The Development of Mining in the Glasgow Area, 1700-1830.

by

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Introduction.

The history of mining has attracted much attention and in recent years much detailed research has been undertaken, giving rise to important reference works such as that by Duckham entitled A History of the Scottish Coal Industry. (Newton-Abbott, 1972). However these studies have tended to be nationally focussed, even when based on detailed primary sources. Local or district studies in depth have not been attempted in any systematic way, but the growing availability of mining records has opened up the possibility of such detailed local study. This thesis sets out to establish for the Glasgow Region a record of the development of its mining industry from its earliest origins to the onset of rapid industrialisation in the 19th. century, at which point the story of coal mining becomes entangled with the progress of the iron industry and general manufacturing.

The thesis, by looking in detail at available records seeks to develop Glasgow's mining along a number of themes. Principal of these has been ownership, together with the relationships between various companies and individuals. Emphasis has been placed on mercantile influences together with district influences and how early industry stimulated the coal trade. This in its turn contributed to the structuring and organising of mining so that it might respond more easily to market needs.

The growth of the coal trade from early domestic trading to colonial trade is traced. The various types of markets are identified and the dominance of the domestic trade is shown. The response to industrial needs is shown, as is how the opportunity presented by the deepening of the River Clyde led to the export trade. The coal trade along the River Clyde and to the coasts and lochs is shown, together with the links to the limestone trade that developed naturally from it. This particular aspect of trade was traced principally in contemporary newspapers, which also served to provide the background for the identity of coal combines and early market organisation. The thesis traces the growth of market organisation.

The social situation of the miners has been surveyed, tracing their politicization and identifying the main labour disputes to affect the Glasgow mining area.

The thesis by examining in detail recorded accidents sets out to identify the main causes and to place them in perspective. It is possible to show that the majority of accidents were related to the failings in the technology of support.

Technology is closely examined to determine what were the main problems encountered and what was the response. How these were overcome forms the broad subject of this section. The number and deployment of steam engines is examined at some length.

District studies are used to highlight particular features of mining development. The principal of these was the change in emphasis away from mining to surface land use, as mining became less productive and financially worthwhile. The changing patterns of land use are highlighted with regard to Barrowfield, Gorbals, and the West End of Glasgow. The chapter "Aspects of commercial geology in relation to the rise of the West End of Glasgow, c1790-c1905" by transcending the main time period of the review, illustrates the legacy of mining and its effect on town planning.

Coal was not the only mineral wrought by mining, and the roles played by the allied industries of alum, brick making, and limestone are examined. The links between the colliery industry and the brick making industry are shown, and how the shale brick industry of the late 19th. century was used to remove the surface remains of many collieries.

The main theme of the thesis is that the period 1700-1830 was the hey-day of Glasgow mining.

Brian S. Skillen.

Abbreviations.

Except where obvious the only abbreviations used are:

G.B.R. - Glasgow Burgh Records.

O.C.H. - Old Country Houses of the Old Glasgow Gentry.

S.R.A. - Strathclyde Regional Archives, the codes given are their references.

S.R.O. - Scottish Record Office, the codes given are their references.

Chapter 1.

Mining in the Glasgow District to 1700.

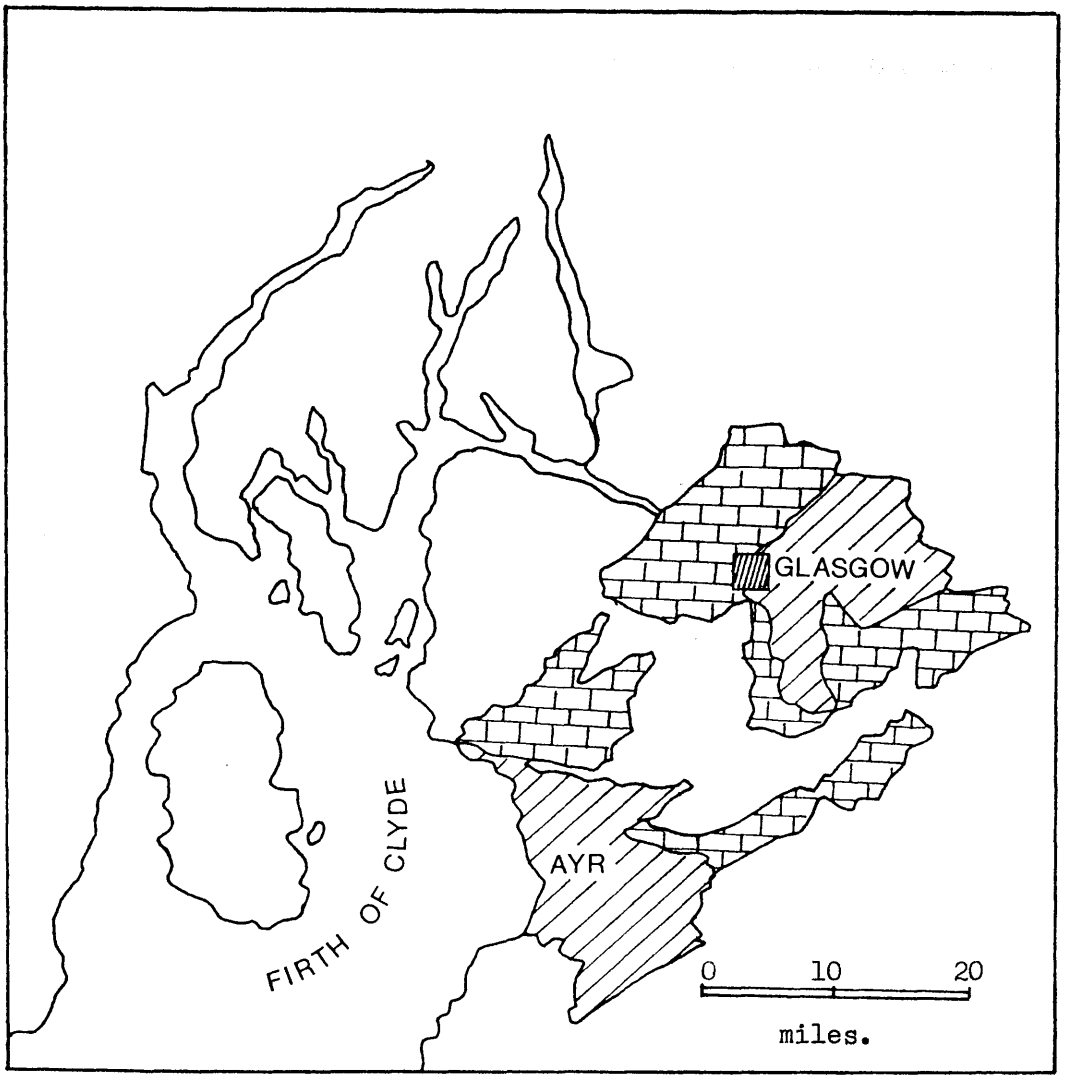
Setting.

Glasgow's situation in the heart of the Central Valley, a small basin with narrow outlets, almost completely surrounded by higher plateau rising to 600 ft. or more, dictated its importance as a human settlement. It became a centre of communication, as a bridging point across the River Clyde, to a series of interdependent townships which grew up along the Lower Clyde Basin.[1] Human settlement promotes the interchange of ideas and the exploitation of local resoures. The establishment of Glasgow as a diocesan centre served the growth of local knowledge, attracting pilgrims who carried new ideas between widely separate religious and burghal communities.[2]

Ecclesiastical interest in coal mining is well known. There is evidence for shallow extraction of coal by monks in medieval times from outcrops as, for example, at Newbattle Abbey,[3] and in the vicinity of Nostell Priory in Yorkshire.[4] There was a similar involvement in the Barony of Renfrew c1294 and in the Gallow Green area of Paisley at a later date.[5]

Similarly coal could be of importance to the armies of that period. The purchase of coal, always in small amounts of 4d. or 6d. appears in the expenses of the English Army of Occupation

Figure 1.



Location map of the West Region Coalfields.

Key.

Carboniferous sandstone and limestone.

Coal measures.

Source. Based on the maps of the British Geological Survey.

during the Wars of Independence not only at Dunipace, Edinburgh and Linlithgow, but also at Glasgow, the coal being normally for smithy work.[6]

Glasgow's first coal workings probably developed from the quarrying of building stone, mainly the sandstone of the Carboniferous period. Within the Limestone Coal Group there occur at least three horizons of building stones. At Eastpark Quarry, Maryhill, two sandstones were formerly worked above and below the Knightswood Gas Coal.[7] The old quarries of the Easter and Wester Common, the medieval Terra Communis, would also have shown thin but workable coal seams. The Terra Communis was waste land held by the burgesses in common, used for pasture, for fuel and building stones.[8] Provanside in close proximity to the medieval town could also have provided coal, with a thin seam of 3 ins. a few feet from the surface, above a workable sandstone of about 8 ft.[9] The early sources of domestic fuel were most likely to have been peats, brooms and small whins, from the periphery of the built-up area. Coal was probably a by-product of the demand for building stones with little organisation to its exploitation. (Carboniferous sandstone occurrence is shown in Fig.1).

The change in tenurial arrangements of the growing town in the 16th. century saw the transfer of the commonty to private owners. Land in Glasgow changed from being the basis of social relationships and of the life style of the community to being a commercial asset

available for sale and exploitation at a price, with all the restrictions that that imposed on free access. It may be that new ownerships demanded the better organisation of fuel supply as seams became worked out or were no longer available when access was refused by new feu holders. The agricultural development of the area around the town would also have restricted fuel gathering to out of season, and the demands of cattle and crops would have restricted options still further, for example peat extraction would have stopped when the turnip crop had to be singled out for harvesting.[10]

The Cathedral Close probably dominated the exploitation of coal on account of its considerable property holdings, until the diminishing power of the church and the Reformation in the 16th. century saw the community power balance shift in favour of the merchant class. It was a period when the growth of the coal industry becomes detectable in leases, sinkings to new seams and a steadily increasing market. The fortunes of the merchant class established Glasgow as a major commercial centre, with consequent demand for fuel, if only for the hearths of merchant houses and offices. A factor in the growth of Glasgow was mercantile movement and the town's relationship to its port, Dumbarton. Glasgow enjoyed an entrepôt trade as goods passed to and fro through the city to the port. These provisions

included coal for Ireland - a trade established by 1556 when 7 chaldrons and 12 barrels of coal were shipped from Dumbarton.[11] The profits from this and other tradings provided compensation for the fragile commercial structure of a city and district in transformation.

Early Records of Mining.

The first reference, apart from the demand for smithy coal made by Edward I and his army of occupation in the Glasgow area, occurs in the 16th. century and refers to the Kilpatrick District. There is probably little wonder in this as the deep stream beds of the area must have made local building stones and coal seams easily traceable. The coal seams lay in close proximity to the local limestones and sandstones, which provided building materials, all being easily quarried at outcrop. The developing exploitation of coal is hinted at in its mention in the transfer of tenancies and land rights in the district from from c1550. The estate records of Hamilton of Barns provide many such examples. Firstly, there was a charter of alienation by Hugh Crawford of Kilbirnie and Drumry in favour of Andrew Hamilton, Captain of Dumbarton Castle and Agnes Crawford his spouse, of the lands of Hutcheson and Hole, with the coal seams thereof, in Kilpatrick, dated 12 March 1550.[12] A similar document exists dated 20 September 1550.[13] The coal could

have found use for ordnance work at Dumbarton Castle. Thirdly, there was a precept of resignation by Andrew Hamilton of Cochno empowering an unidentified person, but probably a tacksman, to resign the lands of Hutcheson and Hole with the coal seams thereof into the hands of Hugh Crawford of Kilbirnie, for granting to Andrew Hamilton's son Thomas.[14] The fourth item is an extract of retour of Claud Hamilton, as heir to his father Andrew Hamilton of Cochno, the lands of Hutcheson and Hole with the coal seams, dated 26 May 1573.[15]

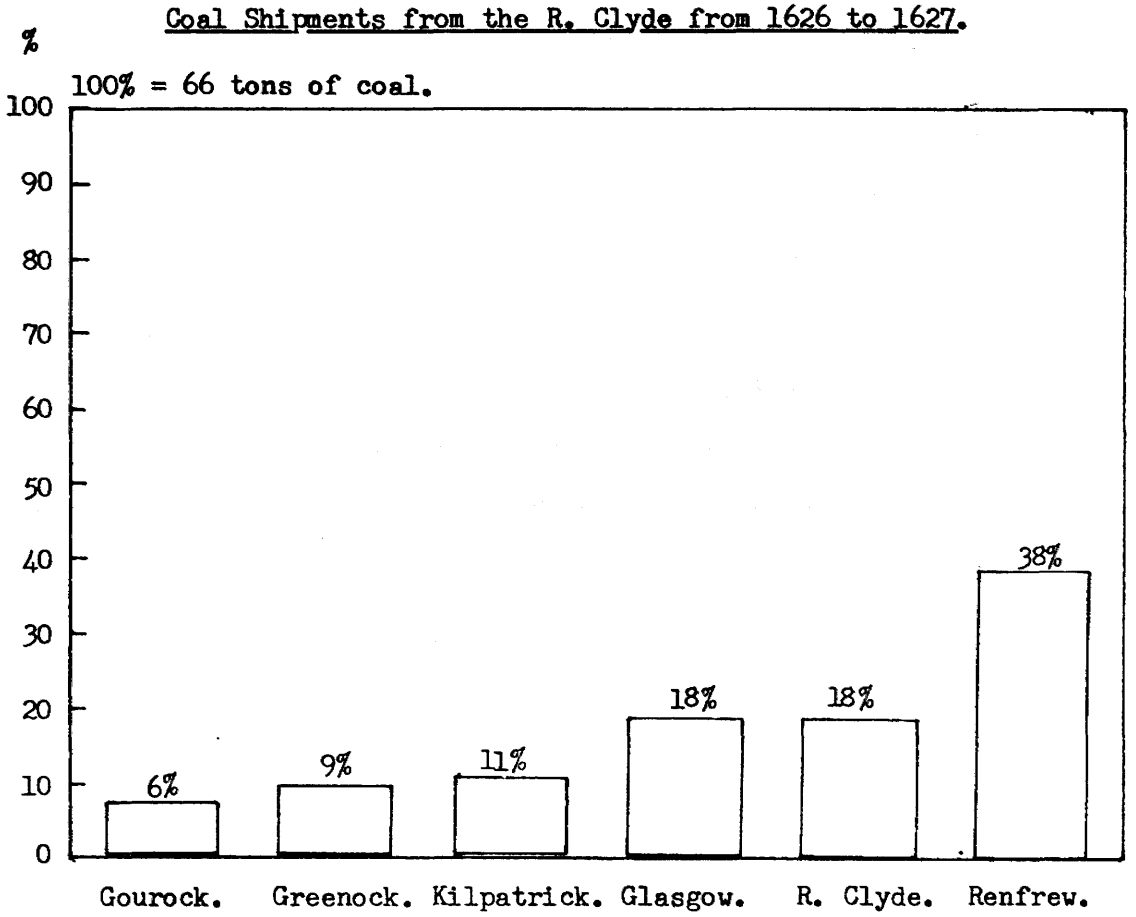
Mining more local to Glasgow dates from the same period, with reference in Protocol 2248 of 1575, to a road leading to the town's colliery. That mention was made at all hints at the growing local importance of mining, further underlined by the granting by Archbishop Boyd to David and Fergus Kennedy of coal workings in the Barony in 1578. A tack duty of £40 and 70 loads of coal was payable on the 3 year tack from Martinmas 1578, implying that a good return was expected and that mining was probably already begun in the area. The tack itself suggests this in relation to arable land use, for Martinmas was after harvesting and a great deal could be done in trials between the harvest and resowing the following spring. Mining remained subservient to the croftland needs and damaged crops would have been a serious blow to a small community, so care would have

been exercised in mining. This tack is also of interest in that the Kennedys sublet to Matthew Boyd to undertake the actual mining; Boyd presumably had either the money enough to support the operations or was already experienced in mining.[16] Protocol 3495 carries further reference to coal in the Glasgow area identifying a coal yard on the northside of Gallowgate, to the west of the Molendinar Burn.[17] It was well placed in proximity to the junction of Gallowgate, Trongate and Waulkergate, which formed a natural market place and the focus of domestic town life and coal sales, apart from which coal would also have found use in smithies, fish curing and tanning and hides industries. By the late 16th. century mining was established for such markets. Many small pits such as that of Kirklee in operation c1590[18] provided domestic coal, joining with others to satisfy a demand from bodies such as the Glasgow College, contracting for supply in 1602.[19]

Increasing demand for coal encouraged the exploitation of land for minerals, by merchant families such as the Grays of Dalmarnock. The Grays were active from the early 17th. century, a period which also saw an increasing export trade, the Scottish Plantation of Ulster being conducive to this, with 66 tons being shipped from November 1626 to November 1627.[20] The bulk of the tonnage sailed on boats from Kilpatrick or Renfrew and the source may have been the collieries of the Kilpatrick District, as again evidenced in the sasines of the period.[21] Glasgow contributed too and one source

Figure 2.

Coal Shipments from the R. Clyde from 1626 to 1627.



Gourock = 4 tons of coal.

Greenock = 6 tons of coal.

Kilpatrick = 7 tons of coal.

Glasgow = 12 tons of coal.

River Clyde = 12 tons of coal.

Renfrew = 25 tons of coal.

Source. "The just compte off guidis and marchandes transportit furchte off Clyd and entered at Glasgow, fra the first off November 1626 til the first off November 1627" in Charters and other documents relating to the City of Glasgow. Vol.II. AD 1649-1707. 1906. p.580.

may have been the Carntyne collieries of John Gray, who quickly recognised their potential and had established an important mine by 1628.[22] But whatever potential the export trade may have had for coal (see Figure 2), immediate expectations were principally to satisfy local demand. This was the case for workings such as those of Corseford, which supplied only the immediate area of Renfrewshire,[23] or Hurlet where workings established in 1634 employed only 5 miners and can have served little more than the immediate district. The rent for the colliery under lease from James Lord Ross was 1,400 merks, about £77 15s 6d. per annum.[24]

The Development of Mining.

What can be said of the aforementioned workings was that they were of the simplest. Exploitation was still limited to what was found easily or in the process of digging and quarrying. Mining merely to justify curiosity seems unlikely and some basic knowledge of the underlying strata would have been necessary to justify any trial or sinking on account of expense. Miners were in a sense both their own prospectors and geologists; skills learned in the hard school of practical experience would have made them a specialised group of artisans able to exploit what they saw before them, the first steps in which would have been a survey. That patterns of formation were known by the 17th. century is expressed

in George Sinclair's writings:

> "It is to be considered, that all free-stone, though of different natures, hath the same coarse, with the coal that ly either above or below them, except it be accidently interrupted: therefore, whatsoever is spoken of one is applicable to the other. And so we find in digging or sinking, that after the clay is past, which keeps no coarse, all metals, as stones and tiles (which are seams of black stone, and participat much of the nature of coal) ly one above another, and keep on regular course."[25]

These patterns would have been obvious to an observant eye at outcrop in steeply dipping terrain as, for example, in Linn of Cart with coal, shales, blaes and limestone outcrops. These methods were though generally unreliable and discoveries little more than fortuitous. But they were tempting, and on 26 March 1649 the Town Council of Paisley arranged for a miner from Riccarton to survey the area. Reports were encouraging and on 3 June 1649 ex Baillie Alexander was appointed to:

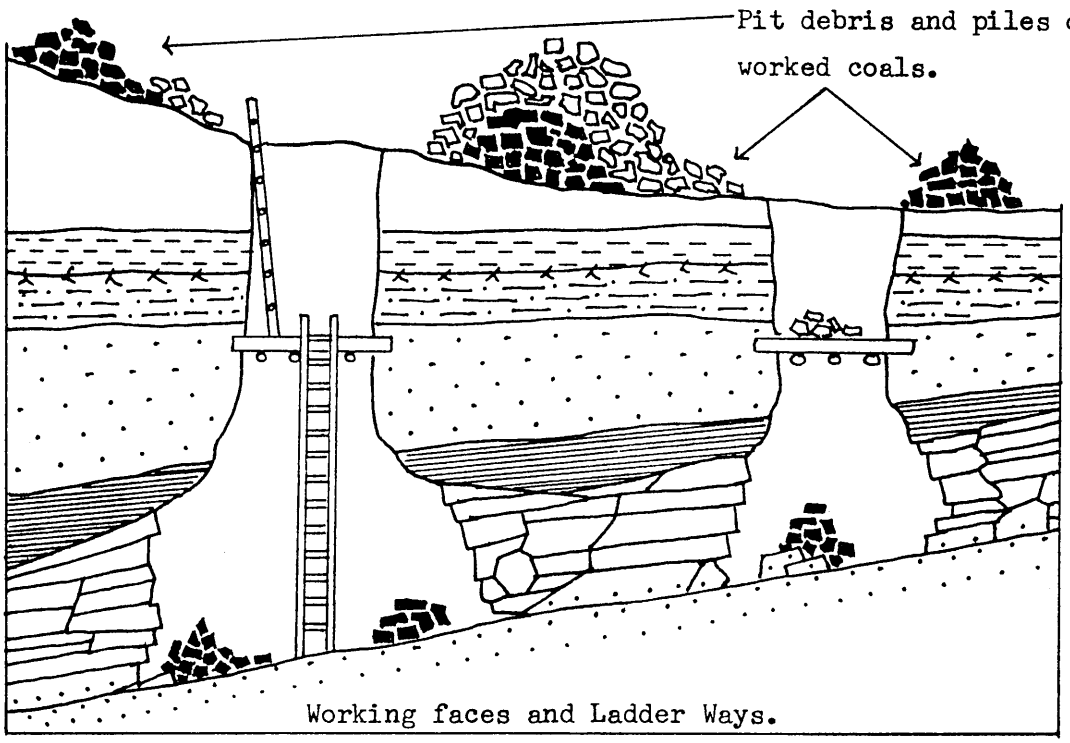
> "oversee the workers at the heuche for the space of eight days,"

at a rate of 13d. per day.[26] The inference that skilled labour had to be brought from outside to test the possibility of mining

at Paisley is of interest. That workings were continued by local labour with a general overseer suggests that mining skills were at a premium. These early mines were probably in the form of bell-pits, which contributed little to the success of the venture. There was an enormous loss of property arising from having to leave coal between the pits which were dug several feet apart. To illustrate this where workings were dug 12 feet apart on a 1 ft. by 1 ft. coal seam, this would have resulted in a loss of 12 cubic feet of coal, the loss multiplying over a large area of extraction. The sinking of bell-pits in weak strata would have been hazardous; this form of exploitation (illustrated in Figure 3) precluded any underground connections. Where scraps of coal were sought by random pit sinkings, the cost of such labour would probably have required half the sale value of the coal.

Considering the above, the question can be asked as to how coal mining rated as an activity within the framework of trade and commerce. What evidence there is suggests that as at Paisley and Corseford, mining could generally supply only local markets, and bell-pits could not have provided the output to support the the development of an export market to any distance. Workings that followed the seam would have had a greater potential for expanding output to meet market demands. Certainly, coal workings were becoming increasingly attractive investment options,

Figure 3. Idealised Bell Pit Section based on the Local Mining Geology of West Glasgow, illustrating the seam loss entailed in this form of Working.



Key.

Surface materials.

Mud

Sandy Shales and Seat Earths.

Shales.

Coal Seam.

Sandstone.

and mine owners such as the Grays, were not only members of the community and exploiters of minerals, but also of the Town Council, a Town Council quite prepared to promote mining with ever increasing demand from domestic hearths and small industries. The Gorbals Lands of Town, Trades House and Hutcheson's Hospital, were purchased in 1647, from Sir Robert Douglas of Blackerton, and are an example of land bought for mineral resources. Sir Robert Douglas had championed the cause of the Charles I and the losing side, plundered by Presbyterians and Covenanters alike, part of which booty was Gorbals. Douglas with the consent of Dame Susannah Douglas, his wife, disposed to the City the £6 Lands of Old Extent of Gorbals and Bridgend, with the coals and collieries, partly in reparations.[27] The record of the transaction suggests that mining was then already in operation in the area, the Council:

> "To hold and have all and whole the foresaid six pounds lands of old extent of Gorballs and Brigend, with coals and coal heughs within the said bound."[28]

This new mineral field was of some importance with increasing market opportunities. By 1651, the coal trade to Ireland was quite regular, with open boats of 4-10 tons capacity, sailing there from the Clyde. There was too, a lmited trade with France, probably as with Ireland, primarily in small smithy coals.[29]

Coal workings around Paisley did not enjoy the same fortune, for the coals found were of such poor quality that workings were discontinued. On 26 January 1652, the baillies and Town Council of Paisley resolved to close the workings on Gallow Green, and:

"to fill all of them with moss stocks, soils and timbers."[30]

The exploitation of Gorbals continued with the sinking of more shafts in 1655, a useful initiative to put more coal on the market, and open for mineral exploitation this area which had the benefit of being on the doorstep of its market.[31] The exploitation of Gorbals also provides the earliest records of leasings, though the lessee named Bryce did nothing to distinguish himself in his working relations with either the Town Council or other mining tenants, when he undermined and flooded a rival mining property.[32]

By 1660, there were 5 notable coal works within 5 miles of the city and the industry slowly expanded in the hands of landed mercantile men in response to demand for coal from industries like sugar refining, rope manufactury, cordage, hardware, soap, glass, porcelain, earthenware, for calcining limestone and domestic heating for a population of about 14,768.[33]

The Economy and Organisation of Mining.

