political statement about their personal authority.

The development of a money economy in Scotland was, after all, already well underway by the time these coins appeared. The principal purpose of these early Scottish coins was to augment the foreign, mainly English, coinage which was already circulating in Scotland. The use of cash for local and regional transactions had specific advantages for the estates and trading communities involved, but the origin of the coin in circulation makes it quite clear that the appearance of a money economy in Scotland was overwhelmingly the result of international trade. Even in the later thirteenth century, when the number of coins produced in Scotland increased dramatically, the composition of coins in hoards from the British Isles and the Continent would suggest that only around 6% of the Scottish currency consisted of Scottish coins, and the vast majority of the coinage in use was English. Conversely, about 4% of the English currency consisted of Scottish coins (Metcalf 1977 11).

Even before they produced their own coinage the Scottish kings were, through their control of the burghs and foreign trade, directly involved in the driving forces behind the introduction of a money economy. Indeed it is sometimes difficult to see who was leading whom, king or burgesses. David I's decision to mint coins would certainly have met with the approval of his burgesses and might in part have been carried out at their request. There can be little doubt that the creation of a money economy was very much to the mutual advantage of both burghs and state, although on balance, it was probably the king who benefited the most.

Apart from the profits that could be made from having a monopoly over the minting of coins, the king was able to use his considerable influence over the composition of both urban and rural rents to force tenants to pay a proportion of their rents in cash. This placed many tenants in a trap worthy of the inventors of indirect taxation. The principal way tenants could acquire the cash they needed to pay their rents was to sell their farm produce at a burgh market and the only way they could enter such a market was by paying part of their goods in tolls. Given this twist of double taxation it is hardly surprising that barter remained so prominent outwith the burghs. Barter must have been as endemic and un-traceable then as the black economy is today.

Part 3 The Creation of Urban Wealth

The development of the money economy is of more than just passing interest to the way in which manufacturing came to be concentrated in the burghs. As long as cash rents in the countryside were paid or converted into money acquired through the sale of agricultural produce within the burghs, then farm produce had to contain a proportion of cash-crops. Apart from the possibility that burgesses were not self-sufficient in the food and materials they themselves needed, the only reason such produce could find a market in the burghs was if it could be given some added value and then re-sold. One of the simplest ways of doing this was to transport produce from those burghs where it was readily available and inexpensive to where it was scarce and

expensive. This might involve shipping goods abroad or just to a different region within Scotland, but in either case profits made from exploiting the availability of goods were almost entirely created by merchants who saw a marketing opportunity and exploited it. The alternative method of enhancing the value of agricultural produce was through its physical alteration. This might involve the preparation or preservation of raw materials for use by others, the conversion of produce into finished goods or just the preservation of seasonal foodstuffs against the day when they would command a higher price. Whatever the nature of these value adding alterations, it was craftsmen who carried out the work and who created the extra profit. Maximum profit for the burgh as a whole was, of course, generated from those goods which were worked on by craftsmen and then exported by merchants.

The role of merchants in this cycle of wealth creation was undoubtedly important, but it was also extremely restricted. Merchants could only ship the goods they had to hand and without craftsmen to process and alter the mainly agricultural produce reaching the burghs, the range of goods that merchants could trade in was necessarily restricted. The key to initial urban growth was the addition by manufacturing industries of new products to established trading systems. The two great staple exports of medieval Scotland, hides and wool, demonstrate this point admirably.

Hides had almost certainly been traded in Scotland long

before David I identified his towns and townsmen as burghs and burgesses. However, if they were to be transported or stored for even a short time hides and skins had to be preserved. The simplest and cheapest ways to preserve hides were to dry and salt them or to dress them with animal oil. However, if the final product was to be more durable leather, then both these processes represented an unnecessary expense. Before these temporarily preserved hides could be tanned, all the salt and oil which had been added to them for transportation had to be washed out. It was far more cost-effective therefore to construct tanneries at the Scottish ports, and to herd cattle and other animals to these sites for slaughter and skinning. In this way, burgh craftsmen not only removed the need for any temporary preservation of hides and skins, they also opened up a whole range of new markets for Scottish merchants, and the possibility for other craftsmen to produce finished goods in Scotland from Scottish leather.