By the mid 17th. century problems were arising for mining both in the general economy, the technology, and even in relations between mine owners and their employees. Mines went deeper with increasing demand, so the problems of exploitation intensified, especially with regard to drainage, and it is probable that some workings were only accessible in the summer months. Workings in the summer months brought with them the problems of labour supply in an economy where agriculture remained the dominant employer. These factors are seen in relation to the coal pits in the Barony of Glasgow, which though important to the inhabitants of Glasgow, were a serious burden on their owners from an almost permanent problem with drainage, apart from employees. An account of the period suggests that the men were often drunken and idle, worked only 4 in every 6 days, and extracted full wages at seed time and harvest, when they were probably only working part time at the pit head. Wage demands of the period made the upkeep of the collieries difficult and the masters found it hard going. This may be explained in that the colliery serfdom of the rest of Scotland had never been imposed with such vigour in the Glasgow area. The early Glasgow coal masters did not have the process of law to control their labourers as had been formulated by the politically powerful land owning coal masters of for example the

Lothians. By 1662, matters were so serious, that the masters having had enough petitioned for help to the Privy Council of Scotland. As a result a committee was appointed and though the result is no longer evident, the members of the committee give some impression of the importance of the coal trade at that time. The committee included Provost Campbell of Glasgow, and the previous provost John Bell, together with the local baillies and Provost John Scott of Rutherglen.[34] The last is of some interest as from that period the "rulers" of Rutherglen were as often as not mineral entrepreneurs, there being strong links between the collieries and the council chambers.

The problems experienced by the early coal masters in getting their men to work full time at the pit head at seed and harvest time, gives come clues to the mining ethic of the period. The communities around Glasgow were agricultural ones, farming and mining often being carried on together as hinted previously with the dating of leases to natural breaks in the harvest calendar. The constraints imposed by their respective technologies set the parameters for extractive work, limiting both output per day and the number of those spent on mining. The extraction work, at least till improved drainage, was limited by the prevailing technology and climate to better weather, with work concentrated in dry periods. The agricultural calendar

determined what time could be devoted to mining, which would have been brought to a close or at least slowed up by demands of harvesting and herding. Agrarian and mining technology both greatly circumscribed the miners' time availability for mining activity,. at least until the miners were fully independent of the agrarian system.

How would such uncertainties have affected coal supply? Firstly in rising prices as coal became scarce and secondly a determined effort by the principal customers to right the situation. These two factors are seen in the Town Councils attitude to Patrick Bryce on Gorbals Muir. By March 1666, coals were scant and dear, having risen from 4/- to 6/- a hutch due to the run down nature of the local collieries. As a result Patrick Bryce received financial encouragement to open out new mines, he must have got results for even 14 years later the Town Council was keen to:

> "give him quhat he craves for his incurradgement to kep the said heughs, that the toune may be furnished with coal ."[35]

The manufacturies which emerged in the 17th. century probably all created demand for coal. The soap manufacturies of Francis Muire of 1668[36] and John Anderson of Dowhill[37] would both have

demanded considerable quantities of coal for soap boiling. The sugar works which also appeared, would have demanded coal for boiling. The major fires of the period are also a possible pointer to a "fire" technology with consequent greater demands for coal.

Coal interests also show in ownerships; apart from the Town Council and merchant communities, mining also involved the gentry. The bonds of this time reflect this. An example was a bond by Col. Robert Cunningham, brother of the then deceased William Cunningham, Earl of Glencairn, to Dame Elizabeth Cunningham, his sister Lady Minto, with an obligation to pay her life rent of the land of Meikle Farme, with coal works and heughs, dated 19 August 1670.[38] But the impetus for mining really lay with the merchants, some of whom were very successful such as Walter Gibson of Balshagray, bred a malster and who made enough money in that trade to direct into other trade ventures. He traded to the American colonies, to France, Spain, Sweden and Norway, he imported the first Swedish iron to the Clyde on one of his 3 vessels, and his inheritances and ownerships were also of importance. These included the lands of Partick with the collieries of the area, and like Gray of Carntyne he was one of a growing number of merchants who were linked into the coal trade.[39] John Gray's contribution to mining was such that he was appointed a guild brother on the strength of his supplying coal to Glasgow.[40] There were though other merchants involved who were not so fortunate, like John Gilhagie. He took a lease of the workings on Gorbals Muir in 1689,[41] and they were the

ruin of him, for he was like many small lessee masters of the period, operating within a fragile infrastructure of varied business interests, which often became masters of them to their financial ruin.

It was perhaps for this reason that growth was generally faltering with local mining. It is this variety of ownership and fortune that hints at the beginning of problems for mineral exploitation in the area. The lack of concentrated ownership – as in other coalfields such as those of the Lothians, where concentration of ownership in a few very influential families encouraged concerted action in improvement,[42] did little to encourage advance locally. Indeed there is little evidence for local mining investment, hence there was no capital accumulation of any great amount to help mining survive the floundering economy of the late 17th. century.

Glasgow's increasing trade with the Western Isles, with Ireland and southward through the Irish Sea in the 17th. century, were all pointers to the nature of economic development at that time. These in their turn affected the growth of mining as Glasgow established itself as the main commercial centre of the west of Scotland, as its trading contacts became more varied and regular.[43] The period 1660-1670 saw expansion of trade links across the Atlantic, with a consortium of Glasgow men building and fitting out ships to exploit the rich fishing grounds off

Greenland. The period also saw the formation of colonies, some successful as in the Carolinas and others ending in disaster.

The most spectacular of these misfortunes was that of The Scottish Company Trading to Africa and Indies, established on the Darien Isthmus. Glasgow had invested heavily in the scheme, 68 merchants subscribed over 53% of the total monies and the financial loss occasioned by Darien probably halted economic development of the city for a short time.[44] The actual effect if any of Darien on mining cannot be measured, though Darien's failure probably caused a directional change in financing for the merchants directly involved in mining. Diversification into mining took a third perhaps even a fourth place in the immediate quest to develop new trade links and regain some of the monies lost in the Darien Scheme. Suffice to say the economy of the period was directed to opening new markets to gain money even before the home market could be put in order.

Darien resulted in disillusion and stagnation of the economy in which a tentative industry such as mining could expect little investment. That mining did continue was due to the localisation of both mine heads and markets, for the population was above the coal measures that supplied their fuel needs. In Glasgow transport difficulties restricted the main coal routes from Gorbals, Rutherglen and the Barony, to across the low lying ground by the River Clyde; existing records show these as the principal areas of exploitation.[45]

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Chapter 2.

The 18th. Century Coal Masters and the development of mining in the Glasgow Region.

The State of Mining in the Economy in 1700.

When the 18th. century began Scotland was denuded of capital, overstretched and impotent in its trading and barely above subsistence level in its agrarian base. In overview it had suffered the dislocation of its economy time and time again, either from natural disasters in the primitive farming community, or disease and war, but also from Darien, a failure that sent shock waves through the local economy. It may therefore be asked why did mining continue both with restricted funding and few resources? Agrarian disasters of the closing decades of the 17th. century are part of the answer as they gave the impetus to urbanisation which in turn continued demand for coal. Urbanisation in the early stages needed the extirpation of famine, both to ensure its own food supply and to put pressure on people to move to town. A spate of short term problems in "the black years of King William" brought migration as refugees from hard hit parishes moved to those less affected by crop disasters. Alternative staple crops such as potatoes helped the Glasgow area survive bad harvests that affected its neighbours. Flinn notes how Glasgow, Barony and Govan all grew quickly at this time, as people moved from neighbouring parishes such as Blantyre, Bothwell, Glasssford and Hamilton, all of which were rural and showed declining populations by 1700.

There was an obvious need for coal as the population of Glasgow had begun to grow and in the final decade of the 17th. century between 4-5,000 hearths of all kinds can be identified from the hearth tax, though whether they all burnt coal is another question. However it was a sensible decision on the part of Glasgow merchants to invest in mining, where even low levels of investment could be expected to make some gain in the small scale mining of the early 18th. century. The levels of mining were so restricted that small amounts of capital invested in digging a shaft on a shallow seam, could reasonably be expected to bring a quick profit once the coals went to market; whatever the case Nef states that:

> "the evidence of the rise of the [coal] industry, during the period 1550-1700, to a place of great importance in the economic life of the country [was] scarcely less impressive for Scotland than for the North of England."[1]

Similarly, John Chamberlayne writing in 1710 stated that:

"Scotland is said to be richer underground than above."[2]

Therefore there was some impetus to invest, and the contemporary burgh records detail this process with accounts of trials and the working of coal around Glasgow. The economic climate also encouraged such investment as things markedly improved for Scotland with the Union of 1707. There were new reasons to do things; as Hamilton states the economic centre of Scotland was moving to the Firth of Clyde, well situated to take advantage of foreign trade to Ireland and on across the Atlantic. It was this new opportunity that fostered the survival of the West of Scotland economy in the

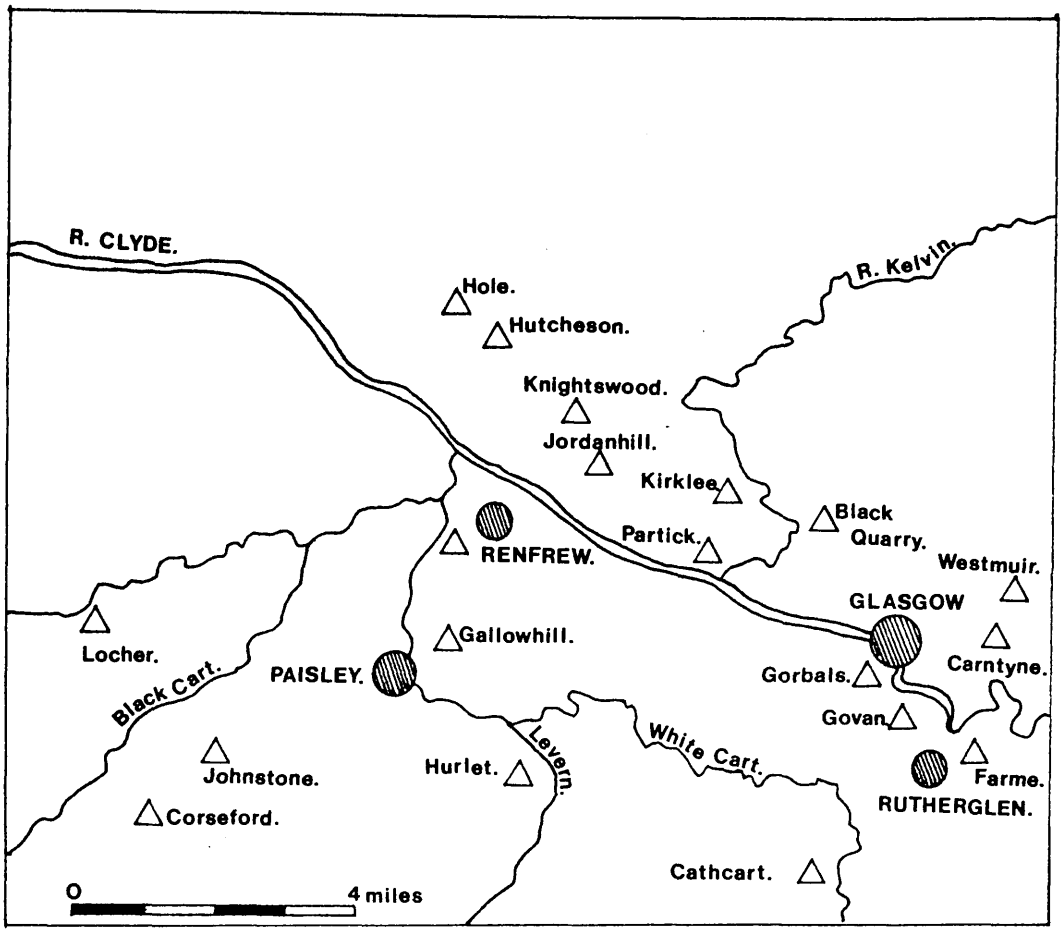
trauma of Union and the dissolution of tariff barriers. There are pointers to greater stability, as in 1709 when a bad harvest did not bring about a subsistence crisis. There is also the rise in population, the lifting of English legislative barriers, and the opportunity of enterprise.

The chief centre of the new commerce was Glasgow, its population in 1708 was 12,766, according to an enumeration carried out by the direction of her magistrates. The setting continued to enlarge for in 1740 her population was 17,034; in 1755 it was 23,546; and by 1780 it was 42,832 including the suburbs of Glasgow. Demand increased as did the capital flow with expanding markets for coal, first domestic and then industrial. But, at least up to about 1730 there was only marginal development and merchant commitment to the mining industry. The few records available provide only pointers to development till the middle decades of the 18th. century,[3] but it is safe to assume that there was already an established group of pitheads around Glasgow by 1700 (see Figure 4).

The Early Coalmasters.

Glasgow in the first decades of the 18th. century offered many new market opportunities for collieries. Industries like sugar refining, the manufacture of rope, cordage, hardware, soap, glass, porcelain, and earthenware all required coal, and there was also the domestic market. The growing importance of coal to Glasgow is demonstrated by mention of the failure of its coal supply from Gorbals in the late lean years

Figure 4.



Principal areas of mining in Glasgow by 1700.

Key.

principal towns.

principal areas of mining, identified by name.

Sources: BUCHANAN, Leslie "Coal in Glasgow" p.27. Book No.5.

Old Glasgow Club Transactions. Vol.VI. 1933.

Glasgow Burgh Records.

Hamilton of Barns Estate Papers. S.R.A. TD589.

CRAWFORD, George History of Renfrewshire. 1782.

the 17th. century. An alternative had to be quickly found with John Gray's workings of the Carntyne area, and he was admitted burgess and guild brother in recognition of his having supplied Glasgow with coal at a low rate.[4] The growing demand for coal and its importance can be shown still further in the way the Town Council encouraged all tacksmen and merchants to search for new coal supplies. In 1704, for example, Thomas Hamilton, deacon convenor; George Buchanan, a maltman; and Robert Buchanan, a baxter; were given the liberty by the Town Council to hunt for coal under Gorbals Muir.[5] Similarly, trials were encouraged in Provand in 1704 with Mungo Cochrane, merchant; Robert Dickie, wright; and John French, a maltman; having been given every opportunity to exploit what seams they might find.[6]

This type of small scale mining could be self-propragating. Even short-term success would have brought a flurry of interest in exploring known and exposed seams. In addition, as the town grew, the Town Council became more interested in meeting requests for leases to work minerals under Corporation lands. This is not surprising for it was Glasgow merchants, many of whom were also councillors, who more than any other group instigated the rise of mining in the district, and were quick to appreciate the need for investment. They recognised that the value of land could be increased if they constantly exploited the minerals found under those lands. Experience was probably gained in small ventures, and as confidence increased the net was spread by taking areas of land in tack for exploitation. The recognition that coal as a raw material became a capital resource with investment of

capital and labour, both of which became increasingly available, brought a technology and structure to the coal and minerals industry. This process can be illustrated from the Town Records; in 1713, for example John Shiells and Allan Dreghorn were permitted to extend their coal tacks in Gorbals Muir;[7] another Dreghorn, Robert, was the tacksman of the Govan area. From 1714 to 1731, Govan belonged to the Town, the Trade's House and Hutcheson's Hospital. Robert Dreghorn pursued mining with considerable success with an annual output of over 20,000 loads.[8] Such was the scale of his activity that in 1725 Dreghorn was petitioning to build houses and structures on Gorbals Muir to hold both his miners and the horses and equipment of the mine.[9] He was granted the right to build on the Muir,[10] and established one of the first purpose built and organised pit heads, which were soon to become part of the scenery of Gorbals Muir as the exploitation of the area increased.

Dreghorn partnered the tack with Messrs Shiells, Watson and Park, other merchants of the period, who all held various parts of the coal, and though Dreghorn was not the majority holder, he was perhaps the most able.[11] It was his success that tempted him eastward, into investment and exploitation of coal around Camlachie and Dennistoun, which continued into the 1730s; with extensions of lease in 1725 and 1730, an interest was retained in Govan.[12]

Mineral activities were not restricted to the eastern coalfield, nor to Gorbals, nor to merchant lessees for landowner's involvement continued as in the previous century as for example at Barrowfield.

Barrowfield Colliery originated in the early 18th. century under the ownership of John Walkinshaw of Barrowfield, who was probably keen to exploit coal seams in such close proximity to the Glasgow market. However, local geology never made operations easy and even in Walkinshaw's time significant expenditure was necessary to keep the mine open. Market potential must have been considerable for exploitation in the face of geological difficulties of running sand and mud to continue. The colliery's success was further hampered by Walkinshaw's Jacobite sympathies which led to the estate's forfeiture and the flooding and neglect of the colliery. But demand must have held sufficient promise for on the amnesty of 1717 and the return of the estate to Walkinshaw, he employed William Douglas of Glenbervie, an experienced coalmaster and family friend to get the mines working once again. William Douglas became the tacksman of the coals in both Barrowfield and Camlachie, and his managerial skills were such that he became Walkinshaw's estate factor. But in the face of continuing problems he advised the sale of the estate to the City Magistrates in 1723, for 30 years purchase of the rent of the lands and 12 years rent of the houses; the coal was reserved in Walkinshaw's favour. Thereafter operations continued till increasing problems with the water c1730 led to Walkinshaw being unable to finance the workings any further. James Walkinshaw of Walkinshaw, a brother of John, then took the lease, financing the colliery from his own funds. Necessary remedial work and the sinking of new shafts was estimated at c£200 but time limitation from the 24 years remaining reserved in

the sale to the magistrates did not encourage massive investment. The sublease from William Douglas to James Walkinshaw was of 24 years duration, but that a break was allowed in the sitting tenant's favour at the end of 2 years does not suggest that Walkinshaw entertained much hope of its continued exploitation. A further change in ownership of Barrowfield, just 5 months after the signing of the lease, probably affected any positive long term moves towards mining. On 29 September 1730, the City Magistrates sold both Barrowfield and Camlachie to John Orr an experienced coalmaster. After little success James Walkinshaw relinquished the coal lease of the then colliery to Orr in May 1734, and that family then worked the area till their financial ruin in the late 18th. century.[13]

In the west there is a similar story of success and failure. In 1739 Hugh Cathcart, a merchant, took a lease of Kelvinhaugh with a view to exploiting local minerals,[14] though there is no physical evidence to suggest that he did so. Both Hillhead and Partick were then successful mining areas and Cathcart may have had some involvement there and also in the west; William Crawford of Balshagrie, had a colliery in operation on that property in 1748 and presumably worked it till his death in insolvency in 1755.[15] There is more evidence for workings south of Gorbals Muir to Cathcart in an area where at least 3 coal seams were being worked by the middle decades of the 18th. century.[16]

It is clear from the surviving tacks and records that most of the early coalmasters were merchants with multiple interests. For example the Rutherglen collieries were, in the 1750s, worked by James Scott, John Leith and David Scott. David Scott was a maltman, John Leith a general merchant, and James Scott a weaver. Similarly, in 1757, the Maxwell of Pollok collieries of Shiells and Titwood, were leased by the same John Leith and James Scott, this time in association with William Muir, a vintner, and Archibald Shiells. This group of men also worked the Langside Colliery at that time, their manager being John Chalmers.[17]

By the middle decades of the 18th. century there is already a pattern and that is of merchant mineral lessees supported by a broad money base of their other investments. These are the successful coal masters and it is notable that neither of the major landowners who worked their own minerals enjoyed long success for they did not enjoy the liquidity of the merchant masters who were to dominate mining in the latter part of the century.

Organisation and Ownership in the Tobacco Period.

The opportunity to increase mineral exploitation came with the capital accumulation of the tobacco trade, in Glasgow's colonial period. The Tobacco Lords comprised at the most 10% of the merchant community, but their influence was disproportionately greater than their numbers. The tobacco trade was a risky one and none of the merchants trusted to it alone for riches, diversifying into land

investment and industry. It was common for merchants to hold industrial investments, and according to Devine there were 163 merchants in Glasgow having partnership status in the transatlantic trade. Eighty five of these had a share in at least one co-partnery engaged in manufacturing and extractive industries. James Dunlop had extensive mining investments and was also a partner in the Dumbarton Glass Works Company, one of the principal heat intensive industries and a major coal user. A list of his partnerships is given below (collieries underlined):

Bell's Tannery; Ropework Manufactury of Glasgow; Glasgow Bottlework Company; Dumbarton Glass Work Company; Duntocher Cotton Company; Govan Coal Company; Knightswood Coal Company; Elderslie Coal Company; Fullarton Coal Company; Banknoch Coal Company; Hamilton Farme Coal Company; Sandyhills Coal Company; Rutherglen Muir Coal Company; Camlachie Coal Company; Skaterigg Coal Company; McBrayne, Stenhouse & Company, linen printers; Dumbarton Brewery Company. Knightswood and Skaterigg pits were absorbed by the Dumbarton Glass Works Company to guarantee its own fuel supply.

source: DEVINE, T.M. The Tobacco Lords. 1975.

DUCKHAM, B.F. A History of the Scottish Coal Industry. 1972.

In the land market the 124 estates bought between 1770 and 1815 in the Glasgow region, not only conferred landed status upon their purchasers, but also brought rich exploitable mineral deposits. Merchant capital played an important role in the promotion of mineral development.[18] It was perhaps a coincidence of geology that the

majority of estates inherited or invested in by the Tobacco Lords, were next good mineral deposits.[19] Some were content to simply lease their land to persons experienced in the extraction industries, which was guaranteed to cut the risks inherent in mining activity of that period.[20] There were those who got actively involved such as the merchant dynasties of the Dunlops and Houstons. This can be illustrated by a coal tack granted in June 1768 to Colin Dunlop, Alexander Houston, Gabriel Gray, and James M'Nair, by the Town Council to work lands in Gorbals and Govan.[21] Both Houston and Dunlop were involved in the American and Caribbean trades, and Gray and M'Nair were successful coalmasters. The "Virginian Merchant" mining adventurers spread their empire and took a series of coal tacks in Dumbartonshire, Knightswood and in Jordanhill.[22]

In 1773, Dunlop's son, James, joined in the family enterprise both at Knightswood and the Little Govan Coalworks, which in 1800 was valued at £20,000.[23] The Dunlop enterprise included the Dumbarton Glass Works which had a major influence on the minerals trade, Dunlop in conjunction with Houston having purchased 29 acres of Hutcheson's Hospital lands for the Dumbarton Glass Works to exploit the coal reserves.[24]

Whilst the Tobacco Lords played a dominant role, they were not alone in their mining interests. Ownership and involvement in mining was quite widespread as is evidenced by the involvement of John Duncan, the Glasgow printer, as tacksman at Aikenston Colliery about 4 miles east of Glasgow,[25] or William Pagan, of the Wester Sugar House Glasgow, who held Bogton Colliery, Cathcart.[26] Similarly, in the west, coal

belonging to the Incorporation of Bakers in Glasgow at Partick, was auctioned for exploitation on 12 April 1770,[27] and Andrew Reid of Hamiltonhill was seeking agreement with the City Council to sink for coal on their lands.[28] The City Council continued its interests by financing trials there,[29] and the lease was offered in 1771 of their well established colliery.[30]

The dominance of the Tobacco Lords is more evident in the length of time they maintained their investment in mining. They do not figure very often in lists of sequestrations, whereas the smaller coalmasters do, as for example Joseph Hately, the tacksman of Hutcheson Colliery. This Gorbals coalmaster failed in 1772, and interestingly the trustees put his tack back on the market as soon as they could.[31] It was not an isolated case and there is always this element of a background interest in the success of mining, whether it was creditors determined to be reimbursed from estates in trust attempting to work failed mining ventures, or simply land owners ridding themselves of the men of straw. Certainly there were levels of ownership or tenancy, some short run and others of considerable longevity; the long term owners would have become dominant simply due to their continual influence.

This domination is further shown in the move away from single pit operation, to the holding of several small working collieries, in the latter part of the 18th. century. Gabriel Gray of Scotstoun by Rutherglen, held the collieries of Balgray in the Barony, Jordanhill and Westmuir. He also worked Stonelaw in Rutherglen, where he erected

a steam engine c1776.[32] His operations continued till his death on 18 January 1788.[33]

The Easterhill Colliery, Tollcross, and nearby Braidfauld, were worked by Messrs Smellie & McCall. Archibald Smellie was a tobacco merchant, who unlike some of his compatriots, preferred to engage directly in mining and shoulder all the burdens of capital and expenditure, and:

"wrought extensively the coal [on his estates]."[34]

Smellie was successful for many years, but in 1781, the colliery at Braidfauld became insolvent, and his properties were sold off.[35]

Another small business in the area was Fullarton, owned by Robert Hunter. On his death, his wife managed the workings of the colliery for a short time, in due course selling out to James Dunlop.[36] The involvement of a woman at organisational level may be noted, which though only for a short time was very different from the menial position usually enjoyed by women at that time.

The last quarter of the 18th. century saw the disappearance of other early coalmasters. The Grays of Dalmarnock sold their properties c1784. Gray's three quarter holdings of Dalmarnock passed to Thomas Buchanan, and Newlands to Hozier. Kennyhill passed to Gordon.[37] Another business to disappear about this time was that of the Orrs'. John Orr of Barrowfield, advocate and town clerk, inherited from his father the valuable properties of Barrowfield, Camlachie and Gateside in 1775. On succession he

formed a partnership with his brother, Matthew Orr, to work coals on their estates. In 1789, their interests were auctioned and included Sandyhills, Glenduffhills, Barrachnie, and White Cranhill, apart from the aforementioned properties.[38] The collieries failed and were sequestered in 1791.[39] The Camlachie Colliery was dissolved in 1793 and rouped in January 1794. But as old faces disappeared so new ones came on the scene and Robert Dunmore another "Virginian Merchant" known more for his activities in the cotton and muslin industries, moved into the Campsie coal trade in the final decade of the 18th. century.

Robert Dunmore's principal works was at Baldernock, begun c1790, and by 1792 he had purchased into the Bankier Estate and East Blairskaith, leasing several small coal mines around the district as a source of fuel for his other manufacturies. Dunmore effectively modernised the Campsie coal trade, with the introduction of horse gins.[40] Dunmore's investments were probably the last of the major mining ventures backed from the profits of the Virginian Tobacco Trade. The number of collieries that can be identified from available records is considerable, but they were not single ownerships, the Tobacco Lords held them in multiple and as shown in the instance of Fullarton, some like Dunlop were prepared to buy out to increase their empire. (Table 1 identifies the colliery ownerships of the Tobacco Lords).

Table 1.

A List of the Tobacco Lords involved in Mining in the Glasgow Area.

a.	DENNISTOUN, James sr.,	Camlachie Coal Company.
		Sandyhills Coal Company.
b.	DENNISTOUN, James jr.,	Camlachie Coal Company.
		Sandyhills Coal Company.
c.	DUNLOP, Colin	Govan Coal Company.
		Knightswood Coal Company.
d.	DUNLOP, James	Camlachie Coal Company.
		Elderslie Coal Company.
		Fullarton Coal Company.
		Govan Coal Company.
		Knightswood Coal Company.
		Hamilton Farme Coal Company.
		Rutherglen Muir Coal Company.
		Sandyhills Coal Company.
		Skaterigg Coal Company.
e.	DUNMORE, Robert	Baldernock Colliery.
		Bankier Colliery.
		Blairskaith Colliery.
f.	FRENCH, William	Easter Barrachnie Coal Company.
g.	HOUSTON, Alexander	Govan Coal Company.
		Knightswood Coal Company.

Source:

DEVINE, T.M. The Tobacco Lords. 1975.

Glasgow Journal 26 March - 2 April 1767.

Indies Merchants and Mining.

The destruction of the Virginian Trade after 1775, and the American War of Independence, meant commercial initiative was confronted with finding new sources of capital. The substitute was the West Indies, and capital from that trade financed some collieries such as Govan. It was leased by Houston Rae and Lieutenant Colonel Andrew Houston, toward the end of the 18th. century. Both were directors of Alexander Houston & Company, the principal West Indian Trading House.[41] The West Indies Trade was concerned in the industrial renovation of Scotland, principally in the late 18th. century cotton industry, but also in trade and mining. The 18th. century saw the mining industry established and organised in the hands of wealthy merchants, and a good example of this is shown in the case of the Green Coal Work, though in this instance the money was partly East Indian in source, but whatever the source it was a colliery business floated entirely by merchant money.

In 1790, the owners of the royalty were Janet and Grizel Pettiegrew, the heiresses of Archibald Burnett, an East Indian Merchant, and of their brother John Pettiegrew of Green. Janet and Grizel Pettiegrew became adjudging creditors of brother John and whilst they held the lands of Green under those conditions they granted a lease to their nephew John Pettiegrew Wilson (then only 13 years of age) and to his father Walter Wilson as manager of his son's interests. Walter Wilson was totally inexperienced, with no knowledge of how to work let alone manage a mine. In order to carry on working the coal

he took into partnership one John Shiels, an experienced local coal master from Camlachie, to whom he assigned half of the business with his 14 year old son's consent. The business was conducted under the firm of Walter Wilson & Co., completing two pits at which time they were practically down to the last penny. Neither Wilson or Shiels could fund the workings and they went first to the Misses Pettiegrew; and, subsequently, with the same view to funding, they had to assume as partners Messrs James Milligan and James Burnside, two Glasgow merchants. The firm then became known as the Green Coal Work Company. Milligan fulfilled the role of agent for the company. He was also the single biggest investor in the company and had at one time £1,732 invested; his bankruptcy a few years later destroyed the financial base of the company, showing how dependent it was on mercantile money. Duckham states that the funds of the Green Coal Work Company were made up thus:

Pettiegrews invested,	£361
other contributions,	£190
Burnside invested,	£500
Milligan personal,	£846
Milligan's business investments,	£337

source: DUCKHAM, B.F. A History of the Scottish Coal Industry. 1972.

The investment acted as surety for Milligan's other business

interests, but as personal security it impinged on the coal company's security for it became too dependent on the success or otherwise of Milligan's many investments. It may be that this was a common method of safe-guarding interests by investing on their behalf, suggesting that there was a considerable degree of interdependence between 18th. century businesses and that Milligan's investments rose from an initial £1,183 to £1,732 does suggest that it was often successful, though part at least was from Burnside's investment which had been assigned in his favour after Burnside's withdrawal. The Green Coal Work Company was also of interest in its inclusion of women in the investment structure, but it was a structure too dependent on one man's finances.[42]

In 1794, a serious dispute arose between the partners John Pettiegrew Wilson, Walter Wilson and James Milligan on the one hand and John Shiels on the other, as to who ran the company, illustrating how fragile the partnership structure could be, and by 1796 the original company had been sequestrated.[43]

The Early Industrialists: local influences on mining development.

The Green Coal Company had been typical of the proliferation of small companies in the 18th. century,[44] featuring colonial merchants, or small time industrialists and investors, with an experienced miner on the team such as John Shiels. One reason for this pattern had been from the entry of the landed classes to mining. Their activity in financing such a capital intensive industry brought

them into relations with the trading classes, both because of their need to find capital and because of their need to find markets for their pit produce. In their turn the trading classes would have ventured into mining to assure fuel and eliminate the agents who handled coal supply and took a percentage. Indeed many small industrialists encouraged mining to assure coal supplies. An early 19th. century example was a bleacher named Robert Hay, of Netherplace in Mearns, who together with other local industrialists financed trials of the Pollok Estate for coal and advertised for coalmasters to work the area at advantageous leases and in their turn Hay and his friends promised to improve communications in a determined effort to sort local coal supply problems.[45]

Why was there such an interest in coal? Part of the reason may have been that it was the Age of Cotton. In the first phase of textile production cotton mills, bleachfields and printfields sprung up everywhere there was a stream, but opportunity remained low until the application of steam power transformed the mechanics of industry and increased fuel demand as indeed it did across a whole range of industries. This then couples to the production of dyestuffs and chemicals for cloth processing for which the alum industry became an integral part of mining. A comparison of the location and range of industry from the late 18th. century onward shows not only its growth but also how it extended and transformed mining from localised scrapings to an industry which linked country to town and vice versa and moved the interest from not only coal but also

to the other minerals which were available for exploitation. The long term change first came at district level and the influences that were to change mining are examined at this level in the following chapters.

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Chapter 3.

Influences on the development of the Campsie and Kilpatrick Districts in the early 19th. century.

The Campsie District.

The policies of the Campsie landowners such as Lennox and Kincaid mirror the tendency to total exploitation hinted at in the previous chapter, thus encouraging many concessionaires in the local mining industry. Lessees were attracted both by the low rates of leases and potential profit, and from the immediacy of markets both in the printfields and the local domestic hearths. Leases in whole or in part were readily taken; part leases were auctioned as original lessees retired from the scene for many reasons, but their places were soon filled as is shown from period newspaper advertisements. This can be illustrated with the Copperas Works at Barraston, erected on lease about 1805 for 18 years, the remaining years were auctioned in Glasgow on 21 September 1808.[1] Auction details also evidence the extent of Campsie mineral sales, with 50 acres of Bankier Estate being auctioned in 1812 solely for minerals exploitation.[2] The minerals of such areas were often worked by more than one partnership and Bankier Coal & Limestone Works was carried on by John Wilson & Sons, whilst the ironstone was worked by John Stewart and James Wilson, in 1813.[3] Messrs Stewart and Wilson carried on Bankier till c1817, when with James Wilson's death and the sequestration of Stewart's

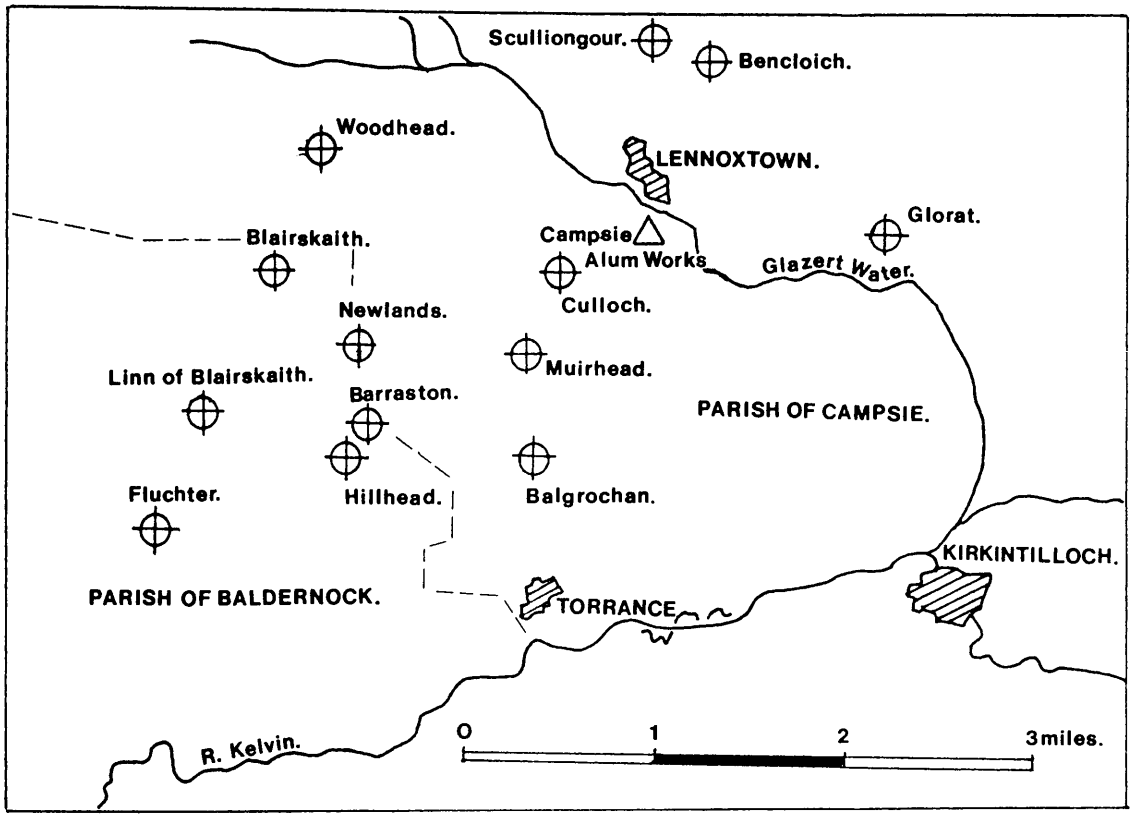
estate, Bankier once again went to public auction.[4] Public auction favoured the land owners where minerals were good enough to tempt a competitive spirit on the auction room floor, and thus higher prices. But this spirit of competition surrendered control to a few coalmasters across the area, instead of the dozen or more small holders workings of the previous century. The mineral leasees of the 19th. cantury Campsie minerals were often experienced men, such as Robert Paterson of the Westmuir Colliery Glasgow;[5] or John Loughrey a local man of considerable personal experience.[6] John Loughrey appeared on the scene in 1812; in company with a man named Hume, Loughrey took the lease of Millfauld and the Kincaid Coal & Limestone Works, from John Kincaid in that year.[7] The coal was used both on the Kincaid Printfield and to calcine the locally mined limestone, which was spread on the Kincaid farm lands. It was a very successful enterprise and Kincaid as landlord benefitted from his minerals leases both in their bringing in money on the open market, and their additional use as a fuel and manure on his own lands at no great outlay. Kincaid's influence on the minerals exploitation of the Campsie District was considerable, the uniting of the Kincaid and Lennox Families by marriage increased his hold. Loughrey became his agent for minerals in the Campsie District, a loyalty which helped enforce Kincaid's grip on the mining of Campsie.[8]

The other minerals concessionaires were merchants and local land holders of various names and experience, working either individually

or in partnership. The individuals included Alexander Aitken at Glorat;[9] the partnerships such as John McLeod jr. and Andrew Young at Balgrochan,[10] a company which appears to have had some masonic connections in Glasgow, principally through Thomas Wilson, who acted as agent in Glasgow.[11] The small holders in minerals included the Plough Lairds of Balgrochan. They leased the coal and limestone, together with the copperas ores in the lands of Carleston and Easter and Wester Balgrochan, and included William Maitland, John Angus and William Downie.[12] Maitland was also involved in mining around Newlands and Muirhead,[13] and the Maitlands as a family remained dominant masters on the local mining for many years, in particular James Maitland. Mineral ownership principally lay with Kincaid Lennox but was not confined solely to the area or to Glasgow, for Barraston was owned by John and William Henry of Dalry c1800,[14] and then by Hugh Brown of Saltcoats.[15] All coal, limestone, copperas, and brick clay, was separately leased.

In the foregoing it is obvious that Campsie provided "home" to many small mineral entrepreneurs, with a few more dominant. It is likely that with the exception of Loughrey and Paterson, that mining was not a single occupation, the Maitlands for example originated as farmers and a lot of mining in Campsie seems to have been combinations of farmers and merchants, both relatively prosperous groups who could use their funds to finance investment in mining to increase their wealth. It was normally successful for the mining

Figure 5.



Location Map of the Campsie District Mines, c1800.

Key.

centres of habitation.

principal coal and limestone mining sites.

△ the Campsie Alum Works, Lennoxtown.

– – – parish boundary.

Source. SKILLEN, Brian The Mines & Minerals of Campsie. 1985.
Lennox Estate Papers. Deposited Feu and Mineral Plans.
S.R.A. TLX. First Statistical Account. XV "Parish of Campsie" 1795.

names in Campsie exist throughout the 19th. century, but there were failures as epitomised in the partnership of Robert Wilson and George Brown. Robert Wilson, a Balgrochan farmer, partnered Sculliongour with George Brown of Westertown of Glorat. In October 1817, Wilson bankrupted and the partnership dissolved.[16] Such then were some of the smaller owners and lessees of Campsie, the pattern of coal exploitation was probably a microcosm of the whole Glasgow region and is shown time and time again as for example in neighbouring Kilpatrick.

The Kilpatrick District.

The principal mineral proprietors of the Kilpatrick District were by the nature of the local geology confined to the Parish of New Kilpatrick, with the notable exception of William Dunn of Duntocher, and possibly Buchanan of Auchentorlie who may have had proprietorial rights to minerals below his lands.[17] In the Parish of New Kilpatrick, the principal families of Douglas of Mains, Colquhon of Garscadden and Killermont, Campbell of Succouth, and to a much lesser extent Glassford of Dougalstane all had some interest in minerals under their lands. Glassford's involvement is based on the tenuous evidence of his yearly distribution of considerable amounts of coal to the poor of the local parishes,[18] and some trials to the south west of Milngavie.[19]

The principal lessee of the district was William Atkinson, who worked his way up from the ranks having been an agent for the major

18th. century coal and limestone entrepreneur Messrs Glassford.[20] William Atkinson took over Glassford's empire assuming the lease of both Baljaffray and Lawmuir, and also Colbreggans, owned by Sir Archibald Edmonstone. Atkinson also held the benefits of lease of the minerals of John Douglas of Mains, and worked the area to considerable profit.[21] Success tempts others and even the few absentee landlords showed more interest in the local mineral wealth once it became obvious. David Turner who resided in Greenock, and owned land in Kilbowie tried to promote it for mineral exploitation at the same time.[22] Kilpatrick was in many ways the exact opposite to Campsie for instead of many mine masters as at the latter, there was seemingly only Atkinson holding leases from several landlords, and as a result he overstretched his resources. It is probable that arson and machine wrecking was the first financial blow, which was compounded by a fad for engine building which strained Atkinson's finances too far and he ended in bankruptcy in 1816.[23] His bankruptcy is of interest in that it introduced the lawyer Henry Gordon to the scene as one of the trustees. Gordon as a nephew to Glassford of Dougalstane, acquired the latter estate on the transfer of rights from the Glassford Family,[24] and it may be that he had acquired considerable mineral connections, if only in terms of assuring their legality.

In the aftermath of Atkinson's demise, the progress of mining slowed, but by 1823 Baljaffray was once again active.[25] The mineral wealth of the Mains Estate continued and was tenanted by Alexander

and George Dalgleish, with John Douglas as proprietor retaining an interest. In December 1823, the Mains Estate was offered for lease,[26] though the Dalgleishs remained till c1825[27] and after; for it was not until their Langfaulds Coal & Lime Works had been declared in favour of their trustees, that they had gone.[28]

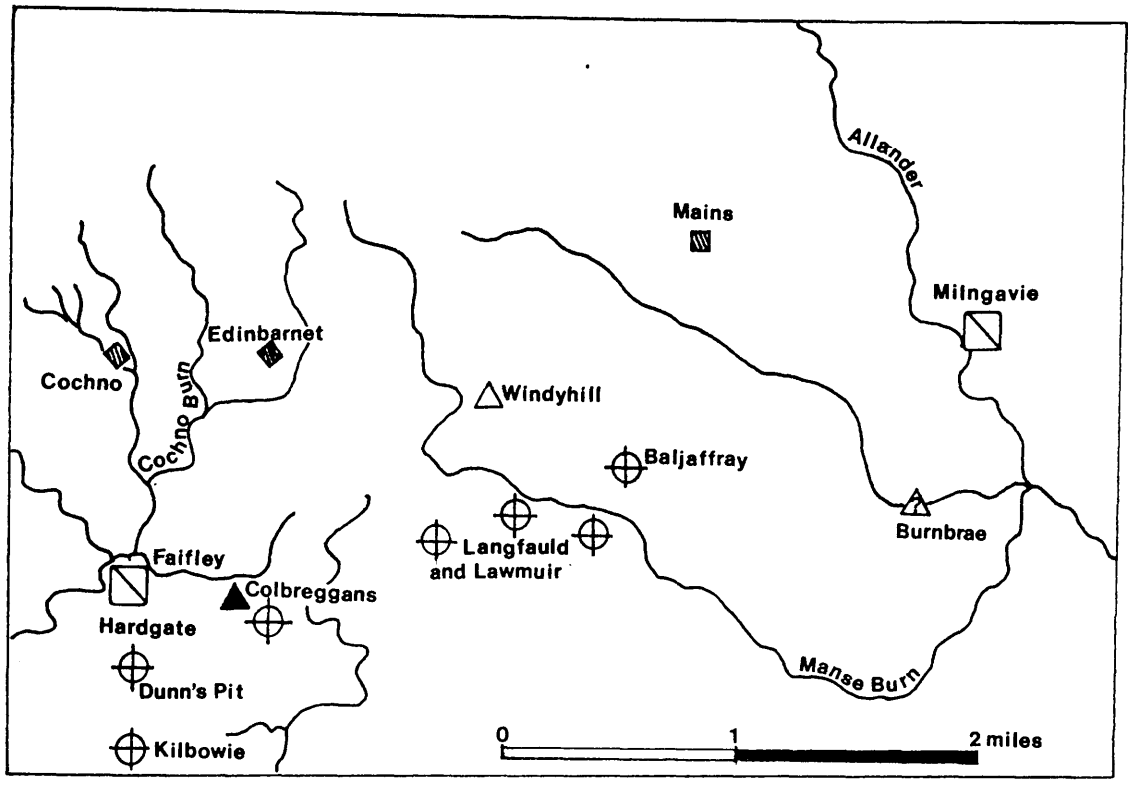
The other minerals master at this time was an industrialist named William Dunn, who held a wide range of investments mainly in the cotton and farming industries. Dunn held the Faifley, Hardgate and Milton Mills, by purchase from the Faifley Spinning Company, whose main mill at Faifley was steam powered, both Duntocher and Milton were in due course steam powered too creating a steady demand for fuel. Dunn held about 2,000 acres of an estate in the area, where again coal must have been in demand for he used it to calcine lime used both on his farms and sold locally. His foray into the brick trade would also have required coal for brick-burning, as would the Dalnottar Iron Works, also part of his empire. It was therefore little wonder that he took such an active interest in mining in the locality so as to fuel his diverse industrial interests.[29]

This high level of need is the common factor between Campsie and the Kilpatrick District and as a result there was little competition as there was opportunity for all, unlike the cut-throat existence of some other areas. Outside influence was minimal occuring only in shortfalls where industrial and domestic demand together exceeded local coal supply, as in the Kilpatrick District where domestic

demand had to be satisfied from collieries near to Glasgow. Industrial demand encouraged self sufficiency, as is seen in the collapse of the Irish limestone industry in Kilpatrick. Irish limestone was brought over to Dunglass in sloops in the early 19th. century and calcined in kilns next the River Clyde. The cessation of the trade came as local Garscadden limestone was exploited, for it could be processed and supplied far more cheaply than its Irish counterpart.[30] In turn this allowed the Kilpatrick District to become competitive with other limestone producing areas such as Campsie and brought the coal and lime merchants to the fore. Recognising the potential many merchants were attracted to the trade, which in its turn increased coal demand for calcination. Hence the internal nature of mining to these areas both for fuel and raw material for lime-works, for bleachfields, mills and printfields and then the infant chemical industry on the linking of copperas and alum ores to the textile industry and dye manufacturies, all in their turn created a need for fuel, and minerals masters joined readily in local industrialisation for it assured their own profits.

Both Campsie and Kilpatrick though old mining areas had never been wrought to the extent of districts closer to Glasgow. Mostly this was due to the low levels of communication before 1800 but as transport improved they offered new opportunity as areas which had enjoyed continuous exploitation became less viable. New and quite dramatic influences came to affect these long established areas, especially where they were in proximity to town. Surface land use

Figure 6.



Location map of Mining in the Kilpatrick District.

Key.

Centres of habitation and industries.

Local estate houses.

Locations where minerals may have been quarried.

Quarries often with additional mineral workings.

General area of coal and lime workings.

Note. Colbreggans was worked for both coal and sandstone. The white gritty sandstones were quarried and a coal occurring about 20 feet below was mined from shallow shafts. The location of Dunn's principal colliery south of Hardgate is conjectural.

Source. Based on maps of the British Geological Survey.

CLOUGH, C.T. et alia Geology of the Glasgow District. 1925.

is one example as Glasgow spread out over former muir land at every compass point but more particularly in the south of the town, a result being that attitudes to mining in these districts began to change as is traced in the following chapter.

References to: Chapter 3 - Influences on the development of the Campsie and Kilpatrick Districts in the early 19th. century.

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3. " 9 December 1813.
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5. Lennox Estate Papers. Relative to Hillhead Colliery. S.R.A.
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8. SKILLEN, Brian op.cit.
9. Glasgow Chronicle 30 January 1819.
10. " 30 September 1821 and Edinburgh Gazette 28 August - 31 August 1821 p.226.
11. Glasgow Chronicle 21 May 1822.
12. " 17 June 1819 and CAMERON, John Parish of Campsie. 1892.
13. Glasgow Chronicle 12 June 1827.
14. Glasgow Courier 25 March 1800.
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16. Edinburgh Gazette 25-28 November 1817 p.388.

17. New Statistical Account. VIII. "Dunbartonshire" 1845. p.23. and evidence of the field maps of the British Geological Survey. The presence of a pit for flax at Auchentorlie may have confused the issue of mineral workings close to the distillery.

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21. Glasgow Chronicle 8 August 1816; 8 October 1816. Edinburgh Gazette 13-17 March 1818 p.76; 31 March - 4 April 1818 p.97.

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24. New Statistical Account. VIII. "Dunbartonshire" 1845.

25. Glasgow Chronicle 8 October 1816; 28 June 1823; 6 December 1823; 7 March 1825; 11 October 1825.

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Chapter 4.

The evolution of the mining districts south of the River Clyde to the early 19th. century.

Some aspects of the Gorbals-Govan Coalfield.