As has been discussed, the terminology used to describe hides and leather makes it difficult to be certain at what stage hides for export began to be tanned rather than just dried and salted. However, the restrictions imposed upon those who could salt and trade in hides would suggest that even by the twelfth century a significant proportion of the hides being exported were tanned rather than just temporarily preserved (above p 80; Statuta Gilde chs 24 & 30). This would certainly fit with what is known about the highly developed structure of the leather trade in the early burghs. Professional distinctions between the makers

and users of leather are apparent even in twelfth-century documentation, with the clear implication that the leather industry was already adding manufactured products to an established trading pattern in tanned or otherwise preserved hides.

The considerable cash value of wool exports has tended to distract economic historians from the rather limited value of the wool trade as an economy builder. Before the wool could be exported, the only industrial processing that was necessary was a certain amount of washing and sorting, and even this work was more likely to have taken place on those rural estates where shearing took place than in the towns. It was not until the wool was actually woven into cloth that its value was substantially enhanced by manufacturing. There was never, for instance, a separate trading market in carded wool or yarn. The results of adding the manufacture of cloth to an urban economy could be dramatic, as the growth of the Flemish weaving towns clearly demonstrated. Indeed so successful were the Flemish at producing quality cloth for export, that the failure of other urban economies to do the same has in the past been seen as a contraindicator of industrial success (van Werveke 1954 237-45).

The production of high quality cloth for export was certainly very lucrative, but it was also an extremely risky business. For instance, the Flemish towns were almost entirely dependent upon international trade for both raw materials and markets. Scotland, like many other

European countries, was not in the enviable position of being at the centre of a variety of trade routes. Trade between Scotland and the Continent depended very largely on a single route down the east coast of England. The state of relations between Scotland and England and indeed between England and the Continent, had therefore considerable influence over the way in which export-led industry developed in Scotland. There was little likelihood of a particularly labour-intensive high value industry, such as specialist cloth manufacturing, developing, if a large part of the market for such goods relied upon a sea route that was being blockaded regularly. It made more sense to export a basic raw material which could be used, at least until the fifteenth century, to secure credit a year or more in advance (Duncan 1975a 428-9; Stevenson forthcoming).

Under such circumstances it is not surprising that the Scottish textile industry was significantly different from that which developed in Flanders. Its main product was utilitarian cloth intended in the first instance to satisfy Scotland's own regional markets. It may even have been that the main centres for the manufacture of Scottish cloth were on the great estates, and that the burghs were only involved in the manufacture and finishing of better quality cloth, which imports of teasle heads and dye-stuffs confirm was taking place. It is nevertheless significant that, when trade routes were open, even the addition of such a limited product as plain everyday cloth could be put to good use and merchants were able to create a strong market

for Scottish grey cloth in the Netherlands (Stevenson forthcoming).

The trade patterns that are discernable for the Scottish leather and textile industries underline the fact that in the first instance diversification of manufacturing affected regional, not international, trade. In part this may have been because one of the simplest ways for burgesses to add to the range of work undertaken in their burghs was to copy popular imported goods, and then undercut the price of foreign manufactured goods in their established local markets. The manufacture of such replicas might be undertaken by local craftsmen who simply recognised an opportunity to diversify, or it could be the result of foreign craftsmen moving to Scotland and bringing with them designs and manufacturing skills they had learnt as apprentices. Archaeologically this is most easily demonstrated through the typology of hand moulded artefacts such as ceramics. For instance, pottery known by its fabric to have been made from clay found near Perth was, in the late fourteenth and fifteenth centuries, deliberately being made in imitation, first of vessels imported from Scarborough and then of Continental stonewares (Blanchard 1983 509). It seems unlikely that this was an instance of first Scarborough and then Rhenish potters moving to Perth, but there are many examples in the documentary sources of foreign craftsmen being encouraged by kings, from David I to James VI, to move to Scotland and begin production in one of the burghs.