The Govan collieries were sited immediately south of Glasgow in the Parish of Gorbals. Their proximity to town guaranteed their importance, as did the quantity and quality of coal found in the area. The pitheads' situation less than a mile from the bridging point across the River Clyde to Glasgow, favoured the mine's success in terms of seam access and much more importantly the immediacy of markets.[1] In turn this stimulated the exploitation of the area which originated in the Restoration and was well established by the middle of the 18th. century. The Gorbals-Govan coalfield was then the subject of many leases in various lots. In the period 1714-1731 Robert Dreghorn I (1680-1742) operated the collieries quite successfully under lease from the owners, then the Town Council, the Trade's House, and Hutcheson's Hospital.[2] Dreghorn was putting out almost 20,000 loads of coal annually to satisfy a demand which in turn encouraged yet more leasing. By the mid 18th. century Robert Rae the proprietor of Little Govan realised £10,000 on the sale of mineral assetts, pointing as to how valuable the area had then become. The coal was worked by a plethora of small time coal masters, such as John Geills.[3] The value of Rae's minerals was recognised by others, especially for pecuniary gain. Rae's

neighbour John Anderson advertised the merits of Rae's minerals as an incentive to investors in his own lands which lay to the rise of the Govan Coalfield.[4] By 1766 the Gorbals-Govan coalfield was in the hands of a mercantile partnership featuring Colin Dunlop, Alexander Houston, merchants and Gabriel Gray, Provost of Rutherglen, together with land owner and minerals master James M'Nair of Greenfield in the Barony.[5] Colin Dunlop and Alexander Houston were the driving force, organising the delivery of coal to town and the Broomielaw where it was sold at 2/1d. per cart. Typically Little Govan had its town agencies, in 1766 Robert and William Knox fulfilled this duty.[6] Ivor Campbell also fulfilled a similar role at the Govan Coal Work Office in Glasgow, together with Alexander Nisbet at Knightswood in 1774.[7] Messrs Colin Dunlop, Alexander Houston, Gabriel Gray and James M'Nair, were all involved at Knightswood at this date and strong managerial links were forged between Govan and Knightswood, especially with the interlocking business interests of the Dixon Family in coal, glass and iron. John Dixon I was a well established coalmaster at Knightswood by 1790 with connections to the Dumbarton Glass Works.[8] These were typical "establishment groups" the varied commercial, land and mineral interests transcending the locality of the pit. In the instance of Govan this was reinforced when c1790 the colliery was leased

by Lieutenant-Colonel Andrew Houston of the West Indies Merchant House of Alexander Houston & Company, and by Colin Dunlop's son James Dunlop. This created continuity together with fresh capital, a tool with powerful influence as in the Glasgow Coal Company of 1790, when Govan alone accounted for a quarter of the production quota of the cartel: this being 50,000 carts per annum out of 200,000 carts.[9] After Dunlop's bankruptcy in 1793 Andrew Houston was joined by Houston Rae, also of Alexander Houston & Company. Duckham points out that Rae probably provided the necessary additional capital to retain the solvency of the colliery during the economic stress of the late 18th. century.[10] Yet in the closing years of that century the Govan Coal Company profitted of £10,166 9s. and the lease itself was valued at £30,000 by William Dixon, the manager, and John Boyd, the book-keeper.[11]

William Dixon I (1753-1822) was successively manager, partner and then owner of the Govan Colliery. Dixon had gained considerable experience, from his arrival from Tyneside c1771 to take up the post of colliery manager at a pit near Ayr.[12] He had also been a partner in the erstwhile Elderslie Coal Company, which had had strong connections to Knightswood and the Dixons there, and also a minerals master in the Monklands District. The question immediately arises why was Dixon so intent on extending his bases of operation when he had an assured job at

Govan Colliery? Career decisions are hard to evaluate other than in an historical context and there were two major factors. The first of these was that Dixon well understood and appreciated the market opportunities presented with increasing demand for coal from industry. Secondly, in his managerial role at Govan he must have appreciated that coal reserves were limited after nearly two centuries of operation. This common factor probably affected many of the old collieries by that time, hence coalmasters such as Dixon were turning to the relatively unwrought coal seams of the Monklands, a decision which was clearly enforced considering the physical state of the old Gorbals-Govan coalfield, revealed in a survey carried out in 1801.

The Gorbals-Govan Coalfield in 1801.

The 1801 survey was carried out by Stephen Moore, a highly experienced "viewer" of many years experience which included service under the Dixons at Knightswood and the management of Barrowfield Colliery.

Stephen Moore's report gives a highly detailed account of the problems that were facing the old Govan coal workings by that period. Moore pointedly stated that the coal workings were nearly exhausted and that there were significant problems to the then further exploitation of the coalfield.[13]

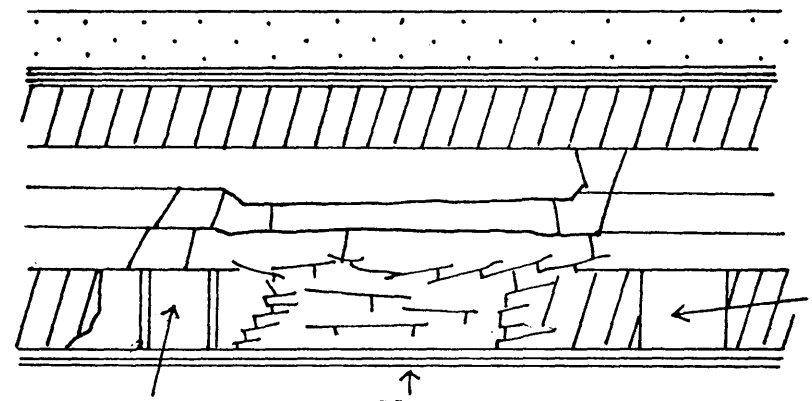
Moore described how there were six seams running below Gorbals Muir, the upper four being close to crop and the bottom two cut off near Coplawhill. The upper seams had been worked near to exhaustion and only about 20 acres of coal on the lower seams was left below Sandy Acre and Holm Park. This comprised the Low Ell Coal, a splint coal of about 3½ ft. thickness and a free coal of 6½ ft. thickness which was called the Low Main Coal. The two seams lay about 10 ft. apart with the intervening ground of clay, ironstone and shale; as a result the upper of the two seams had practically no floor and the lower seam no roof, which made their working very difficult. (see accompanying Figures 7.1:7.2 p.64-65).

Dixon derived a method of working not unlike longwall. The lower seam was worked out first and the intervening ground between allowed to fall down into the goaf of the lower seam. Once this had settled the miners returned for the upper seam and worked it out. The upper seam had a following of loose strata and after that a freestone for its roof, but from the great height of the excavation below, between the two coals, the roof was totally unstable, and the coal pillars left in for support were not adequate. Dixon had as a result the greatest of difficulty in keeping the mine open with the constant need to maintain passages and air courses as series of underground collapses took place, threatening the very survival of the mine. Moore comments how the mine workings were falling in at the very heels of the miners as they worked along the seams. In turn this contributed to surface damage and Senex notes how badly subsided much of the

Figure 7.1.

Diagram Illustrating the Method of Working Seams Below Gorbals Muir.

Section 1: Working on the Lower Seam, Gorbals Muir.



Not to Scale.

Key.


Coal Seams.

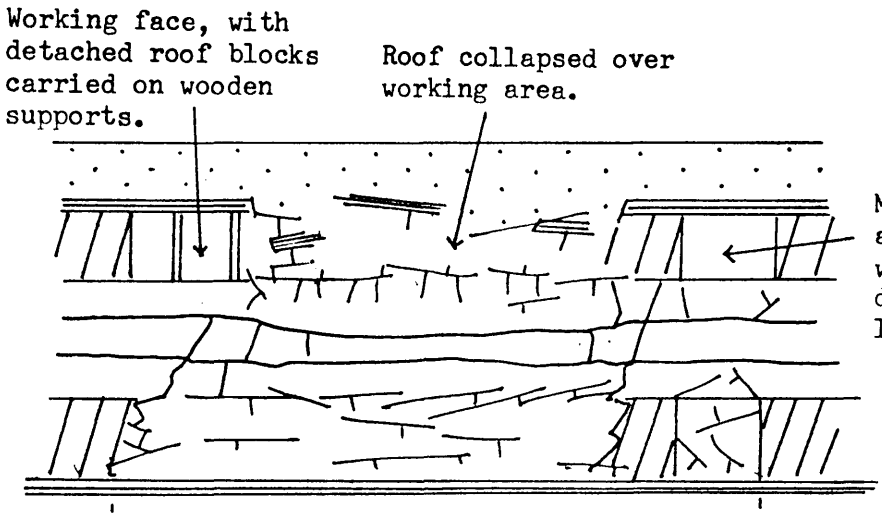

"Following"


Clay, Ironstone and Shale.


Freestone.

Figure 7.2.

Section 2: Working on the Upper Seam, Gorbals Muir.



Area of increasing instability due to fall of roof of lower seam in to the goaf and migration up through middle seams lying immediately above. This then followed by the fall of the roof of the upper seam in turn in to its goaf, being followed by the following seam on occasion. Alternatively the collapse of the whole working through support pillars being driven down into the loose "floor" strata by the weight of overlying strata, thus causing a "sit."

Source: Figures 17.1:17.2 were derived from the physical description of mining provided in SRA DTC 6/414/6.

Gorbals-Govan coalfield was even in his day, remarking that Dixon bothered little with roof support.[14] This in its turn meant little forward planning and a lack of good records as seen when the Govan Coal Company hit wastes near Holm Park. The wastes had been badly flooded and once the water was run off the result was a series of sink holes in Craig Park. This was evidence of extensive former workings, which the miners had not bargained on, suffice to say they were running blind. This is seen again with the working of the Causeywayside Pit, where when the Ell Coal was reached it was found to be worked out and only a piece of the Main Coal remained. This of course had been robbed of its support by the method of working already described and the miners had the greatest of difficulty in getting it out. Moore remarked that it consumed more wood and labour than it was worth. In any case it was cut off from other workings and fresh coal by a major fault line, which brings into focus another problem which beset the Govan Coal Company. The coalfield was much troubled by faulting, the coal in places being thrown up or down from 18-72 ft. on occasion. The Sandy Acre Pit was similarly affected, its old workings wrought out and access to new coal cut off by a faultline. At least in this instance the Ell Coal was still accessible and expected to yield coal for a few more months.[15] Thus in 1801 the old Govan Colliery was on its last legs, of the four pits open for work only one had any promise according to Moore's report and the future must have looked very

bleak indeed. This is the reason why the operational base was expanded, why Dunlop, Houston and Dixon were moving southward to Crosshill and eastward into Hutcheson and Hangingshaw. Dixon for his part expanded his own interests in Monklands, a form of surety which guaranteed seams then little exploited and customers in the form of local ironworks and others. Dixon and Creelman formed the Calder Coal Company whose chief customer came to be the Calder Steel & Iron Company, formed by the Glasgow merchants David and Alexander Allan, together with David Mushet and James Burns in 1800. Mushet's discovery of blackband ironstone in 1801 attracted Dixon's attention and on the failure of the iron company in 1804 he promptly bought it out. Appreciating the potential value of the coal-measure iron ore, for it provided the two raw materials of iron making together, Dixon formed a new partnership with Creelman and Mushet as the Calder Coal & Iron Company. In turn this dissolved in dispute but it did allow Dixon to strengthen his hold on mineral investments. By 1807 Dixon alone owned Calder and he continued to develop both mineral extraction and iron making to become a coal and iron master of considerable consequence, especially as in the former case at Govan. He had chosen to invest heavily in the Govan coalfield and to reduce his involvement on Gorbals Muir, which by 1804 he informed the Town Council was worked out.[16] Certainly by that time the level of exploitation had so increased on the eastward part of the Gorbals-Govan coalfield, that its turnover during

the two years 1804-05 exceeded £24,700. This period of Govan's operations has been analysed by Payne, though the principal points may again be stated.

The Govan Colliery, 1804-1810.

In the period 1804-05 the Govan Collieries' employed about 137 workers, of whom 50 were experienced miners, 48 oncost labour, 14 crafts and 25 carters and others connected with distribution to markets.[17] They worked in four pits of which the most important were the Corner and Firrs pits. The other two were known as Bankhall and Gilliesink. The manner of working and depths of the coal seams led to considerable organisational differences from pit to pit. Bankhall pit which was worked room and stoop employed only 8 miners whereas Firrs Pit, which was worked on the long wall system employed 24.[18] Long wall by which the coal was extracted all at once was by far the more economic method and was applied to all pits other than Bankhall.

The market served was then predominantly domestic, with sales peaking in winter months. In the summer months coal was stockpiled for poor winter weather made exploitation so difficult that pit head prices fell just as coal prices on the market were at their highest. Seasonal distribution difficulties simply meant that the collieries could not benefit from this rise. William Dixon then maintained a force of 14 to 18 carters to take his coals to market. The maintenance cost of horses was minimised by growing a large proportion of their fodder at the Govan Colliery Farm.[19]

Most of the coal taken to town was distributed through Andrew Houston, partner and coal agent for the Govan Colliery, who also held the advantageous post of shore master at Broomielaw. The wharfage at Broomielaw became a first stage for the distribution of coal both coastwise and foreign, especially with the transfer facilities at Dunglass. Coals went to Ireland, America and the West Indies and Payne suggests that the special cwt. sacks of coal prepared for Robert Bogle & Co., were bound for Jamaica.[20]

Over the two years of Payne's study 45% of coal output locally sold went for domestic use, 25% to general merchants and 10% to manufacturers. Perhaps 20% of coal was sent to local towns along the River Clyde, or across the sea to Ireland. The local industries using Dixon's coal included William Dudgeon, brickmaker at Hangingshaw, and R.B. Niven & Co., soap and candle makers, of the Gorbals and Trongate.[21]

The contemporary favourable market situation of Govan contributed greatly to its success. The boom inaugurated in coal mining carried Govan on for a few more years, before a sudden fall in prices forced the colliery onto the market in 1810.

The Sale of the Govan Colliery Estate in 1810.

The sale of the Govan Estate in 1810, was divided in eight lots, which included local mineral lands, farms and quayage at Broomielaw, Kilpatrick and Paisley. The lots were as follows:

Lot 1. Govan Estate.

Coal and ironstone in the lands of little Govan, Polmadie,

Shawfield, Rutherglen Muir, Bencathhills and Blackfaulds, in all about 700 acres, held under a perpetual feu granted in favour of the Govan Coal Company by Houston Rae. Feu of £473 payable to superior after 31 December 1809 for 65 years and at the expiry of that period the feu duty ceased and thereafter minerals held for a 1d. Scots for duty. Entries of heirs were similarly taxed and there were privileges of access and for sinking.

Lot 2. Govan Estate - Hangingshaw.

Coal and ironstone in Hangingshaw held by heritable right and not subject to rent or feu duty.

Lot 3. Govan Estate - Crosshill.

Coal in lands of Crosshill held by lease dated 17 February 1770 for 99 years after 1 October 1768. Rent 2d. Scots per annum.

Lot 4. Govan - Coal Yards.

Ground at side of the new coal road at William Scott's garden, reserved for coal yard, and another piece feued from Robert Thomson, near the River Clyde for a coal yard.

Lot 5. Govan Estate - Paisley.

Coal quay with a grieve's house in Paisley, held by feu right from the Abercorn Family for payment of 2/6d.

per annum with duplication at entry of heirs and a quarter of the rent for the entry of a single successor.

Lot 6. Govan Estate - Dunglass.

Tack right of coal quay at Dunglass Castle with adjoining property. Held by tack from Sir Archibald Edmonstone for 76 years after Martinmas 1784. Rent £10 per annum.

Lot 7. Govan Estate - Farm.

Tack right of the colliery farm at Govan of 110 acres, held by tack from Robert Houston Rae for 80 years from Martinmas 1794 and expiring Martinmas 1874. Rent £300 per annum.

Lot 8. Govan Estate.

Lands of Hill in all about 17 acres 1 rood, under lease from Robert Houston Rae for 74 years after Martinmas 1800.

Source. Glasgow Courier 8 September 1810.

The tactical leasings revealed in the above illustrate how Dunlop and Houston had expanded Govan's sphere of opportunity, together with the management task confronting Dixon. The leasing of wharfage at Dunglass and Paisley show the expansionism, for Dunglass opened the way to foreign coal markets and Paisley provided a market for surpluses.

Dunglas provided a transhipment for the shallow upper river craft and their cargoes to ocean going and coastwise craft. The wharf at Paisley was on the River Cart and it was only with the opening of the Glasgow, Paisley & Ardrossan Canal a year later that Dixon got a real hold on the Paisley trade.

The influence of the Ardrossan Canal on the Govan Colliery.

The Glasgow,Paisley & Ardrossan Canal had found its roots in the idealistic dream of the 12th. Earl of Eglinton to create a a sea port for Glasgow at Ardrossan. Two surveys by John Rennie in 1800 and by Rennie and Ainslie in 1804 sketched out a route which was modified by Thomas Telford in 1805.[22] It was at that date the first real links to the Gorbals-Govan coalfield emerged, for the scheme's original course took it across the coal-mining and quarrying belt to Eastfield. There were howls of protest from the land-holders, such as Moses Steven, and only the proprietors of Govan Colliery appear to have taken any interest in the canal's future. This is hinted at in the scheme for a tramway from the canal basin at Port Eglinton eastward along the canal's former proposed course to Eastfield. The Canal Company's Minutes state that a survey was to be made by Messrs Telford and Howell, and bluntly that the tramway would not run beyond Govan Colliery unless the Eastfield minerals proprietors were prepared to finance it.[23] It seems that financial assistance had been promised by the Govan Coal Company, and once the canal was opened in October 1811 to Johnstone, Dixon did indeed make use of it.

It now becomes possible to appreciate why Govan was such an attractive option to the owners' combine of 1813, which bought it out as one of its first actions. Govan close to town and river transport and with a blossoming canal terminating almost beside it, offered market opportunities seldom seen previously. As Dunlop said:

> "It became necessary to purchase Govan because it has so much the superiority of all the works in points of situation, that in the hands of a man of capital and interest it will knock them all out."[24]

The price paid was £30,000, and the purchase effected on 26 August 1813. William Dixon, the manager of the old Govan Coal Company, took up $^{4}/_{9}$ths in his own name, but the remaining $^{5}/_{9}$ths were taken up by the other committee members divided into 331 shares, and taken in proportion to their interest in the trade.[25] Dixon was the dominant part of the partnership, which included Robert Gray, James M'Nair, James Farie, Colin Dunlop and James Sword.[26]

Dixon increased his command of Govan by acquiring much of Colin Dunlop's holdings as for example the coal basins at Port Eglinton in 1816.[27] The Minute Books of the Canal Company invariably mention Dixon in relation to Govan and it is clear where management lay at that period. The Canal Committee was happy to entertain such an important customer though not to bow to Dixon's every whim. In early 1817 with a good stockpile of

coal on hand, Dixon took advantage of a cold snap to reduce the price of coal sent along the canal, hopefully to stimulate sales in Paisley. In case it failed to have that affect, Dixon had a meeting with the Canal Committee to ask them to reduce the tonnage paid on coal sent along the canal. This would have meant that any short fall in money from reduced prices would have been covered at least for Dixon by cheaper transport costs. The Canal Committee agreed to a tonnage of 1½d. per waggon of 24 cwt. in place of the previous 1½d. per ton of 20 cwt. But this was only if Dixon employed an agent of the Canal Committee's own choice in addition to the already existing agent, to dispose of the coals. The Committee conceived of the idea that employing two agents would increase coal sales so as to make up the difference in canal carriage rate.[28] It is unlikely that the move was in anyway cost efficient as it necessitated an additional waged member of staff, but the result is unfortunately not recorded. However it is very clear that what business the Canal Committee had with Govan was always transacted with Dixon.

Once Robert Gray, James M'Nair, James Farie, Colin Dunlop and James Sword, sold their shares to Dixon on 3 July 1819, then he became sole proprietor with his son William II (1788-1859).[29] Both continued to exploit the canal as a trade link, which is shown by the development of the Port Eglinton sales point. When Dixon senior died in 1822 he had become one of the foremost figures in the Scottish coal and iron trade.[30]

The Govan Colliery, 1822-c1830.

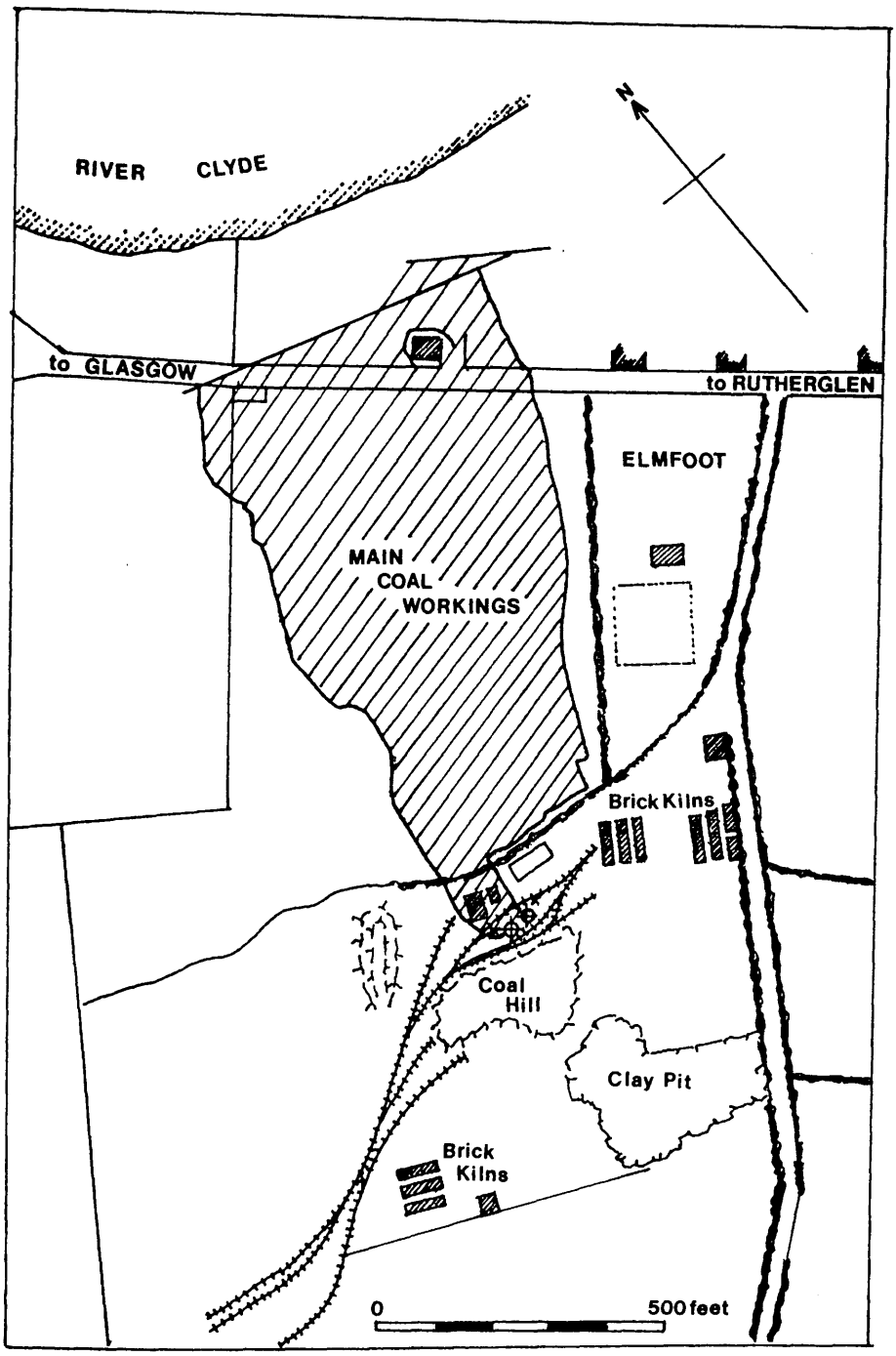
When Dixon died his estate was divided between his sons John and William II. John who had little love for the iron trade surrendered his option to William.[31] William shared his father's business acumen as evidenced from the fact that the colliery shipped 283 vessels of coal at the Broomielaw from March 1822 to March 1823; with an average tonnage of 50 tons per ship this works out at 14,150 tons of coal. Again there was the spread of business interests for example into brick making,[32] as the demand for building material increased with the feuing of Gorbals. Similarly a much greater interest was taken in neighbouring coalfields, such as Strathbungo, the leasing of which was managed from Govan.[33] The distribution points were augmented, the Canal Basin Sales Book identifies almost 30 regular customers, which included the Royal Bank of Scotland, presumably for its office fires.[34] It may be noted that the 30 or so customers identified in the Canal Basin Sales Book were all Glasgow based. This was presumably due to the opening up of the River Clyde allowing sizeable ships up river to the Broomielaw. There they could be loaded in one go and the extra distance they had to travel was less of a handicap for coal traffic than the double transshipment from canal to other modes of transport involved in the canal route. The opening up of the Clyde challenged the canal's principal reason for existence and ensured that its use to the Govan Colliery would thereafter be restricted. By the late 1820s the Canal Basin was only a local

sales point, for by 1831 Dixon had established a much larger coal yard close to Gorbals Church Yard, on the doorstep of the developing new town. It was linked directly to the colliery and Govan coal could then be easily brought to the yard and then barrowed to town and hawked through the streets of Glasgow, which had always been its main customer.[35] (The pit head development of Govan Colliery by mid century is illustrated in Figure 8).

Patterns of change across Gorbals Muir, and beyond.

The development of Govan during the first thirty years of the 19th. century eclipsed Gorbals Muir. The old mineral workings both of Gorbals and the areas south, gave way before the residential and industrial expansion enjoyed by Glasgow at that time, it was no longer a case of simply mining but mining in relation to all that developed around it. Tradeston and Hutchesontown arose from the feuing proposals of the Town Council, Trade House and Hutcheson's Hospital Trustees. They realised that their proximity to the expanding town offered the possibility of increased revenue from house building and feuing in preference to the then mineral rents. Coal rents were low, taking for example the 600 acres of Govan, Polmadie, Shawfield and Rutherglen, the feu value in 1800 was £1,600 whereas coal rents were just £473. Surface values were far higher as for example where if each acre of Hutchesontown offered for building had been taken at £20 per acre it would

Figure 8.



The Govan Colliery Pit Head, c1850.

Source: Based on mapping carried out by Neil Robson, in 1842, and on mapping by Thomas and William Kyle, in 1853.

have netted £2,000. It was therefore little wonder that contemporary newspaper advertising was stating that there were on:

"the Estate many beautiful situations for villas, and the whole is conveniently situated to be feued to great advantage for manufacturers."[36]

Houston Rae of the Govan Colliery, Archibald Grahame of the Thistle Bank, and William Dixon, all with mineral interests and well aware of their potential value, acted as estate agents, emphasising the increasing surface values of land in proximity to Glasgow.

This is not to deny the fact that there was still considerable interest in the presence of any workable coal in proximity to Glasgow, and a committee was soon appointed on behalf of the Town Council, the Trades House and Hutcheson's Hospital, to report back on the state of mining in the Gorbals area.[37] That they reported back in favour of lordships rather than rent, hints at the state of then existing mining, for the lordship at least ensured an income from whatever minerals were raised, and thereafter they were an accepted part of the leasing in the area.[38] In an attempt to find a workable seam, Andrew Paton was appointed to bore for coal around Docanyfauld, close to Gorbals; trials which were financed in respect of the landowners' surface interests. The Town Council held ¼ and the Trades House similarly ¼; whilst Hutcheson's Hospital held a ½ share. The bore was a total failure and because it was in the Town's lands, Paton billed them for £17 14s 2½d.[39] This was paid off and

it would seem that any further trials would have been financed by the others, the Trades House or Hutcheson's Hospital, but these did not take place.

Hutcheson's Hospital Trustees' lack of interest may be explained from their surface interests, particularly west of Docanyfauld in Stirlingcroft and Wellcroft. There the surface interests had been held by Andrew Houston of Jordanhill and James Dunlop, passing via Andrew's eldest son Hugh Houston to William MacDowall of Garthland and Robert Houston Rae of Little Govan in partnership with James McDowall, a Glasgow merchant, for feuing. The influence of such prominent feuars would have dictated against local exploitation, and though each was involved in mining investment elsewhere there is nothing to link them to the minerals of Stirlingfauld, perhaps it was surface investment for building feus in the light of Laurieston, certainly the minerals were reserved in later feus, suggesting some concern for surface use.[40] Laurieston was the ambitious plan of David Laurie, who feued 47 acres for residential dvelopment, including Stirlingfauld and Wellcroft after the Houstons' withdrawal. Acquired 1801 to 1803 it was though some 30 years before building spread southward of Carlton Place. It may well be that this was a conscious decision to allow consolidation of ground in the area.

The division of feus for surface land use were often in complete opposition to the interests of mineral tenants.[41] This is seen when the Gorbals coal lease expired in 1805 and the Town Council found

itself bound to pay a claim for damages to its lessees, this being for damage done by water entering into wastes from a hole in the Town's Quarry at Cracklinghouse.[42] The fact that the freestone quarries were leased separately raised the ire of Messrs Gray and Dixon of the Govan Coal Company, alarmed over the possible flooding of their workings.[43]

The lands and mineral rights were held pro indiviso[44] until 1810 when there appear to have been some divisions of interest by surface ownership. However, the four lots of the Barony of Gorbals remained as they had done in 1803, with Hutcheson's Hospital holding a half and the rest divided between the Town and the Trades House, the mines and minerals were reserved cumulo subject[45] to all those concerned.[46] But by 1820 there was a change in attitude to minerals exploitation particularly with the growth of Laurieston and feuars' rights and particularly their influence. It would have done the landowners little good to have offended prominent merchants such as William Lockhart of the East Indies Company, or Dugald Patterson, Cotton Yarn Merchant in Glasgow, thus minerals became subject to surface use. There was a general cessation of rights to minerals in preference to surface use, particularly in Tradeston, where a horse barracks was planned. This was a result of the fear that the damage to surface buildings that might have resulted from such workings would have cost more than any possible rent from the mines.[47] As a result the mine workings of Gorbals Muir close to the River Clyde ceased, and the city became dependent on outlying collieries for its

coal supplies. This was of course not economic and it is one reason for the enthusiasm with which Nimmo's workings of Hozier's mineral estate of Barrowfield, was received; similarly with Wilson of Hurlet and their mining of Playfair's minerals under Dalmarnock.[48]

Building activity across the Gorbals Muir from the first terraces by the river, intensified from 1818, but the general development of the area did not contribute to its prestige and as a middle class development it was socially disadvantaged by the invasion of industry such as brickmaking in advance of the building line. Ineffective regulations against industry could not save property values and though sasines might forbid smoke,[49] the increasing demand of building made clay grounds desirable and brickburning too common for a clean atmosphere. As a rising industry it proved attractive even to established coalmasters such as Dixon who encouraged brickmaking at his Govan Colliery.[50] The building trade also influenced the extractive industries of Renfrewshire, and once limestone was recognised not just solely as a manure but also as a medium for cement, this industry blossomed. Lime works such as Arden and Darnley grew in importance attracting small merchants who often took leases for long periods. James Fleming was one such person, holding Arden and Darnley on lease from Maxwell of Pollok for two decades.[51] Similarly Matthew Spreull served the Paisley building trade for many years from his Stanely limestone workings.[52] Limestone workings needed coal and this in turn encouraged the growth of coal mining in the area. William Wilson's Cowglen Colliery,[53] and Alexander Graham's Cathcart Colliery,[54]

both served local lime works. The immediacy of markets encouraged proprietorial interest in mining along with other industries as each part could be made to serve the other, and complex local economies began to appear. An example is seen in the many interests of Maxwell of Brediland, who was first involved in quarrying for local building stones, then turned his attention to proving coal below the quarry which was successful, and in 1822 it saw its first use in another of his proprietorial interests, the Brediland Pottery. This cane ware, lustre and brown ware manufacture, served the locality and Paisley. The good local clays also proved good for brick making, which the local coal could be used for burning, and Maxwell held several closely knit industrial units for many years.[55] Demand brought an expansion in mining and increasingly co-partneries formed to work the local minerals, some successful as at Colonel Fulton's Hallhill Colliery, near Corseford. There were others that were less so as with the dissolution of James Nimmo's partnership with John Brown in the Williamwood Coal Company, which ceased on 18 May 1824.[56] Nimmo was also involved in the Barrowfield Coal Company and it may be that his resources were over stretched, so that the decision was made to concentrate on Barrowfield alone, when market opportunity increased. This occurred with the cessation of collieries on Gorbals Muir and the problems of some of the eastern pits, and the increasing dependence on mining at a regional level for Glasgow's coal supply.

What conclusions can be made about the evolution of the south bank mining districts? The most striking is the phasing of exploitation across the whole area, and the power groups involved. The level of experience at management level was notable with men such as Dunlop, Houston, M'Nair and latterly Dixon already experienced both in the west of Glasgow at Knightswood and to the east in the Barony. The interlocking business interests of all concerned meant that opportunities could be taken to expand when they arose as there was always the financial base on which to rely. This could take the form of another company such as Alexander Houston & Company, and this again is a point of note, the long connection between the Houstons and Govan. In turn this led to a continuity of purpose and experience that contributed to the success of their ventures, for even where bankruptcy loomed there were new sources of capital on which to rely.

The Houstons' Govan interests bring out one of the most important patterns to emerge in mining by the early 19th. century. This was that mining was in the hands of financiers and experienced minerals masters, who had built on decades of experience. Mining had moved from the time when even a little capital invested could bring profit, to a much extended financial base. It had become big business due to the building

of a financial structure around it by the Tobacco Lords and other colonial merchants. The keywords were money and organisation, both of which laid the solid foundation of an extractive industry able to respond to the industrial needs of an increasingly commercialised community.

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Chapter 5.

Early 19th. century mining in the Eastern Districts.

Merchant influences.

Patterns of exploitation in the districts east of Glasgow were firmly rooted in the late 18th. century, and though technically little different from elsewhere, they were subject to far greater mercantile influence. The realisation of mineral wealth in close proximity to Glasgow had made it an attractive investment opportunity and unlike mining districts such as Kilpatrick or Renfrewshire where

merchant influence over proprietorial interest only began in the 19th. century, the eastern mining districts were already dominated by mercantile families.

The continuity of merchant influence on mining is illustrated by the speed with which neighbouring mineral territories were bought up. James Hopkirk, the merchant proprietor of Dalbeth is a good example. Hopkirk worked the coal and readily extended the boundaries of the paternal estate by purchasing portions of adjacent lands as they came on the market, for:

> "all the adjoining lands were full of that mineral [coal]...a source of much emolument to the several proprietors, during many years." [1]

James Hopkirk added to his property on the bankruptcy of his neighbour and fellow tobacco merchant, Archibald Smellie, during the American War.[2] Smellie had worked coal and Hopkirk's purchase allowed mining to continue. Mining was an economic asset and James Hopkirk joined Andrew Buchanan of Ardenconnal, William French, John Campbell of Clathic, George Coats, and others of whom James Dunlop was the outstanding example in purchasing territory in mineral rich north Lanarkshire.

Longevity of influence is also shown, for example by the Grays of Carntyne, who by the 19th. century had held Carntyne for c300 years, Tollcross even before that and Dalmarnock from c1678-1784. Thus by the 19th. century minerals were held by the eighth Gray in

succession and it was only on the cessation of Westmuir on account of flooding and late 19th. century feuing,[3] that Grays bowed out from the extractive industry.

Considering all of the above the widespread nature of mercantile influence was considerable. Unlike John Douglas of Mains or Maxwell of Brediland who only held sway over their own patch, the eastern mining families such as Gray or Hopkirk came to influence mining at a district and then regional level. It was from the eastern mining district that much of the influence on mining development in 19th. century Glasgow came.

Successful mining was sustained by exploiting low overheads of existing plant and existing trends. Mining merged into the 19th. century much in the pattern of the previous century's closing decades. Merchants had the credit and connections to maintain a form of status quo. But dislocation came too easily either from the failure of secondary investments already demonstrated with Milligan and the Green Coal Company, or for other reasons -- principally the ruthless geological environment where capital intensive specialisation could become suddenly necessary to maintain operations. Perhaps for these very reasons some companies which had bridged the divide of the centuries suddenly found themselves in difficulty. McAlpine, Brown Company, who had traded as the Netherfield Coal Company, Haghill, failed in May 1800.[4] Its demise was soon followed by that of the powerful Westmuir Coal Company and the sale of its extensive assets.

These included Nether Carntyne, Parkhead, Wester Shettleston, and parts of Camlachie, Whitecrosshill, Gateside, and Crownpoint, in all about 130 acres.[5]

Why did these companies fail? It may be that they could not easily compensate for lower returns from failing seams by cutting operating costs, for these would have increased in an effort to get at the coal. That the sale of Netherfield included the pit timbers suggests the total cessation of mining probably on account of inaccessible seams.[6] It is likely that a number of these older collieries were near the end of their economic lives. But it may have been a failure or death in the partnership which brought problems. Netherfield included a woman, Janet Hamilton, with Walter McAlpine and John Brown, the coalmasters, in partnership to distribute the company's assets to creditors. This suggests she controlled the division of the estate of a deceased partner as an adjudging creditor. The probable senior partners of the Westmuir Coal Company also presided over its disposal, these being the merchants Archibald Wallace and Gilbert Hamilton, with Robert Gray who held the proprietorialinterest, suggesting that dislocation had come from some other quarter within the partnership.[7] The level of limited liability within companies of that time is open to question.[8]

Credit was of consuming importance in partneries and the collectors of debts often took a direct role in mining, or were closely linked to

the industry through investment. Gilbert Hamilton is the prime example but such people also included the small men such as John Mennons, as often as not with some previous proprietorial interest in mining. John Mennons became the debt collector for the Eastmuir Coal Company on that partneries collapse in 1806.[9] He then joined with McLuckie & Company to finance further the operations in that area. This continued to Mennons' own sequestration in 1808.[10] Why Mennons who was really a printer and publisher by inclination ventured back into the coal trade is not clear. His previous experience of mining had been during his brief ownership of Jeanfield from c1790 to 1798 during which times pits were in operation on the estate. Perhaps it was an investment to finance his other business of printing.

Mennons sold Jeanfield to John Finlayson in 1798, a brother in law of M'Nair of Belviedere who was also involved in the extractive industry. This brings out an important aspect of mining in the eastern district, investment purchases and the merchant family links which were often forged in the interests of business. Jeanfield remained in the Finlayson Family hands for many years, Robert Finlayson still having a proprietorialinterest in mining in 1821.[11] Inter-connections between families, estates and business interests increased in the early 19th. century. Another example is that of Barrowfield.

Aspects of the Exploitation of Barrowfield.

The failure of the Orrs c1791 [12] had seen the cessation of all workings for a short period, this is hinted at in that the coal tacks for the whole area were all offered at the same time in August 1791. The areas were Mountainblue, Fordneuk, Middle Park, Burn Park, Well Park, Rounfauld, Stabtree, Dovecotte, Langlees and Willowgate Parks, in all about 100 acres. The coal seams worked were Upper; Ell; Main; and Lightburn Hard and Soft Coals.[13] The leases were half yearly hinting at trials rather than purposeful workings, but the proximity of the coalfield to Glasgow still instilled great interest as shown by David Dale's acquisition of coal in the area in an attempt to keep down coal prices in Glasgow in 1792.[14] The minerals interest is also shown in the joint proprietorship of Barrowfield and Camlachie, by John Dunlop and Robert Scott, the former an avid purchaser of mineral lands to gain control of supply and increase his influence. Dunlop's failure saw his Trustee Gilbert Hamilton, both an agent of Carron and a coalmaster of some import, convey half of Barrowfield and Camlachie properties to Archibald Grahame, a writer, and then partner in the local Thistle Bank, a Glasgow banking house which was to have some influence in the fortunes of Barrowfield.[15]

Robert Scott who was also a writer, pursued in partnership with Grahame a policy of feuing. This policy is seen in the sale of the colliery's equipment in 1801. The sale included an 18½ in.

cylinder steam winding engine, and a larger 22 in. cylinder engine for pumping; also included were 120 ft. of 8 in. pumps, about 12 pit cylinders giving a total shafting of 60 ft. and Elm sheeting piles. The latter items all point to the problems experienced in drainage and working in the soft thin sands and muds of the area, suggesting that surface land use might have been an attractive option to the problems encountered below ground.[16] However, only one feuar Duncan M'Callum, a Glasgow land measurer, appears to have built on speculation, erecting a few villas in 1802-03. The other feuars, James Baird and Alexander Clark, both Glasgow masons, appear to have done little on their feus, and the same may be said for John Finlay, lime burner in Cathcart.[17]

When in 1806 the Barrowfield Estate came up for sale mining was still dormant, and a clear idea of land use in the area may be gained from the lots for sale. There was the Mansion House and the Farm of Barrowfield, including Rounfauld which was partly feued, similarly with Stabtree, but Fordneuk and ground owned by John Agur were open land. This was probably then in trust if the John Agur referred to was the brick and tile maker of that name, who had died a few months previously.[18] There was also interest shown in local clays for the large brickfields of Samuel Coulter and Richard Bell were adjacent to Agur's former property.[19] Brickfields would have found an immediate local demand with building in Calton and the Burgh Lands. The sale included the ground rents of the Burgh Lands, feued to

messrs James Baird, Duncan M'Callum and James Stewart. Part of this area was held by the nursery gardeners James Findlay and Robert Yool, similarly Gateside was owned by the gardner and nurseryman William Cowan. John Neilson owned land in both of these areas and the basic picture is one of open land, nursery gardens, villas and the mansion house. Industry was represented by the brickfields and the Barrowfield Mill by Camlachie Bridge; mining is notable by its absence and economic geology is relevant only to brickmaking. The level of demand was such for bricks that it proved economic for Bell and Coulter to split up, and about 1807 the Barrowfield brickfields were divided. Samuel Coulter's portion was 1 acre 3 rigs 32 falls in size, the rent charged was £30 per annum, Bell's land was one fall less but still at the same rentage.[20]

On the deaths of Scott and Grahame, the former's part of the estate was held by his son Robert Scott of Aitkenhead. Grahame's part went to his partners in the Thistle Bank, messrs Archibald Colquhon of Killermont, Henry Ritchie of Busby and James Rowan of Bellahouston. Rowan and Colquhon both had mineral interests of their own properties and were probably aware of Barrowfield's potential, but there is no immediate evidence of their minerals involvement on that estate. William Hozier again a partner in the Thistle Bank eventually acquired the whole of the estate c1809 and it was under his proprietorship that mining once again took place.[21]

The Barrowfield Coal Company.

The exploitation of Barrowfield in the 19th. century probably lasted no more than two decades, from c1817 to c1836, but this short period of intensive activity illustrates some of the problems found in mining and most importantly the change in attitudes to it as surface land use became increasingly important with the spread of industrial buildings into Calton, Bridgeton and Barrowfield. Mining in respect of industrial property is immediately seen in the lease of 1817, which opened Hozier's lands to exploitation by James Nimmo. There is the expected provison that mine workings would be kept 100 yards clear of Hozier's Newlands Mansion, the same applies to Messrs Dunlop's Cotton Mills, then established in the area, and the 30 year lease suggests in its headings that consideration was given to surface use, though as will be shown these provisos were not always heeded.

James Nimmo when he came to Barrowfield was probably attracted by its proximity to Glasgow, and therefore its market potential. He was already an experienced coalmaster but his "country" colliery at Williamwood, to the south of Glasgow, served a restricted local market.[22] The great opportunities afforded by Glasgow's proximity to Barrowfield Colliery tempted immediate investment to ensure the coals got easily to market. Nimmo's "iron railway" from the pits to Mile-end,[23] was an insurance that his coals got to market at a price competitive to other collieries in the area

which had more immediate access, and it was probably also a method of avoiding at least one toll-bar, thus also reducing the cost of tolls which were handed on to the customer in high coal prices. The initial workings were too far east for immediate access to market and this may also have been the cause of the railway's construction, which hints at why Nimmo turned from Newlands to look at the possibility of working coal at Bridgeton, close to Glasgow. He made quite determined efforts to attract customers to Barrowfield with sales of coal and dross at low prices,[24] but necessity dictated extensive trials near Bridgeton in the early 1820s.

It was at this time that Nimmo tried to establish a pit head at Ruby Street, Bridgeton, but during shafting the pit was flooded with mud and running sand and 2 men were lost. In such unstable ground shaft sinking was hazardous and the next attempt was made with cast iron pit cylinders. But, like its predecessor this pit was also flooded. Evidence of bore tables and newspapers of the period suggest that it was pumped out or filled in and another shaft begun in close proximity. The Baltic Jute Mill reputedly used the shaft as a source of water, but equally there is evidence that some workings did take place, ceasing c1835, and what really happened is unclear.[25] But what can be stated is that Nimmo used portable plant during his trials,[26] hinting at considerable investment in minerals speculation in the area and the necessary expense of trials.

Nimmo's search for coal eventually succeeded in Laigh Barrowfield in May 1824, when a 4 ft. seam was located and pits sunk to it.[27] This instilled great local interest which is referred to in the Glasgow Chronicle, being seen as a way to bring about a fall in coal prices. Prices had been pushed up with the cessation of collieries close to Glasgow on Gorbals Muir, and the failure to exploit part of the Shettleston Coalfield to the east.[28] Coal had therefore to be brought further which in turn pushed up expense. The exploitation of Barrowfield with regard to its proximity to Glasgow, is also mnetioned in the Burgh Records.[29] Nimmo appears to have made a conscious decision to concentrate his resources in Barrowfield at that time, for his partnership in the Williamwood Coal Company was then dissolved.[30]

Mining proceeded vigorously through the 1820s, though in 1827 a ventilation accident, due to insufficient air movement in disused workings, killed 4 men, and the colliery was out of action for several days.[31] Production once resumed continued with the Barrowfield Coal Company putting out 16-18,000 tons of coal per annum pointing to the nature of its market and its importance as a domestic and industrial supplier of coal. Ironstone workings for the same period account for 5 % or less of output annually.[32]

In 1829 the probable original partnership collapsed when William Brown and David Henry Wilson withdrew from it on 12 May 1829.[33] Brown may have had connections with the Williamwood Coal Company, as Nimmo's partner in that had been a John Brown and there may have

been a family connection. In 1831 coal and ironstone in Bridgeton and Barrowfield were offered for sale, suggesting that the Barrowfield Coal Company in its first constituted form was defunct and Nimmo was trading on his own if at all,[34] though the colliery was still active at Whitsunday 1831.[35]

Barrowfield at this time had seen increasing surface use, with the establishment of the Barrowfield Weaving Company's four-storey factory (c1829). Dunlop, Ferguson, Mather and McHaffie all had invested in mills,[36] and machinery with Bolton and Watt engines for power.[37] Property values were therefore considerable, similarly feuing of land took place for building, encouraged by local architects such as John Weir of London Street.[38] Hozier was in the dilemma of whether precedence should be given to mining or to his feuars, and the problems arising soon came to a head.

In 1833, Nimmo granted a sub-tack in his own favour and a reconstituted Barrowfield Coal Company. This was intimated to Hozier in February of that year, when the coal company had begun active exploitation by driving a mine straight towards Ferguson, Mather and McHaffie's mill. The poor mineral stability created alarm both with the mill owners and Hozier. Hozier's concern was not just with subsidence but whether he would be blamed should it take place. This was the result of badly planned and indecisive leases, which left the question as to whether they covered above or below ground unanswered, and whether if the lessee pursued his course,

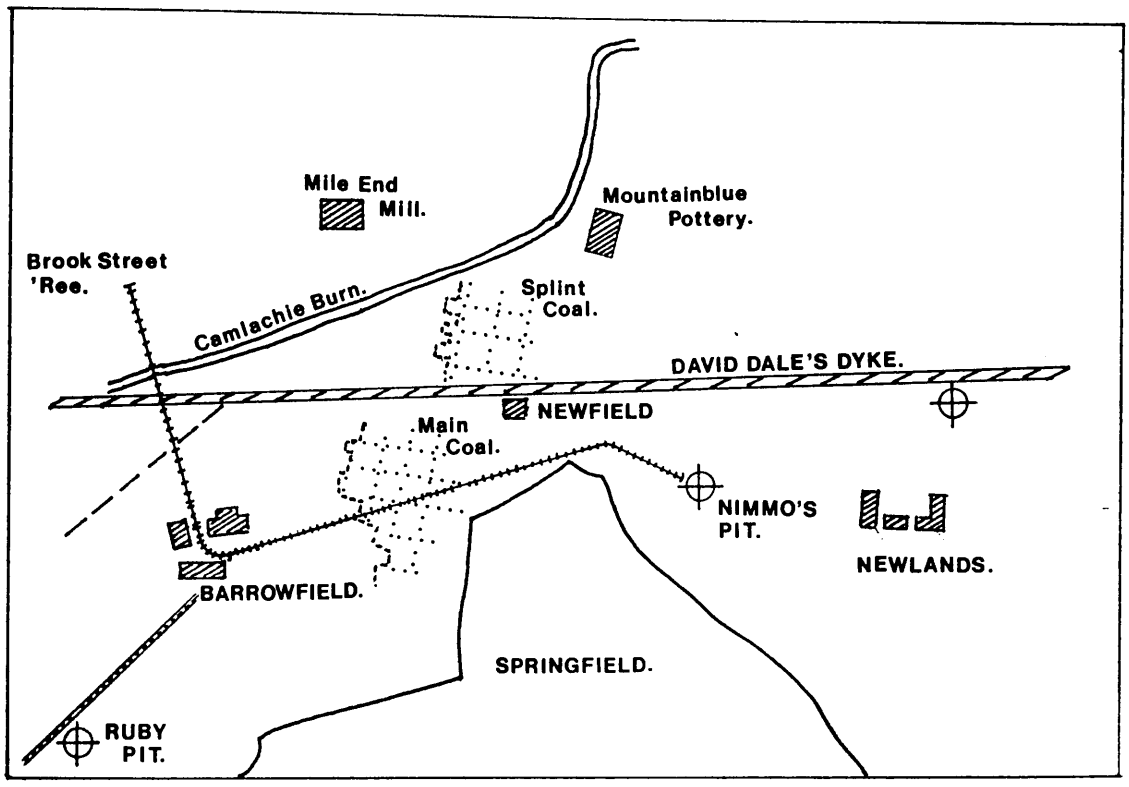
as he could so long as it was in a correct fashion, would he or Hozier be liable for surface damage.

This peculiar situation arose from a case of the early 19th. century in which attempts had been made to stop surface building in the interest of the underlying minerals. The courts allowed the building but with no definition of where responsibilities for surface damage lay.[39] In Hozier's case it would have been his responsibility due to the confusion of feu rights and misconduct of his tenants. Quite simply proprietors were responsible for and to their tenants in the long run.[40] What is also interesting is the change in attitudes for the impression is that in this instance surface building was more important than mining, an attitude increasingly prevalent as Glasgow expanded.