In addition to the replication of foreign manufacturing processes and goods, it was also common for established industries to expand and diversify through the addition of new work to existing processes. In the normal course of events, this took the form of a specialisation of labour within established industries. Craftsmen who were able and willing to learn more elaborate techniques could go on to produce a wider range of objects, and gain financial and professional recognition of their greater skill. The leather and textile industries once again provide useful examples of this progression towards more specialised trades. As has been mentioned, documentary sources indicate that as early as the twelfth century a distinction had been drawn between the work and professional status of skimmers and cordiners. This trend continued with more and more processes coming to be identified with specific categories of workmen, so that by the sixteenth century, several of the larger burghs could boast the additional trades of shoemakers, glovers, saddlers, furriers and others. The textile industry likewise entered the twelfth century with a range of named trades, notably weavers, waulkers and dyers. However, given that by the sixteenth century the variety of recognised textile trades had expanded to include carders, shearers, bonnet-makers, tailors and others, the likelihood is that earlier weavers waulkers and dyers were involved in a wider range of work than their name would suggest.

It is virtually impossible to look behind the introduction of these and many other craft names, to discover what

social and professional changes were taking place in the medieval burghs. Fifteenth- and sixteenth-century legislation helps to indicate the range of work undertaken by some of the trade incorporations, but there is no way of knowing how such work was divided in earlier times. Moreover, the range of work undertaken by ostensibly the same craftsmen would almost certainly have varied according to the status of the individual and the town in which he worked. A further complication is that this same period saw a considerable increase in the amount and variety of a whole range of documentation, so that it is possible that these 'new' divisions of the fifteenth and sixteenth centuries had simply become more apparent than they were before. In either case the steady progression towards more precise trade names would strongly suggest that craftsmen had, for some time, been becoming more specialised in the work they undertook.

Whatever the reasons behind its creation, it will be apparent by now that the addition of new craft specialisations formed one of the most important and lasting methods whereby urban communities could strengthen or expand their economies. Without new work there could be no new trade, and without new trade there could be no commercial growth. The successful addition of new work depended, however, not only upon the presence of suitably trained craftsmen but also the availability of raw materials and expanding markets. In a limited number of instances, domestic or ad hoc manufacturers who made use of debris from other urban industries could turn professional

and so strengthen an urban economy by adding new work from within the existing resources of a town. For instance, this would have been the case when bone and horn working began to be undertaken commercially. However, in the majority of cases the addition of new work required ever more resources and ever larger markets.

In an era of craft patronage, protectionism and trade monopolies, the provision of additional resources and markets was not simply a matter of medieval merchants organising supplies and satisfying demands. Resources and markets were politically sensitive subjects and the concentration of agricultural and other raw materials in specific urban communities was as closely bound up with the development of larger political units as it was with industrial growth. Indeed, as with the introduction of a Scottish coinage, it is difficult at times to know whether the driving force behind the creation of larger political and economic units was the result of the aspirations of rulers or the requirements of expanding urban communities. Part of the problem is that the political and economic interests of a state and its towns were, more often than not, one and the same, and it was only when the similarity of their goals led them into competition that their almost symbiotic relationship began to break down. Perhaps because its towns were relatively small, such rifts were less common in Scotland than on the Continent, where the city-state was, at least for urban communities, a logical solution to their increasing self-interest. In terms of who held the upper hand in Scotland, king or burgesses, it

is interesting to note that while rulers initially exercised considerable control over the fate of individual burgesses, such as Mainard the Fleming, by the end of the sixteenth century the government of the country was almost completely dependent upon revenue and loans raised by the burghs (ESC No 169; Edinburgh Burgh Rec. vi 74, 87, 89).

In Scotland, intervention by the state in the industrial base of the burghs was usually intended to be mutually beneficial, even if the results were sometimes quite the reverse. Much of this intervention was in any case indirect, and it may be doubted whether legislation, for instance the instruction that burghs were to build and maintain ships, was ever treated as anything more than an indication of the king's interest and intent (APS i 179, 183, 235-7, 242, 345). Of more effect was the conscious, or more probably unconscious, use of government expenditure to promote the development of specialist craftsmen. Commissions and retainers were frequently given to burgh craftsmen, while foreign craftsmen were sometimes granted favourable trading rights in order to encourage them to establish workshops in the Scottish burghs. The goods being commissioned covered the full range of equipment and materials needed for the construction and maintenance of the king's estates, as well as all the necessities, luxuries and military equipment required for his household.