Alarm was premature for geological problems were making mining once again difficult. In an area which had been worked for so long questions over future reserves of coal did not encourage any investment, though for a short while things did seem to be improving. Robert Napier the foundry master and engineer had speculated quite heavily in the Barrowfield Coal Company, in which he also enjoyed partnership status. Writing to a friend in May 1835, he described it thus:

"I am also connected with a coal work, which till lately has certainly been a sinking fund; but no other losses that I am aware of have risen from it, but, on the contrary, within

Figure 9.



Not to Scale.

The Barrowfield Mining Area c1830.

Key.

Centres of habitation or industry.

Conjectural position of mine - Main Coal at 120 ft. below ground.
Splint Coal at 144 ft. below ground.

Principal known shafts.

David Dale's Dyke - downthrow to south.

Upper Coal in proximity to Ruby Pit.

Ell Coal.

Nimmo's "iron railway"

Source. Evidence of SRA TD 547/2/1-3. Geological Map 1st. Edition and Francis Orr's "Plan of Glasgow" 1844.

the last twelve months it had begun to pay a little of the sunk funds."[41]

However, the sunk funds began to sink again, probably as a result of driving in unstable ground and Napier wrote to Hozier to renounce the lease. In a letter dated 23 November 1835 he renounced the lease for £2,750 and promised to make good all damage caused by the mineral workings.[42] The mills remained safe for by December 1835 all workings had ceased. The chattels of the Ruby Pit were sold on 23 December 1835. These included pumping and winding engines, pumps, pipes, whirlies, rails, chains, screws, the stone work of the engine house and the wall around the Ruby Colliery, all of which were sold at Barrowfield Colliery.[43] In 1836 a large atmospheric pumping engine with 48 in. diameter cylinder and 7 ft. stroke, was also sold to get some return on the investment in machinery to keep the mine dry; the final items of the mine were auctioned by the Glasgow auctioneers J.&.W. Graham on 11 May 1836.[44]

The Widening of Horizons.

Even as the curtain began to come down on Barrowfield the balance of influence had already shifted away from mining in the proximity of town outward toward the Monklands. The principal cause had been the creation of a new economic infrastructure, which contributed to the improvement of communications. In the late 18th. century the work of Golborne, Smeaton and Rennie had transformed the River Clyde from a tidal backwater to an important ship canal. The Forth & Clyde

Canal had also opened up new opportunities. Glasgow's route to the east was related to the tobacco men's need to reach European markets, while the Monkland Canal was financed by the same group to relieve the city's coal shortages by opening up the Lanarkshire Coalfield. Initially less than successful, financial difficulties had forced the canal shares on the open market in 1781. Glasgow bought a percentage but the issue was eventually acquired by the Stirling Brothers, merchants in Glasgow, who turned the enterprise into a success especially once it had been joined to the Forth & Clyde Canal. Stirlings saw the canal as a means to an end rather than an end in itself and this general attitude brought increasing trade to Glasgow, as coal became a major constituent of total outward bound cargoes. So successful were the north Lanarkshire mines and the Monkland Canal that coal prices in Glasgow fell, and the established coalmasters attempted combination to maintain price levels. The outcome was a division of interest between those who saw profit from mining itself and those who invested profits from land, trade and other industries of which the most notable was the iron trade, in opening up new coal seams as additional investments. A result was the development of power groups as old established coalmasters for example at Govan, linked to new mineral territories as at Faskine, in an attempt to control market levels. It also created a linear zone of mining activity along the banks of the Monkland Canal and with it new opportunities for enterprise, an interesting example being the encouragement of agriculture in the

area with increased demand for food for miners and feed for the pit-ponies. But more importantly it provided the impetus to open up new mining territory for exploitation, notably around Provan.

Changing Emphasis.

The minerals exploitation of Provan was significant in Glasgow's mining history as being a direct purchase in mineral territory by the Town Council. Its attraction was the accessibility of seams for both the coal and limestone were near the surface, clearly shown considering that later railway building cut both the seams.[45] Provan was acquired in 1704 by the Town Council, when Glasgow was said to be "in great need" of coals.[46] However the coal was little worked, perhaps problems of communication defeated the project, but by the late 18th. century it had found purpose enough in the local limestone industry for what could be produced to be used locally in calcination. The evidence of advertisements supports this with Kincaid's lime works at Robroyston supplying Glasgow with lime,[47] and coal identified for calcining purposes at sites such as Auchenloch Farm, Robroyston.[48] It was then common policy to mention the proximity of coal as a fuel or lime as a manure, in land sales, and neither receive mention in the sale of the 122 acres of farmland around Garthamloch Mansion in 1800.[49] Assuming this to be quite definite it suggests that minerals exploitation till the beginning of the 19th. century, lay north of Provanmill, for even by 1801 there is only mention of coal and limestone workings at Robroyston.[50]

Resurgence of interest in Provan came with the increasing scarcity of coal that was still accessible within the limits of the then technology under Gorbals Muir. The virgin nature of the coal in the Provanmill area attracted speculation, especially as it had been proved to the north at Robroyston. A result was that the lease was taken up by an experienced local coalmaster named Matthew Liddell in 1802. By the family name he appears to have had links with the ironmongery trade, and the family featured in the coal trade to c1840.[51] The tack duty was £40 per annum or a lordship of 4¾d. per cart of 12 cwt. on the option of the magistrates;[52] as a lordship it was comparitively high for the period. It is also of interest in being computed on hundred weights or a cart measure, when tonnages were increasingly common.

There is unfortunately no record of the success or otherwise of the colliery, excepting that a damages claim arose in respect of a claim for James Millar, the tenant of Provan Mill, a malt mill, a debacle that went before committee on several occasions. Malting was an important ancillary activity to both brewing and distilling, craft activities of consequence in Glasgow. Though the result is not recorded it illustrates an aspect of minerals exploitation which dogged the Town Council, with its division of feus for surface land use and minerals exploitation frequently in opposition to the interests of respective tenants.[53] It also gives a clue to the

location of this old mine not far distant of the then new Monkland Canal at Riddrie Basin, where the transport of coal and malt from the mine and the mill to Glasgow could be arranged.

The Monkland Canal helped emphasise the importance of mining areas such as Provan, and the long lease of 30 years of the North Mains of Provan taken in 1805, suggested some expectancy of success, though the remains of this lease were offered for sale in 1827. Property rights in the area were held by Andrew Wilson of North Mains of Provan and William Todd of Campsie,[54] symbolic of the geographic extension of property ownership in the 19th. century, which is seen too in the aforementioned Andrew Stirling's involvement in mining.

At this time the general area of Easterhouse was becoming of increasing importance as a direct result of capital investment in the Monkland Canal, which in many ways was a "coal route" and hence the opening up of relatively new coalfields to provide coal, to feed along the canal to markets in Glasgow. Andrew Stirling was an important coalmaster and capitalist who not only invested in the exploitation of his Drumpellier Estate, but more importantly in the canal to give access to markets for his mines at Faskine and Hallhill. At its conception Stirling acquired all but eleven of the shares in the canal for his family interests,[55] which included coal transportation to Glasgow. Andrew Stirling and then latterly his Trustees had very extensive interests in the mining of the Hallhill area.[56] The extent of the investment was considerable for it

covered 76 acres in total, with an annual rent of £600 per annum and a lordship of 6d. per ton on ironstone output; the land lords also had an option of 9d. per cart on gross output or $^{1}/_{5}$th. of the value of the coal in lieu of rent. Included in the lease as inducements were two steam engines and the hire of coal boats, rented at £12 each per annum. The inclusion of machinery and boats in the bargain suggests that the site was of real value with its waterway link to Glasgow. It is also clear that in Stirling's time, management had shifted away from a local emphasis to the Faskine Colliery's Counting House in Brunswick Street, Glasgow.[57] Faskine had first really featured in colliery politics with the 1813 Coal Combine, when it had been bought along with Govan to rid the Combine's members of cut throat competion.[58] It illustrates clearly how closely the development of Glasgow and Monklands mining were related with the improvement in communications made possible by the canal.

Opportunity created by the canal had brought coals flooding to market, with at least 12 successful proprietors and tacksmen forwarding coal from the east to Glasgow, by the second decade of the 19th. century. These were John Rhymer, William Young, James Merry, William Dixon, Alexander Baird, James Monro, John Cairns, Robert Simpson, David Buchanan, Peter McAdam, George Nisbet and Archibald Frew & Company.[59] But as new faces appeared on the scene so old ones began to disappear with a spate of failures c1820.

The post Napoleonic War trade depression had brought great stress to the coal industry immediate to Glasgow. Weapons manufacturies had boosted iron demand with a consequent need for coal to fuel the furnaces. Once peace came, over capacity had a devastating effect on the traditional mining districts of eastern Glasgow that had responded to ordnance demands. It hit the 1813 Combine's members particularly hard, the Combine itself ended and with it much of the regulation in the coal industry. James Sword jr one of the Combine's principals bankrupted in 1818 from a variety of causes,[60] expediting the major shift of power that brought Dixon to dominance and gave real encouragement to the coalfield proprietors of the east. Sword's failure broke the power group that had dominated the eastern district through their hold on Faskine and Govan. Robert Gray, James M'Nair, James Farie, Colin Dunlop and Sword withdrew from Faskine on 15 February 1819 and then Govan on 3 July 1819.[61] Dixon then emerged as the dominant coalmaster by acquiring their shares in these collieries. The upheaval continued with the departure of the Rutherglen coalmaster, William Dickieson;[62] then the dissolution of the Alexander Rae, John Walker, and Robert Paterson, Belviedere Colliery partnership, on 1 December 1819.[63] Similarly Peter Mann's Barrachnie Colliery failed.[64]

The mining district east of Glasgow was therefore in some turmoil and other reasons may also be suggested. Mining enterprise demanded incorporation to share risks and to assemble very large and premobilised

capitals, these probably came under pressure with post war depression. Under capitalisation was one of the problems of the credit crisis provoked by the Napoleonic War and partnership financing problems could arise through inefficient management by members of kinship groups in each other interests. Entrepreneurship brought its problems too, for its dispersal between partners meant that decisive voices were commonly and often in dispute with the collapse of the partnery when expressed too fully. The majority of the partnership failures over this time suggest this with one partner leaving some months ahead of the collapse of most of the above mentioned collieries. Indeed inadequate personal management could never respond to economic pressures. These problems were then compounded by geology for neither cash flows nor managers could solve the quirks of strata. Proprietorial mortality would also have had its effect on mining and with the death of Colonel James Corbett of Porterfield of Tollcross, land and coal at Camlachie was sold off. There was then a question of what would become of the land or the coal. Corbett's estate included 13 acres of arable land, surface let to Robert Thaw, a Camlachie cow-feeder, with coal therein at £155 per acre. Camlachie coal of 50 acres extent was also offered at £2,160, significantly less per acre than the pasture land,[65] suggesting some competition for land use even at this early date. However, Dunlop's dynastic leasing of coal tacks around Tollcross to assure fuel supply to the Clyde Iron Works, restored the balance in favour of continued exploitation.

Dunlop's hold was consolidated on the death of Colonel James Corbett,[66] then the lapsing of the minerals into trusteeship and the eventual estate purchase on the death of Cunningham Corbett.[67] This meant that Dunlop dominated the extractive industry around Tollcross, Fullerton and Hamilton Farme. It epitomises the changing pattern of local exploitation with the consolidation of large areas of mineral wealth under a few owners rather than the many as previously. Mining had become a means to an end rather than an end in itself and this was especially true as the value of ironstone found with the coal came to be appreciated and the principal coal and iron masters merged as one.

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Chapter 6.

The structuring of the mining industry.

Organisational developments.

The foregoing chapters illustrate the varied influences on ownership in mining. This in turn affected organisation of mining for whilst surface workings had required only a modicum of management, the enterprises that had developed by the late 18th. century faced real managerial problems. This affected landlord and lessee alike, especially where the varied business interests and absorbtions in commercial life restricted the time merchant coalmasters could devote to mining. Delegation of duties down through the ranks came of necessity.

Delegation developed in two ways, firstly in the letting and organisation of mineral properties. Secondly in the management of the colliery itself. In the first instance Campsie illustrates how the organisation of letting devolved from the proprietors down to

the tenant farmers. In Campsie's case this probably originated from an historically established second line of estate administration whereby Lennox of Woodhead's minerals were dealt with through the Woodhead Baron Baillies Court as late as the 18th. century.[1] At that time estate administration passed to the factor's office and men such as William Hamilton[2] became the initial contacts for those answering leasing advertisements. It was only in the drawing up and signing of leases that Lennox came to be involved, arbitration and administration falling as a duty to the estate's functionaries. The tenant farmers also played a role in this by assisting potential lessees to view properties under offer. The farmers would have had an intimate knowledge of the mineral rights to which they had enjoyed long standing privileges. They are frequently identified as contacts in leasing advertisements, the farmers of Balcurroch and Greenfoot or Capiestan and Loanhead are examples of those that fulfilled this role.[3] Outgoing minerals tenants also seem to have fulfilled this role but farmers played the crucial part in the area's mining, especially the Plough Lairds whose enjoyment of mineral rights over a large area contributed to an extensive local knowledge. The minerals in the Eleven Ploughs were directly administered by them as landlords with no go-betweens, thus the tacksman of West Bankier, William McGregor of Dobbies Loan, Glasgow, had direct dealings with the proprietor John Wishart of Castlehill.[4]

Kincaid the neighbouring landowner chose to make use of his experienced mineral tenants to administer his estate on his behalf. Thus John Loughrey who wrought Bankier in the Parish of Baldernock, became Kincaid's confidant. Loughrey's name often appears with reference to Kincaid's estate.[5] It is perhaps wrong to read too much into the activities and responsibilities of such men as this form of administration soon passed to the professional writers, lawyers and accountants who ran the bureaucracy of state in increasing numbers. They fulfilled the factorial duties of many estates and illustrate how administrative boundaries had broken down, with Edinburgh accountants, clerks and lawyers involved in the leasehold of territories neighbouring Glasgow.[6] Their names are often identified with referance to mineral leases advertised in contemporary journals, the accompanying table is compiled from that source. (see Table 2).

Table 2.

List of Legal Functionaries Identified as Contactees for Mineral Leasings, 1700 - 1830.

Dates.	Name of Mines.	Names of Agents.
1727	Renfrew,	Hugh Crawford, Clerk to the Signet, Edinburgh.
1727	Renfrew,	Ludovic Stuart, Writer, Glasgow.

Dates.	Name of Mine.	Names of Agents.
1750	Barrachnie,	Robert Barclay, Writer, Glasgow.
1778	Cambuslang,	Claude Marshall, Writer, Glasgow.
1785	Cullich,	James Hill, Writer, Glasgow.
1785	Langfauld,	James Hill, Writer, Glasgow.
1786	Colbreggan,	James Davidson, Writer to the Signet, Edinburgh.
1787	Houston,	Hugh Snodgrass, Writer, Paisley.
1793	Knightswood,	Robert Grahame, Writer, Glasgow.
1793	Skaterigg,	Robert Grahame, Writer, Glasgow.
1796	Bankier,	William Finlay, Writer, Balfron.
1797	Dumbreck,	William Wilson, Writer, Glasgow.
1798	Muirhead,	Hugh & John Snodgrass, Writers, Paisley.
1799	Oupley,	James Hill & Thomas Kippen, Writers, Glasgow.

Dates.	Name of Mine.	Name of Agents.
1800	Balgrochan,	Robert Walkinshaw, Writer, Glasgow.
1800	Barraston,	Smith & Crawford, Writers, Glasgow.
1800	Eastmuir,	William Bogle, Writer, Glasgow.
1800	Eastmuir,	Peter Peterson, Writer, Glasgow.
1800	Jordanhill,	Robert Grahame, Writer, Glasgow.
1800	Jordanhill,	Andrew Mitchell, Writer, Glasgow.
1801	Bankier,	John Lang, Writer, Glasgow.
1801	Bankier,	Robert Robison, Writer, Glasgow.
1801	Milton,	James Hill, Writer, Glasgow.
1802	Provanmill,	James Hill, Writer, Glasgow.
1803	Shettleston,	John Wilson, Writer, Glasgow.
1805	Hamilton Farme,	Robert Grahame, Writer, Glasgow.
1805	Hamilton Farme,	Andrew Mitchell, Writer, Glasgow
1805	Hurlet,	John Stewart, Writer, Glasgow.
1808	Barraston,	Walter Ballantine, Writer, Glasgow.

Dates.	Name of Mine.	Names of Agents.
1808	Barraston,	William Taylor, Writer, Glasgow.
1810	Govan,	Charles Selkrig, Accountant, Edinburgh.
1810	Govan,	Tod & Romane, Writers, Edinburgh.
1811	Easter Camlachie,	Thomas Falconer, Writer, Glasgow.
1812	Craigenfeoch,	Hugh Snodgrass, Writer, Paisley.
1818	Lawmuir,	Henry Gordon, Writer, Glasgow.
1819	Barrachnie,	William Bogle, Writer, Glasgow.
1819	Barrachnie,	James Harvey, Writer, Glasgow.
1820	Campsie,	Henry Paul, Accountant, Glasgow.
1822	Camlachie,	Hill, Grahame & Davidson, Lawyers, Glasgow.
1824	Belviedere,	D. Turner, Writer, Glasgow.
1824	Benston,	Adam of Colinslee, Writer, Paisley.

Dates.	Name of Mine.	Names of Agents.
1824	Benston,	J.&.J. Wylie, Lawyers, Paisley.
1824	Comedie,	Thomas Smith, Writer, Glasgow.
1824	Comedie,	D. Turner, Writer, Glasgow.
1824	Jeanfield,	William Bogle, Writer, Glasgow.
1824	Jeanfield,	James Harvey, Writer, Glasgow.
1826	Auchenlodment,	Adam of Colinslee, Writer, Paisley.
1826	Auchenlodment,	J.&.J. Wylie, Lawyers, Paisley.
1826	Kaimhill,	William Campbell, Writer, Johnstone.
1829	Drumoyne,	Mathie & Craig, Writers, Glasgow.
1829	Netherhouse,	Taylor & Cross, Writers, Glasgow.

Source.

The Glasgow Advertiser; Glasgow Chronicle; Glasgow Courier; Glasgow Herald; Glasgow Journal; and Edinburgh Evening Courant.

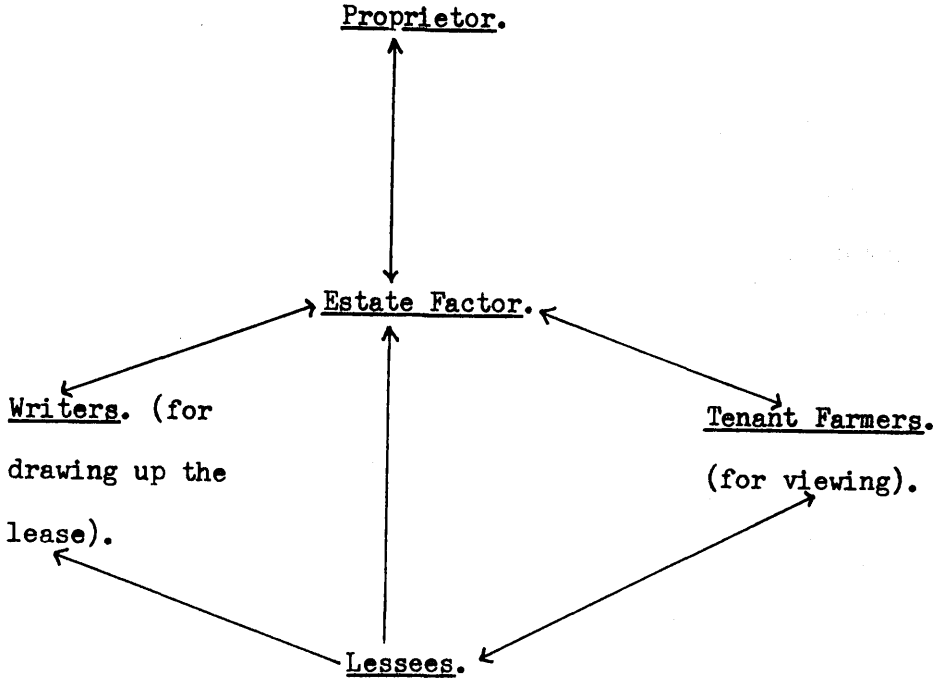
Arranged chronologically the table shows clearly how the larger extractive enterprises were represented by more than one law agent on the estate market. They fulfilled an important role both as the landowners' town representatives and also as go-betweens within the merchant groups. This is suggested by surnames such as Bogle, which was the family name of a powerful merchant administrative group. Similarly, Snodgrass enjoyed a partnership in Craigenfeoch which he also legally represented. The close links which developed between landowners and the legal body is not to be wondered at, for it was common practice for the sons of gentry and well-to-do merchants to choose the legal profession as a course of career.

The role of intermediary could also be fulfilled by town officials, thus Benjamin Barton the Commissary Clerk of Glasgow was involved in the leasing of part of Gairbraid.[7] This was really more common where the mineral lands were held by town councils, so that the setting of Hamiltonhill in 1771 was dealt with by Arthur Robertson, the Town Chamberlain, and Robert Findlay, Master of Work, for Glasgow.[8]

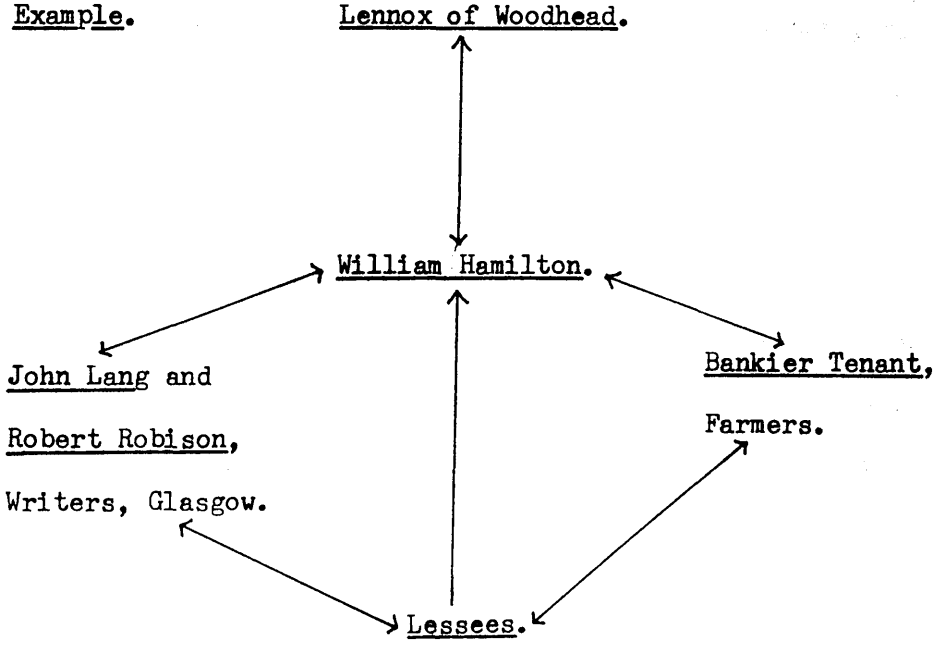
The authority structure of those involved in the process of mineral leasing could therefore take several courses, but in its simplest form can probably be expressed as follows:

Figure 10.

a).



b). Example.



Source: Glasgow Courier 19 May 1801

The Lease.

The lease or tack was the prerequisite of mineral exploitation, the primary element to which attention turned once some sense of agreement had been reached through the process described above. It was the contract or leasehold establishing the relationship between the landlord and tenant over possession of land. It was a provision for eventualities which could affect either the landlord or tenant, or both; the mode of working could be regulated by covenants written into the tack to suit the situation. Leases evolved into formal and complicated documents but at least at the beginning of the 18th. century were simple and often only for a proportion of the product.

In 1744 the Drumlourich and Scullion gour mines, in Campsie, had, under penalty for failure, to supply eight loads from the former pit and four from the latter weekly, to the Woodhead Estate, as lessor.[9] Similarly, in leasing part of the Gorbals Coal from the Corporation of Glasgow, James M'Nair, had in 1752 to promise to supply the Town Hospital, referring the price to the City Magistrates.[10] As mining developed, mineral receipts began to be an important part of the estate income, but the landlord's desire to extract high rents or lordships had to be tempered by the quality of minerals and market potential, so, as lessors learnt their lessee's ways and their own powers, covenants became increasingly encompassing.

However, things did not always work according to plan. The Cochno Estate and lands of John Hamilton of Barns, were mined by the Paisley merchants, messrs John Hart and James Knox. John Hart also had considerable interests in the nearby lands of Kilbowie, which he appears to have both farmed and mined. The estate correspondence shows John Hart squabbling with Hamilton of Barns over additional clauses in a mining charter Hamilton had granted. John Hart wrote:

> "I am not a little grieved to think that I need to tell you that if you refuse granting a charter to Robert Morrison [to work coal] I for my interest will prosecute you for refusal. Albeit---maintain [ing] a sincere friendship."[11]

John Hart's reaction to Hamilton of Barns, suggests some degree of independence, and that some of the experienced coal masters could call the cards on the landlords of their tenancies. It is also of some interest in that it appears to be an argument over subletting, again illustrating Hart's influence. His involvement in the Kilbowie area is also of interest in relation to his having been a Paisley Baillie, showing that mineral tenancies were no longer confined to home territory.[12]

The length of tenancy varied widely, short leases did not invite investment and were too often only a form of trial. The long leases such as those of 70 years and over, were often broken and sold in public auction for the period outstanding on the lease. Similarly,

if the tacksman passed into bankruptcy, the tack would be put up by the estate trustees, as in the case of Hately's Hutchison Colliery tack.[13]

Tenure could be by agreement at setting, and initial offers could be of the most general kind to attract potential lessees. The City Magistrates offered the Black Quarry and Hamiltonhill Quarry for:

"a reasonable number of years."[14]

Similarly the Barrachnie Colliery was put up for any term of years agreeable to the lessee.[15] This demonstrates the willingness of lessors to meet the requests of their lessees, so that minerals would be exploited.

However, clauses in the lease could demand specific performances. James M'Nair's lease of coal in Gorbals in 1762, entailed the erection of a steam engine, or the tack would be declared void. M'Nair had also to promise a fixed performance in working the mine of about 6,000 cu.ft per annum.[16] It appears to have been common practice, at least on the part of the City Magistrates to demand or suggest specific duties. The letting of the Black Quarry and Hamiltonhill Quarry in 1782 included the proviso for driving drains to lower water levels in the quarries.[17]

Lessees' preferred a lordship to a fixed rent, the former bore less heavily on them in lean years. The option of rent or lordship was common by the end of the 18th. century, the lordship varying

with the richness of the minerals, the ease of transport, and the competition among the lessees at the time of setting. Lordships could be designed to exploit mines, principally to attract deeper workings. In 1784, Cambuslang was set in tack to John Farme for 38 years, the duty was £200 per annum, or a lordship schedule which decreased as the mine was driven deeper.[18]

The initial lease also stipulated the annual fixed rent, a useful clue to the potential or size of mines of the period, small rents applied to small ventures and large rents to large enterprises. It also suggests that coalmasters were expected to be men of means, for example in 1791, when Bencloich Coal and Limestone Mine in Campsie was leased, the three years rent was demanded in advance, and the tenant was expected to join with cautioners in a bond to meet this demand.[19] Estate owners fully appreciated the potential of their holdings, such rents as Bencloich suggest their chief aspiration was for as much gain as possible. There were obvious exceptions but in the early decades of the 19th. century, mining had become big business. The evolution of the lease suggests this together with the increasing organisation of the mine itself.

Aspects of Social Organisation.

The social organisation of the pit head was also an important aspect of mining organisation. Some at least of the small time lessees were directly involved in the mines they worked but others chose to delegate duties to trusted supervisors. This was

especially the case where the volume of responsibility could not be borne with other pursuits. Equally it was counterproductive to total management for it was increasingly difficult for masters to control in areas where others involved at process came to know more than their supervisors in a particular field. This is why technology with its engines, ventilation systems and drainage created a hierarchy all its own. Quite simply those who maintained the mine as a working entity were its most important employees. The following functions were delegated:

The personal representative of the owner.

The General Manager.

The Accountants.

Sales and Marketing Manager.

Labour Manager.

Mining Engineer.

These are all modern management terms but they would have had their equivalents. But as explained above delegation was counterproductive to total management as might well have been wished by some mine owners. This together with wanton negligence on the part of some supervisors could be a recipe for disaster. On the financial side some of the supervisors would have been too busy to maintain effective financial control and as a consequence some mines probably failed. There would have been other problems too most notably that of who was running the company, such a dispute contributing to the demise of the Green Coal Work, Shettleston.[20]

Similarly there would have been a reluctance to delegate where owners believed they could not trust their supervisors and this sometimes proved the case, as when Archibald Smellie's hillsman absconded with the company funds.[21] But devolved management came to be forced on owners who had to leave much responsibility to their agents. It was partially a measure of this distrust that there were at least three levels of overseers or grieves.

The grieve had agricultural connotations finding its origins in the head workmen of farms. Duckham suggests that some at least of these men were the sons of head workmen on estates and their position in the estate oligarchy goes some way to support this.[22] Next in line was the coal grieve, with the estate grieve above him, and the underground grieve surprisingly at the bottom of this triarchy. Whilst the coal grieve was responsible for the whole of the mine, the underground grieve as his title suggests was responsible for maintaining the working faces. He in turn supervised experienced miners who probably enjoyed a fair degree of power over the oncost labour, men who worked on time wages.

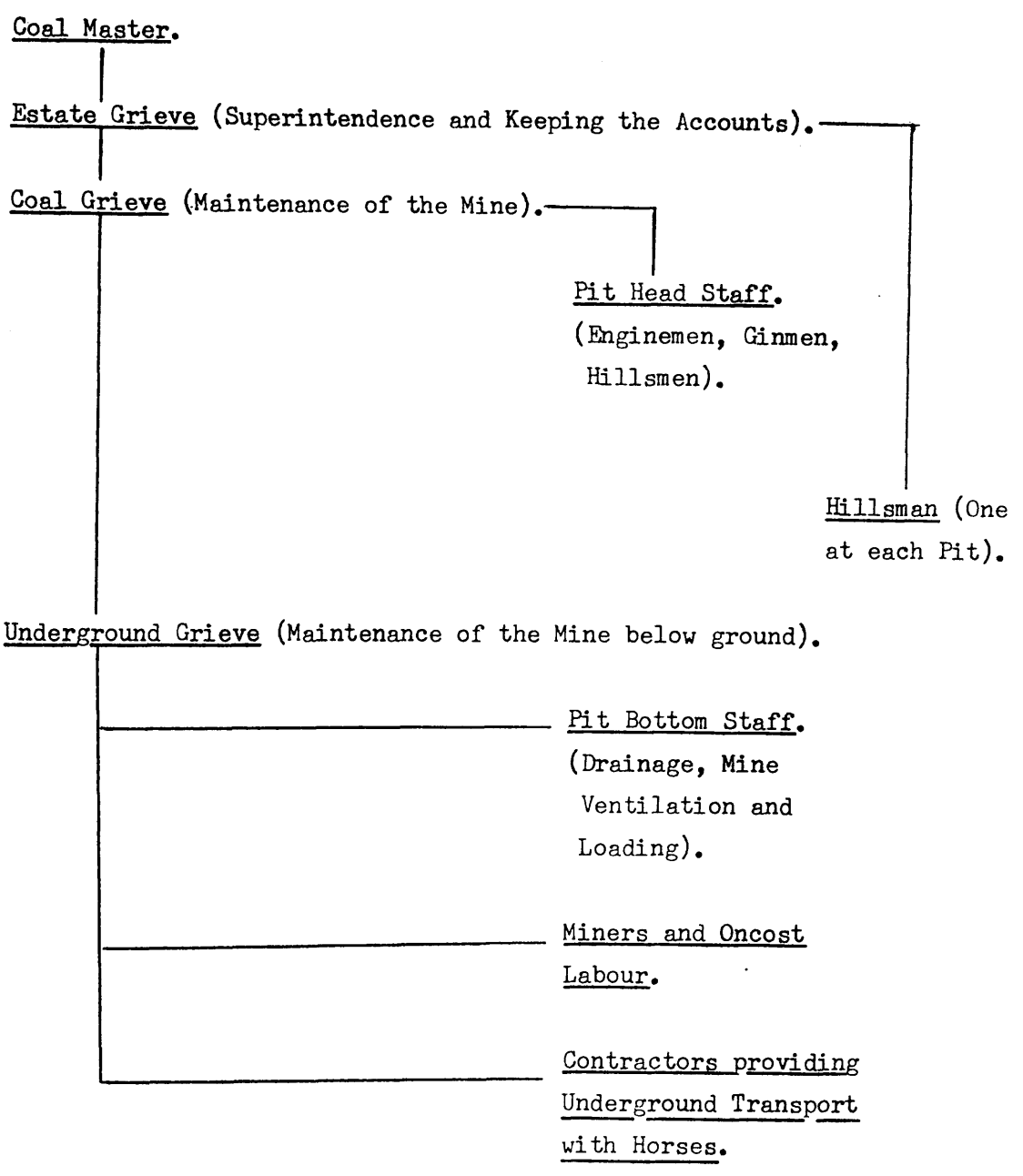
The Green Coal Work which employed oncost labour predominantly under the management of a few fulltime grieves, illustrates the hierarchy below ground from its business books. The working faces were worked by teams with an experienced miner at their head, being paid so much for cutting out rooms and clearing levels. Similarly teams of miners were allocated to drainage from the dip of the mine, at least until the establishment of a steam engine.

This itself was put in by oncost labour and the pumps rigged in the shaft under the direction of two experienced employees.[23] A pecking order existed at this colliery just as it did at many other mines, the following diagram attempts to illustrate the management structure of a typical early 19th. century colliery. (See Figure 11).

Organisation extended even beyond the confines of the mine and into selling on the open market. This will be detailed under the heading marketing but the role of pithead staff may be mentioned here. The principal of these was the hillsman who organised the dispatch of coal via the carters to selling agencies in town. His job was important and much of the profit of the enterprise depended on his integrity, this is why the Smellies were so upset when their hillsman absconded. Orders could be taken by the hillsman and others involved in the mine. This was especially so of limestone workings and may have been related to the different uses to which the lime could be put. Thus Alexander Lawder, one of the Mains Estate Factors, acted as selling agent for Cullich, in which he was assisted by George Kirk the mine's engineer.[24] It is also related to the localisation of organisation at country mines, whereas an authority structure had to be developed at town collieries in relation to industrial and domestic demand. The authority pattern in distribution may be illustrated. (See Figure 12).

Figure 11.

Management Structure of a Colliery.

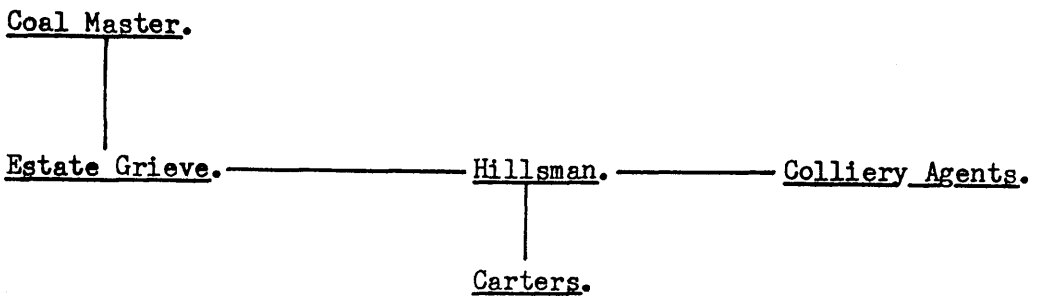


Note.

At smaller collieries many of the above duties might well have been fulfilled by one man, also the facetted nature of each duty means that the diagram is the bare bones of the managerial structure.

Figure 12.

Authority Distribution Pattern.



Once again the pattern is idealised and there were exceptions for some coalmasters acted as their own agents and arranged coal carting as for example Crawford of Balshagray.[25] But a steady general demand for coal and other minerals consolidated the patterns of mining activity and with it the need for business organisation, so that by 1830 organisation had begun to influence all aspects of mining and the vast business organisations that carried mining forward on the ascendency.

The organisation of ownership and control was essential to the success of mining projects and the evolution of the lease shows the trend from small pits of little consequence to large scale workings covenanted to protect landlords and lessees. There was also an increasing degree of social organisation with a hierarchical management system developing. Good management was important for mining to respond to markets and encourage further investment.

References to: Chapter 6 - The structuring of the mining industry.

1. CAMERON, John Parish of Campsie. 1892. p.169.
2. Glasgow Courier 19 May 1801; 14 October 1802.
3. Leases and pro-forma adverts contained in the Lennox Estate Papers. S.R.A. TLX6.
   Glasgow Courier 20 July 1811.
4. " 5 January 1805.
5. Lennox Estate Papers with relevance to the Kincaid leases. TLX6.
6. Estate papers and land advertisements in newspapers during the period, 1700-1830.
7. Glasgow Courier 24 January 1782.
8. Glasgow Journal 3-10 October 1771.
9. CAMERON, John op.cit. 1892. p.162.
10. Glasgow Trades House Record p.384.
11. HART, John ALS 21 October 1759, Paisley to James Hamilton of Barns. S.R.A. TD589.
12. Glasgow Journal 11-18 June 1759.
13. " 10-17 June 1773; 15-22 July 1773.
14. Glasgow Mercury 19 September 1782.
15. " 10 October 1787.
16. DUCKHAM, B.F. A History of the Scottish Coal Industry. 1970. p.166. M'Nair was called on to work 2,000 leats per annum, Duckham identifies a leat as equal to 3 cubic feet hence the estimate of 6,000 cubic feet.

17. Glasgow Mercury 19 September 1782

18. DUCKHAM, B.F. op.cit. 1970. p.163.

19. Glasgow Mercury 19 April 1791.

20. " 21 August 1794.

21. " 16 August 1781.

22. DUCKHAM, B.F. op.cit. 1970.

23. S.R.O. CS96/1087 - Business Books of the Green Colliery.

The ranking is evidenced by the wage rates, and references made to particular "team leaders" who are regularly identified to tasks, such as one miner named Anderson who together with his "team" were cutting rooms in the West Level, in 1791.

24. Glasgow Mercury 31 January 1787; 3 March 1789.

25. Glasgow Courant 23-30 May 1748.

Chapter 7.

Early links between Glasgow Mining and the Iron Trade.

The beginnings.

The most significant aspect of the growth of the iron trade in the West of Scotland, was its slow blossoming. One reason for this was its past of low technology. Originating as it did in charcoal bloomeries, abundant natural reserves were necessary to fuel it and supply raw materials. The western Highlands were a natural choice, with good timber supplies, local bog iron deposits, and a surfeit of water power from streams, rivers and sea lochs. The last in turn reduced transport costs by allowing access to the sea and coastal trade routes. The early iron furnaces were located at Glen Kinglass, established c1725 by the York Building Company, as part of its programme of exploitation of the resources of the estates forfeited after the Jacobite Rising of 1715: at Bonawe, founded in 1752 when Richard Ford & Company, or the Lorn Furnace Company, took leases of Sir Duncan Campbell's woods, and lastly Furnace of the Argyll Furnace Company, built in 1755 by Jonathan Kendall of Duddon.

These small companies became of importance as problems arose in the English trade. Once Scotland and England were in a free trade market and charcoal prices in Cumbria were driven up either by competition among the Cumbrian ironmasters for wood leases, or monopolistic agreements between landowners, then Scotland came into its own with local fuel supplies and power sources. In the mid 18th.

century it was more profitable to move haematite from Furness by sea to Scotland for smelting, simply because the latter had such an advantage in terms of fuel costs, with its ample woodland for charcoal making. This hints at the nature of the iron industry in the west; that it was very restricted and transitory, in the way iron passed into and then out of its economy. This again is shown by Scotland's European iron imports being re-exported to Ireland. In the period 1700-c1730 foreign iron passing through was about 10% of the total value of Scottish exports to Ireland. It was not much but as Cochran notes the yearly values varied. In the period 1700-c1730 iron re-exports were worth £680 equal to 45 tons per annum, and £600 equal to 34 tons per annum between 1750-1799. In this period an annual average of 500 tons of pig iron went to Ireland from Scotland, officially valued at £2,800.[1] Thus Scotland's role was that of staging post, particularly in the case of the western sea-board ports, whilst the mantle of technology was assumed by the West Midlands, with Darby's perfection of coke-smelting at Coalbrookdale.[2] This technology did spread to Scotland, for as Cochran points out many of the post 1760 iron movements to Ireland came from Carron by way of Glasgow.[3]

The formation of the Carron Ironworks, near Falkirk in 1759, was an event of capital importance in the economic history of mining in Scotland, for the works was the first to use ironstone from the

Carboniferous Formation of the central lowlands, and to employ coal in its furnaces, and therefore in turn to encourage mining by creating far greater levels of coal demand. But progress was slow, for though there was no shortage of valuable coal and ironstone deposits, the technology of coal and coke smelting remained a major problem and the Scottish economy lacked both the capital and the skills necessary for such an enterprise. It was to be at least two decades before the Carron Ironworks found any parallel in the western lowlands.

Why expansion took so long may possibly be explained by the fact that iron working was conducted on a most insignificant scale compared with iron imports and movement of iron goods in the economy. Pococke comments on the mass importation of iron.[4] Its movement in the economy can be judged from its position in Glasgow, the trade there having risen in response to the demand for agricultural implements with the opening up of the American plantations after 1732.[5] The smallness of the western industry is most striking, for in 1750 the iron consumed by Glasgow was no more than 400 tons,[6] and even by 1777, only 500 tons were consumed. Though Gibson considered it a large figure, it was really only a small trade when the production of iron toys was seen as a promising outlet for expansion.[7] Iron passed the economy by and this is seen comparing consumption to export. From 5 January 1771 - 5 January 1772, 835 tons 18 cwts 2 quarters and 15 lbs of bar iron arrived in

the Clyde so if the forequoted figures of 400 tons was perhaps consumed locally then at least half was re-exported. But the types of import and how much stayed gives some clues as to the shaping of the western iron industry. According to Senex, 896 tons of pig iron was also brought in, of which only 10 tons were re-exported. But 751.936 short tons of wrought or manufactured iron was exported, so some working may have taken place at Glasgow. This is also shown by the fact that 547.957 short tons of manufactured iron was exported to Virginia after fashioning to malleable utility in small forges,[8] such as that of James Sword of Glasgow.[9] Sword produced nails, cast iron goods, smith work of all kinds, but he also imported Whitehaven boilers for local domestic use. There was little incentive to produce iron locally if the local need could be satisfied mainly from importation, especially with quality iron goods as those sold at the Carron warehouse in Queen Street, Glasgow.[10]

Glasgow's role as an agency in much of the iron trade, and as an agency for "west seas" expansion is further shown in the Carron Company's advertisements of American Pearl Ashes for sale, for they were probably make-weights for boats returning from the Americas after delivering Carron goods shipped out from Glasgow. The framework of economic life in Glasgow was then very different to what it would become later, especially where there was little regional demand for iron as the raw material of machines. These

machines, even the machines of war, were to provide encouragement for the growth of the western iron trade.

The Growth of the Western Iron Trade.

John Sword's forge work was typical of the early Glasgow iron industry, for even though demand was limited and often satisfied from outside, forges and foundries had grown in number around the area. The malleable iron companies were the most active at that time, these were the Cadells of Cramond; the Smithfield Iron Works formed by several Glasgow merchants, and latterly owned by the brothers Robertson and George Bogle, merchants in Glasgow; and thridly the Dalnottar Iron Company. These were little more than extensions of the traditional use of coal by blacksmiths,[11] and were still dependent on outside iron supply, as for example with the Dalnottar Iron Company's nail making business, which was supplied with bar iron from Carron, apparently under contract.[12]

The first steps to independence and a modern iron industry in the west came in 1779 with the establishment of the Wilsontown Iron Works. The founders were three brothers, John, Robert and William Wilson, who were attracted by local material resources both in coal and iron ores, and good water power. The Wilson brothers' gamble on the British need for munitions in the American War of Independence (1775-c1783) was another reason for the emergence of this works. It was though to be a further decade before any expansion could take place for the cessation of

hostilities brought the collapse of the market, and Wilsontown was beset by other problems, most notably that of transport. It was too far from tidal waters that might have provided a route to markets, and the fact that many of the best coal and ironstone seams lay at some considerable distance from the coast effectively slowed the growth of the iron industry, as there was little sense in producing products that could not be sent to market economically, and water was then still the cheapest form of transport. Though the cutting of canals and the deepening of the River Clyde might have been expected to have relieved the situation they did not. Wilsontown was high in the hill country of east Lanarkshire and dependent on roads for distribution.[13] Restrictions on growth are further demonstrated by the fact that not until 1787, did a second furnace appear at Wilsontown.

It was the malleable iron companies and their dependence on imported bar iron that forced the next necessary step in the growth of the iron industry. This was a move to end dependence on Swedish and Russian iron imports to Britain, which were not under British political control. Britain was the dependent party in commercial relations with the Baltic states, for these northern powers supplied the timber and the naval stores without which the British Navy could not exist, as well as iron for iron working. At the same time demand in the north for British goods was limited.

The British government tried to emancipate itself from dependence upon outside sources for such vital supplies by fostering colonial and local production of iron products and ships, timber pitch, turpentine, and pig iron in North America, though the quality might be inferior.[14] This fostering of local enterprise may well have been an influence in the west of Scotland, particularly with Glasgow's entrepot role for trade and ideas, and the close proximity of coal and iron ores in the area. Trade represents the visible transfer of technology between nations and areas and when in the 1780s the price of Swedish and Russian bar iron rose due to their monopoly of supply and production costs in the Baltic, then naturally Britain wished to escape even more.

The opportunity arose with technical experience from the above sources and the commercial production of Watt's separate condenser and the inventions of Henry Gort in the manufacture of wrought iron, inducing the owners of many iron works to produce bar iron themselves and avoid increased importation costs. Henry Gort invented the puddling process in 1784, involving the heating of pig iron in a reverbatory furnace; he also showed how coal could be used to produce wrought iron. Watt's idea of condensing steam in a separate vessel from the engine cylinder came to him in the Spring of 1765, while he was walking one Sunday afternoon on Glasgow Green:

"the idea came into my mind that as steam was an elastic body it would rush into a vacuum, and if a communication was made

between the cylinder and an exhausted vessel, it would rush into it and might be there condensed without cooling the cylinder."

Watt's separate condenser quadrupled the efficiency of the early Newcomen engines and allowed the slow but steady application of steam power to furnaces, the forges, the mills and the making of forge iron and contributed to the expansion of the iron industry in the late 18th. century.[15]

Mines, Minerals and Iron Works.

Technological improvements and the ability to produce bar iron led to a reappraisal of the siting of works with regard to both fuel and transport, and to markets. The first iron masters to do so were the Cadells of Cramond and their manager and partner, Thomas Edington. In co-partnership with John MacKenzie of Strathgarve in Ross-shire, Edington established the Clyde Iron Works at Tollcross, in 1786. The capital was £6,000 divided into twenty four parts, eighteen of which were held by Edington. A few months later William Cadell purchased one third of Edington's holdings, thus forging still closer links between Cramond and Clyde. The iron works was sited on land feued from James Dunlop, and its proximity to Glasgow was an important consideration when land transport was so costly, and though some use was made of the Upper Navigation of the River Clyde it was never a major line of communication,[16] for Clyde like Wilsontown was dependent on roads.[17] The production of pig iron was the principal

activity, together with ordnance material. By 1787-88 pig iron exports to Ireland were, if exported from the River Clyde, originating at Clyde Iron Works, but by 1790 this trade had shifted to Ayr on the Firth of Clyde, suggesting that the pig iron was from Muirkirk.[18] Clyde probably began to turn to armaments, though it did not have a boring mill at that time. Cannons cast at the works were sent down to Dumbarton and John Napier's foundry, where in 1791 there were two steam engines, one for blowing and the other a Newcomen, probably with a Watt condenser, working a boring mill that according to Napier was used to finish cannons.[19] A boring mill was added in the 1790s at Clyde where the furnaces were increased to two by 1792 and a third added towards the end of the decade, all for ordnance purposes.[20] A reason for this change of production was the Napoleonic Wars (c1793-1815). But the link with the major land owner and minerals master Dunlop of Garnkirk, is perhaps the most significant aspect of the Tollcross site.

Dunlop had interests in the West Indies, the North American trade, and the coal, iron and glass trades. The last provides a link to the early iron trade, for John Sword's iron mongery also sold Dumbarton Window Glass.[21] Dunlop was an avid purchaser of land, for he saw estate values not so much as a social cachet, but as an integral part of his own industrial and commercial interests. He bought up virgin areas of coal so as to gain control of supply and increase his range of influence. Thus as the Monkland Canal came

towards completion, so Dunlop purchased as much land as he could in the parishes of Old and New Monklands; this purchasing included the mineral holdings of John Orr, who had been a leading 18th. century coalmaster. Dunlop then became the principal coal supplier to the Clyde Iron Works, through his partnership with Messrs Houston and Dixon in the Elderslie Coal Company, and similarly through his Fullarton Coal Works, close to Tollcross. But the Clyde Iron Works did not always find it satisfactory to purchase coal from independent coalmasters such as Dunlop, and minerals masters and iron masters enjoyed an uneasy alliance. Dunlop had 75 miners at work at Fullarton, but bankruptcy meant his ability to supply Clyde was less than expected. Thus new partnerships formed with Andrew Faulds a local minerals master and Alexander Herriot, to guarantee coal supply to Clyde Iron Works from the latter's Marystown Estate. In this instance Edington probably supplied the capital necessary to get the coal workings at Marystown going, and to bail out Fullarton.[22]

Thomas Edington in due course withdrew from the Clyde Iron Works, his shares passing to the Cadells on 1 July 1802.[23] The day to day running of the iron works was managed by Joseph Outram, which introduces another aspect to the iron industries linkage with mining. Outram designed the Ayr Colliery Railway and the Clyde Iron Works contracted for its construction, which by October 1805 was almost complete.[24] The transfer of technology back and forth from iron works to collieries must have increased Dunlop's interest considerably;

it is very probable that plate-ways in collieries owned by Dunlop originated at that time from Clyde. Thus as a business proposition Clyde must have been very tempting to Dunlop. He recognised the problems of course, stating:

> "I am satisfied that it can never be made a good situation for making iron, unless our coal is united to it, and with that coal united to it, that iron may be made there on lower terms than at any other establishment in Scotland of that kind."