The scale and regularity of much of the expenditure that was being made makes it difficult to disentangle the king's day to day requirements from the occasional item of

deliberate economic policy. There can be little doubt that the king acted first and foremost as a consumer and where he did invest in capital projects, such as fish ponds, mills and ^{that} floating arsenal the Great Michael, but these were all projects intended to provide him with cash, entertainment, food and arms. It is nevertheless interesting to note that some industries were not directly affected by government expenditure. For instance, while there was much government interest in the search for gold and silver, prospecting for iron and its smelting in bloomeries, which was certainly taking place, very rarely appears in government accounts. Likewise the tanning of leather received little or no direct investment from the government. Given that the products of these industries were nevertheless required by the king's household, it is, therefore, difficult to avoid the conclusion that ^{there} was no need to invest in industries such as tanning and iron smelting because their products were readily available.

Although by the time they came to be incorporated, in the fifteenth and sixteenth centuries, the principal urban crafts are fairly easily recognised, it is difficult to assess the contribution made by any one craft to the development of Scotland's urban communities. There are simply too many variables, for the same crafts could fulfil different roles in different towns at different times. The best way to analyse the contribution of these various trades is to return instead to the wider material-based industrial groups, identified and discussed in chapters three and four, and to examine how they both served and

made use of urban communities.

As has been hinted at when discussing the wool trade, the contribution of an industry to the process of urbanisation is a somewhat wider question than whether or not that industry was a commercial success. Commercial success was certainly important to the well being of a town, but the industries which raised the most cash were not necessarily the ones which contributed the most to urban stability. Excessive profit was regarded as akin to usuary in the medieval period, and it is as well for modern analysts to likewise look beyond short term profits to whether or not there was a contribution to the wider availability of raw materials, labour and equipment within an urban communities. The simplest way to do this, is to draw a distinction between those industries which had a centralising affect on the distribution of other trades and those which simply followed upon and serviced the needs of other manufacturers. In many ways the distinction between what may be called 'centralising' and 'centralised' industries is an extension of an argument advanced in chapter four about the difference between main and secondary raw materials. However, it is important to note that centralised manufacturers such as metalworkers, coopers or wheel-wrights who began by servicing the needs of other urban trades and farmers, could go on to expand their markets by selling their produce outwith their own town and its hinterland. Moreover, the profits such centralised industries commanded were often far higher than those of the centralising industries such as fleshing,

because their goods had a certain scarcity value, and were often the product of considerable and skilled labour.

It was, however, the three great centralising industries which were based on the preparation and preservation of fish, flesh and hides that started the ball rolling. All three made use of animal produce for their main raw materials and went on to attract a range of service trades, which in turn made use of mineral and vegetable raw materials. Of these three industries, however, only the leather industry went on to make what for Scotland was the all-important jump from the preparation of raw materials for export, to the production of manufactured goods for the domestic market. In a sense this was quite the reverse of the normal sequence of industrialisation and urbanisation, in which the most rapid cycle of economic growth was based on the export of manufactured goods, not raw materials. Unfortunately from 1296 repeated military intervention by the English combined with naval blockades and piracy meant that the Scots were rarely in a position to develop industries capable of competing with the more securely placed Continental manufactures and exporters of expensive value-added goods. This meant, for instance, that the textile industry was never able to contribute as fully to the economy of the Scottish burghs as it did to many urban communities elsewhere in Europe. In fact the Scottish textile industry came to be based on the same pattern, of a regional market for manufactured goods and an international market for raw materials, as had determined the formation of the leather industry. However, the textile and leather

industries differed from one another in one important respect. While the leather trade came to be centred on the towns because that was where surplus cattle were marketed, slaughtered and skinned, the lack of any foreign market removed any economic necessity for the textile trade to be located in the towns. Any hold the burghs had over the finishing of cloth was the product of legalisation and monopoly. It was the leather trade which provided the natural building blocks of industrialisation and urbanisation in Scotland.