His observation was reflected in his strategic purchase of the Clyde Iron Works, in partnership with Colin Dunlop, in 1810; he then wrote that:

> "so long as Clyde Company's coal and mines are in different hands the expense of working the former will of necessity be such as to render the business of making iron at Clyde not worth the following, while if they both belong to the same person the Clyde Iron Works could be supplied with coals on as reasonable terms as any ironworks in Scotland."[25]

Dunlop in partnership with his younger brother bought out the Clyde Iron Works and took in many local mineral tacks, relevant to coal supply to the iron works, whilst still continuing his many interests and a holding in Govan in partnership with Dixon. In 1829, he bought out the Tollcross Estate on the death of Cunningham Corbet.[26]

Businessmen at that time relied on their own resources, on family capital, savings and investments, loans and interests, to capitalise on their holdings. Land was perhaps the most significant of those holdings and with leasing and strategic purchasing, a greater bond was welded between mines, minerals and ironworks, and heat technology industries. Dixon's brief partnership with David Mushet, of Blackband Ironstone fame, and James Creelman, a pottery manufacturer, to purchase Calder Iron Works is a further example. Mushet's discovery of iron ore in the black clays bisecting the local coal seams, hence the name blackband ironstone, regionalised the links between mines, minerals and ironworks. The economic advantages of possessing rich iron ores and coals in the same locality were appreciated, and though inferior and brittle ores and cost of movement from better areas limited the exploitation of blackband it gained greater appreciation from Mushet's 1801 discovery.

In 1828, the hot blast of J.B. Neilson, of the Glasgow Gas Works, enabledthe splint coal of Lanarkshire to be used uncoked to reduce the richer local iron ores of the Glasgow area in great quantities; it was a speculative investment which directly affected minerals ownership and exploitation, and formed the new technology for ironfounding. The landowners perhaps not realising the great significance of the ores under their estates, charged low royalties.[27] This encouraged the ironmasters to lease, often with a view to

eventual ownership of the minerals. The old ownership patterns of the 18th. century gave way to new patterns of exploitation, by firms such as William Baird & Company, an enterprise which developed from farming, through coal mining as an additional investment, and thus into the iron trade. Bairds' success was the result of ploughing back profits and making inroads into every possible market, their clients ranging from small bleachers to Charles Tennent & Company.[28] The same basic system was shown in the early iron industry, with John Napier directing his selling to the market provided by flax mills and printfields.[29] In order to ensure the supply of coal and ironstone for the furnaces with which to make products for the above markets, tracts of land were either leased or bought for mineral purposes, over wide areas of central Scotland. Mining moved from the little world of the 18th. century and earlier, where winning and working of raw materials and fuel supply were on a neighbourhood basis; to the great world of fuel and raw materials supply at a regional level. No longer did minerals masters work a neighbourhood, they went long distances for both raw materials and fuel and purchased land to assure their supply. Similarly markets were no longer purely local and coupled to this there was a change in philosophy from coal and iron, to iron and coal, and it is this rise of the heavy industries of iron and then steel production, with which mining progress would be linked throughout most of the 19th. century. (Tables developing text themes are presented on p.146-147 and company information on p.148-151).

Table 3.

Iron Production in Scotland in 1778.

	Furnaces.	Tons.	
Carron	4	1,000 each	4,000 tons.
Wilsontown	2	800 each	1,600 tons.
		Coal fired furnaces,	5,600 tons.
		Output of charcoal furnaces,	1,400 tons.
		total,	7,000 tons.

Source: Encyclopedia Britannica 7th. ed. Vol.XII. p.430.

Table 4.

Comparative Table of Fuel Use in Cold and Hot Air Furnaces.

Cold Air Furnace,

Coal for fusion, 3 tons of coke corresponding with	6 t. 13 cwt. coal.
Coal for blowing engine,	1 t. 00 cwt. coal.
Limestone,	10½cwt.
total	8 t. 3½cwt.

Hot Air Furnace at 450° Fahrenheit,

Coal for fusion, 1 t. 18 cwt. of coke corresponding with	4 t. 6 cwt. coal
Coal for heater,	5 cwt. coal.
Coal for blowing engine,	7 cwt. coal.
Limestone,	9 cwt.
total	5 t. 7 cwt.

(Table 4 cont:

Hot Air Furnace at 612° Fahrenheit,

Coal for fusion,	2 t. 0 cwt.
Coal for heater,	8 cwt.
Coal for blowing engine,	11 cwt.
Limestone,	7 cwt.
	total 3 t. 6 cwt.

Summary: Cold Air Furnace used 8 t. 3½ cwt. of fuel.
Hot Air at 450° " 5 t. 7 cwt. "
Hot Air at 612° " 3 t. 6 cwt. "

Notes: The hot air furnaces allowed the use of coal without it having to be coked, with a relative saving in the amount needed. Fuel saving was in proportion to the increase in temperature. In general there was increased productivity for fuel investment in the hot air system.

Source: New Statistical Account. Vol.6. "Old Monkland" p.664.

Company Information 1:

Clyde Iron Works, Tollcross.

Partners: George Cadell, James Cadell, Jonathan Cadell, William Cadell jr., Thomas Edington (till 1 July 1802). Their manager Joseph Outram, was an acting partner by 1805.

t/a Clyde Company.

John Dunlop, Colin Dunlop, coalmasters and merchants, 1810.

Source. Glasgow Courier 12 February 1803.

DUCKHAM, B.F. A History of the Scottish Coal Industry. I. 1973.

The Clyde Company was not the specialised producer into which iron companies were later to evolve, this is reflected in its products list. Customers were principally domestic users and the service industries and the Clyde Company responded to their needs much as the smithy industries had done in the previous hundred years.

Products of the Clyde Company.

Domestic: Cast iron household furniture, book cases and money chests. Boilers, Canada Stoves, Drying stoves. Cast iron window frames and sash weights.

Husbandry: Cast iron husbandry utensils of all kinds, garden and field rollers. Nails, hoops, rod iron, plate iron.

Industrial: Equipment and boilers for sugar plantations and mills, sugar mill rollers and spindles. Calico printing presses. Cotton mill machinery. Industrial cast iron window frames. Steam engines made to order. Engine boilers of wrought or cast iron. Cast iron walking beams for engines, which were cheaper than their wooden counterparts. Fire bricks, probably from clay got in the neighbouring mines.

Tramways: Railways or tram roads, with waggons or trams for colliery purposes.

Weights: Weighing machines of all kinds.

Source. Glasgow Courier 12 February 1803.

Company Information 2:

Nail and Iron Manufacturies in 1802.

Cadells & Edington (Clyde).

Dennistouns, M'Nairs & Tassie.

William Robertson & Company.

James Sword & Company.

Archibald & William Coats.

Robertson, Brown & Company.

Wilson & Liddell.

Graham & Wardrop.

John Stone & Smith.

Maxwell, Miller & Company.

Note: The source for the above list was a meeting between all concerned to establish a joint financial year so that they might improve their accounting.

Source: Glasgow Courier 18 February 1802.

Company Information 3:

Smithfield Iron Work Company.

Partners: Baillie John Craig, Robert Luke, goldsmith, Allan Dreghorn, deacon of wrights, c1735, producing keys and locks and other ironware up to anchors.

John Murdoch, James Dennistoun, Allan Dreghorn, Thomas Dunlop, merchants, 1763. William Robertson a Glasgow merchant was the leading partner in the period 1763-67. Alexander Spiers became a partner in 1767. This is Spiers of Elderslie, a Virginian merchant and tobacco importer.

George Bogle a partner in 1769.

George Bogle, James Ritchie, George Oswald, James Dennistoun, Alexander Spiers, Thomas Donald, John Hamilton, George Buchanan, Allan Scott, William Robertson, 1780-82.

Note: Allan Dreghorn, James Dennistoun and George Oswald, all had some interest in coal mining in the Glasgow district.

Source. DELL, R.F. Register of Glasgow Co-partneries, Joint Stock Companies and Ventures to 1775. 1971.

Conclusion.

The growth of the iron industry was a scene setter for greater industrial alliances, before which much of industry consisted of a series of disparate elements. Disparate only in that the commonality of ownership was so very restricted. There were obvious exceptions such as William Pagan's ownership of his fuel supply for his Wester Sugar House,[30] but generally the sources of fuel and the centres of production were in separate hands, and it was not until the unification of fuel supply and production, that mining moved away from the small kingdoms of many coal masters, to the hands of empire building ironmasters. They were able to take advantage of major technical developments in production, to generally strengthen their hold on the local iron and minerals economy. This in turn was to have its effect on leasing and minerals ownerships were often surrendered into the hands of powerful iron masters such as the Bairds and Dunlops. The greater industrial strength of the Bairds and Dunlops, where they chose to lease, probably brought about the more intricate leases of the 19th. century. There was greater need for controls as the economy blossomed, as the many men of coal gave way to a few of iron. Mining becomes tangled with the story of industrialisation, as knowledge was acquired about the workings of metal materials with greater precision and the recovery and use of minerals to that end.

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Chapter 8.

The mineral trade and its markets, 1700-1830.

The coal trade developed in Britain as other sources of fuel were either used up or became expensive and inaccessible. Throughout Britain and Ireland most easily accessible supplies of wood had been used up in the course of the 16th. and 17th. centuries as demand for wood as a fuel, a building material and as a packing material grew rapidly. Peat remained a relatively cheap, if labour intensive fuel alternative to either coal or wood in some areas, but its bulk prevented its transportation over any distance. Therefore, as the expansion of agriculture left little room for the systematic re-establishment of woodland, the growing urban populations of Britain and Ireland had to reconcile themselves to the use of coal as a domestic fuel. The consumption of coal grew steadily throughout the 18th. century, with periods of market expansion in the early 1720s, the 1760s and the 1780s, reflecting both the growth of demand and the increasing population of the western coalfields of Scotland, of which those around Glasgow were part.

The effectiveness with which coal and the minerals trade could be executed depended not only on the quality and price, but also on the mining organisation and how smoothly minerals could be delivered to their destination. One of the main pressures generated by foreign and coast-wise trade in the local economy was the need to improve internal communication.

In his History of Glasgow, published 1777, John Gibson gives an account of the trade of Glasgow, Greenock and Port Glasgow, from which it is possible to gain some idea of the commercial framework that had evolved by that time. Because of the shallow nature of the River Clyde ocean going vessels could not penetrate upstream beyond Dumbuck Ford. Consequently the river traffic was in three parts, above Dumbuck there was both a transhipment trade and local carrying to and from Glasgow and its environs which extended to the Upper Navigation of the River Clyde. Below Dumbuck and the transhipment wharfage of Sir Archibald Edmonstone's Dunglass quayage, there was a well developed coastal and local trade, which served both Scottish ports and those of Ireland, across the limited expanse of the Irish Sea. There was also a trans-Atlantic trade from Greenock and Port Glasgow to the West Indies, and North America, together with some European trade. The minerals trade was part of this growing traffic which was to expand throughout the 18th. century with coal companies such as that at Govan, the Govan Coal Work Company having invested in a tack of the Dunglass coal quay by the middle of the century, to enable easier distribution of export coal.[1]

Mineral Movements from the Cambuslang and Rutherglen Districts.

The coal trade from the quay at Rutherglen down the River Clyde was an 18th. century phenomena. The evidence of witnesses to an enquiry into the movement of coal in the Upper Navigation, provides

some evidence into the use of the river for bulk carriage by the mineral owners of the Cambuslang and Rutherglen districts, the Duke of Hamilton, Farie of Farme, Gray of Scotstoun, and Spens of Stonelaw.[2]

The low levels of land transport technology gave the coalmasters little choice but to use the river, but it seems unlikely that much of their coal went to Glasgow by this means for the charge of carriage to and from the river and the breakage of coal by shipment and landing, would have exceeded the benefits of water transport under 2 miles. The trade appears to have been directed down river, to Dumbarton and to Greenock. There is evidence for the former in that boats used to carry coal down river, brought produce and in particular slates from Dumbarton to Rutherglen.[3] Herring boats also came to Rutherglen, and in their turn would carry coals on the trip back down the river. The movement of coal down river was for export, of which a high percentage would have gone to Ireland. These movements would have been organised by colliery agents, such as James Dunn, manager at Farme in the 18th. century.

Dunn and others identify craft of the following capacity plying on the River Clyde, the measures being in cart weights of 12 cwt:

15 cart lighters,	180 cwt.	9 tons.
20 cart lighters,	240 cwt.	12 tons.
30 cart lighters,	360 cwt.	18 tons.

There were larger craft of 25 tons, but these large lighters could and often did take two tides to reach Dumbarton. The subjection of the sailings to the mood of the river cannot have been economic, and coal prices went up in response to the problems of carriage on the river in late autumn and winter .[4] It is probable that peak movements came at the Spring tides, which may in part account for the fall in prices which normally took place in summer.[5]

The moody river presented such problems of low water that the coal masters looked for other means to get their coals to market, and naturally they looked to land. But, the roads to Glasgow were so poor and travel so difficult, that when in 1723, a cart carried a tiny load of coal from East Kilbride to Cambuslang:

"crowds of people turned out to see the wunderful machine."

and this close to Glasgow, where according to Smout carting was well developed between burgh, markets, and ports.[6] Coal carting took a remarkably long time to establish from the Cambuslang and Rutherglen districts, especially considering that coal carting from Gorbals was then common. It was still common practice for coal to be brought on horse back to Glasgow even by the middle of the 18th. century,[7] and only in 1783 was a determined effort made by Farie to send an 18 cwt. cart of coal by road to Glasgow, and it bogged down en route. A result was the decision to make up the local roads by local land owners and coalmasters, but that cost money and some of the cost is seen in the rise in coal prices, as costs were passed on to the consumer. Gray charged 18d. per cart

at Cambuslang and Rutherglen in 1783; by 1785 the price of coal from the former had risen to 5/6d. per cart on the Glasgow market, suggesting a hefty rise in delivery costs.

The Dalmarnock Colliery sustained a river trade due to its unique position in relation to its principal coal depot, a few hundred yards down stream on the opposite bank at Hutchesontown. The pits were connected by tramways to a loading jetty, baskets of coal, each of about 21 cwt. were trammed to the jetty and then lifted and put aboard punts, which were poled across river on the tides. Alexander Cameron, puntsman, had a contract to carry Wilson's Dalmarnock Coals to the depot, and describes the punts as having been 36½ ft. long by 14 ft. broad, flat bottomed and drawing 3 ft. of water. The punts carried about 15 tons each, and were run tied together, being poled or hauled or carried down stream, in the charge of 4 men. The punts could go in neap tides, spring tides, and low water. Their maximum capacity as doubles was 30 tons, making them ideal bulk carriers, though only a quarter of the coal put out from Dalmarnock was landed at Hutchesontown. The cross river communication does not suggest that the coal was bound for Glasgow, it may be that part was for export and equally there would have been a localised demand with the mixed industrial enterprises of Hutchesontown, such as chemical, rope and brick and pottery works.[8] In general Dalmarnock coals for Glasgow and the neighbourhood of the north bank were taken through Calton and the Gallowgate to market in barrows and carts.

Dalmarnock's primacy of the River Clyde was due to two reasons, the proximity of the pit to the river bank and the immediacy of the coal yard, the line of communication was very short and mass coal movement both possible and economic. It was less economic where the lines of communication were teased out and only limited amounts of coal could be moved at any one time. The exploitation of the Upper Navigation for minerals movement was due to the inadequacies of land communication. The evidence of Dunn and others suggests that small boats sailed a considerable way up river, even as far as the site of the Clyde Iron Works, to an 18th. century colliery owned by a coalmaster named Smylie. The sailings were probably never economic and though witnesses describe coal boats, it is likely that the majority of those vessels were general small freight lighters, carrying small amounts of coal in their lading. The output was seldom great enough to maintain coal boats alone and witnesses evidence the large number of lighters waiting considerable periods for their cargoes. The movement of coal was never sufficient to make the use of large capacity vessels economic and existing vessels were equally too small to be economic, plus the short distance involved coupled to transhipment costs could not have been a sensible proposition. Obviously land travel continued to present problems for water transport to continue in use but when and where there was a choice between land and water communication the former was chosen and the latter stopped as soon as possible. Sailings to Clyde Iron Works were cut back immediately Smylie's colliery failed and the local coal

trade focussed on the needs of the Clyde Iron Works itself, which was satisfied by a web of roadways from the pits of Fullarton and Shettleston to Carmyle. The wish to make direct sales, thus avoiding the rake-off to the lighter men, also encouraged the move to land communication. To summarise, the use of the Upper Navigation was primarily due to the very low levels of road technology in the Cambuslang and Rutherglen districts; once the Rutherglen Bridge was built in 1775 and roads improved the coal boats ceased to ply. It is also possible that the Clyde Iron Works localised the coal trade to a great extent. By the end of the century water borne transport of coal was confined to the river below the Broomielaw.

Coastal and Lochs Mineral Movements.

In discussing the movement of minerals in the Upper Navigation it is obvious that there was by at least the middle of the 18th. century a quite well developed trade of small ships carrying various cargoes up and down the estuary of the River Clyde. This is hinted at in the extension of the Duke of Hamilton's wharfage for coals from his collieries in 1716. In that year the stone mason William Lawson, rebuilt the quays so that they occupied 3 yards in breadth and a $\frac{1}{4}$ mile in length along the Broomielaw, the extension cost £500, a not inconsiderable sum at that time, and was surrounded by a high limestone wall to prevent the stealing of coal.[9] The extensions to the Broomielaw in 1722 also suggest growing trade; similarly additions made c1770-71 coupled to Golborne's deepening of the River

Clyde all point to increased coal movement down the river from the Broomielaw.[10] It may be noted that by August 1771, Golborne had increased the low water level of the River Clyde at Dumbuck from 14 ins. to 3 ft. of water which greatly helped the passage of boats.[11] Though there could still be problems, a sloop laden with coals for Rothesay having been wrecked in the storm of the 23 January 1773, at Dumbarton Castle.[12]

At least one company appears to have taken direct advantage of the deepening of the River Clyde. The company of Colin Buchanan & Company worked Watehills, near Faifley, and sold their coals down river, shipping them from Dalmuir. Their enterprise is again significant of the western expansion of coal markets. Colin Buchanan & Company delivered coals at Dalmuir Quay at 2/- per cart for cash in hand. Coals for the Leven and Loch Lomond were taken by lighter from Dalmuir to the nearest landing places. The price of delivery per cart at Buchanan and Glenfalloch was 3/7d; from Luss down the loch side to the mouth of the River Leven it was 3/4d; and along the River Leven it was 2/10d. The coal supplied to Loch Lomond and the immediate area, was brought by lighter up the River Leven, remaining 24 hours at the landing places. The customers came and collected their coal orders, and were charged a 1d. per cart extra on each day's delay in clearing "port" or landing stage.[13] That Colin Buchanan was able to set out selling restrictions points to his domination of the local market, and the general sparsity of alternative fuel supply. A possible reason for Buchanan's domination of the

local market is that coal from the Kilpatrick District was used in quantity for calcining at limeworks on Loch Lomond at Arden; at Camiseskan on the Firth of Clyde; at Cairmon; at Cardross; and the Murroch Glen and Merkins close to Dumbarton. These all worked local "bog limestone" a poor but exploitable relation of the better quality limestones eastward around the Glasgow area. There being no coals in the area, attempts were made to calcine the limestone with peat. But, peat could only be cut in dry weather, in the summer months, and was very limited in supply. Coal though more expensive was actually more economic than peat, due to the poor weather and the high cost of working in the rain and hauling along impassable roads, thus coal was turned to for fuel and could be shipped to the proximity of most of the lime works.[14]

Calcining created bulk demand for coal, and its mass movement along with other minerals could most easily be accomplished by water. Recognition of this meant that more and more coal went by water and the Knightswood and Govan tramways were formed to serve riverside loading facilities. Both served export markets, with the coals barged down river and transhipped into larger vessels at Dunglass, Greenock and Port Glasgow. Barges from Yoker also served the Dumbarton Glass Works, and some coals were shipped from there with cargoes of glass. Transhipment was not economic, the realisation that if coastal vessels could load at Yoker, the

cost of transport, often higher than the cost of coal, would be reduced was an additional spur to the development of river traffic below the Broomielaw.[15]

The Coastal Trade.

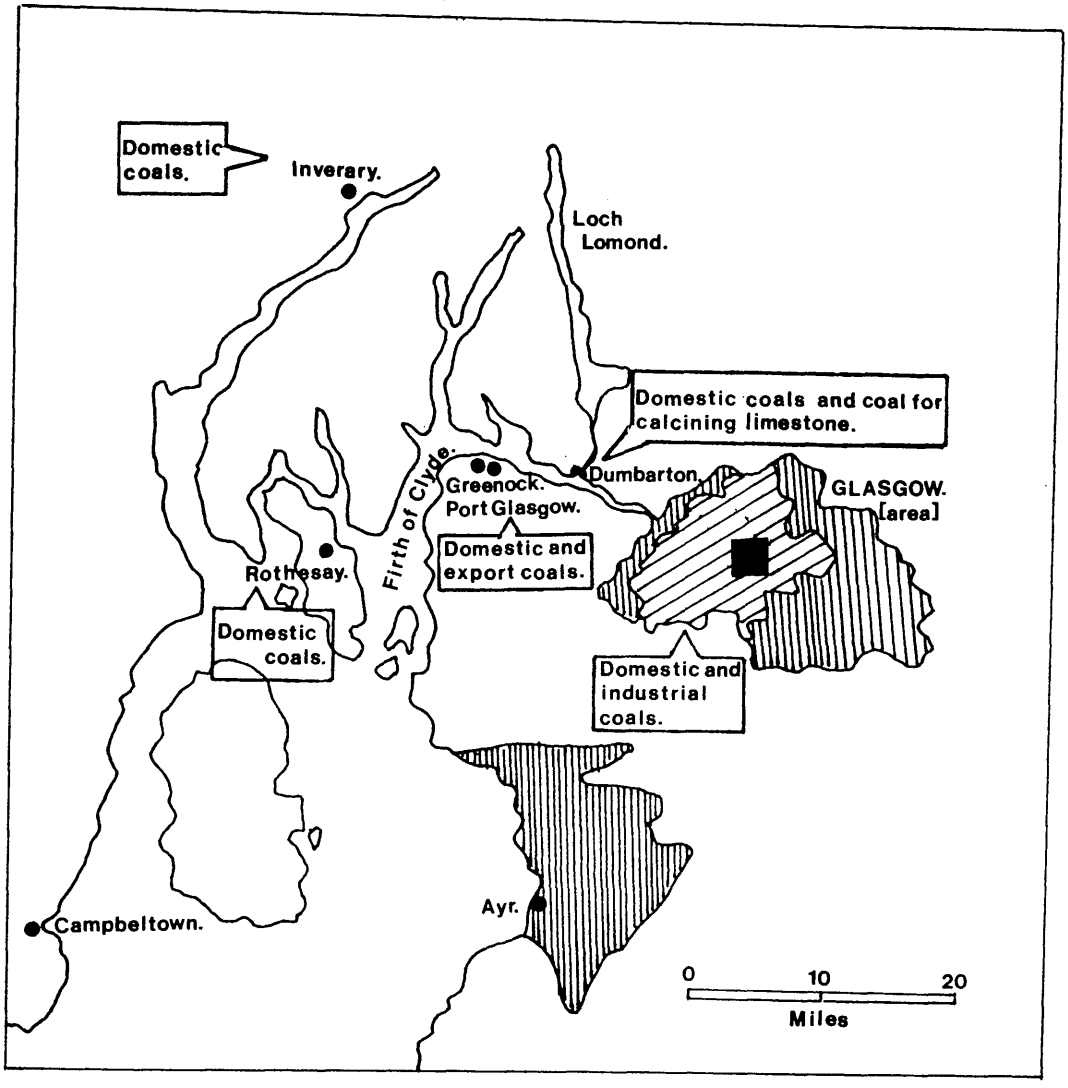
The river traffic below the ports of Greenock and Port Glasgow was also then developing for the mineral trade, again there are facets, those of export and those of coastal, the former will be considered in the following sections, but something must be said of the immediate coastal coal trade.

What evidence there is points to a remarkably limited coastal trade in coal. The Glasgow Burgh Records record the petitioning of the inhabitants of Rothesay over short measures of coal sent from Glasgow,[16] but this and perhaps two or three villages in the Hebrides, the Western Isles and along the coast, provided little demand for coal. Evidence from the early 19th. century suggests that coals were part of general cargoes and certainly there were such sailings from Greenock to Oban,[17] but exact quantities are less easy to fathom and the fuel demands of island families were not great enough for coal as carriage would have made it too expensive.[18] That expense limited demand where there was actual need for coal is hinted at by mining trials conducted along the west coast. Trials were made on Sir John Stewart's estate lands of Kempock and Lang Craig, at Gourock, but these failed and the economic burden of coal supply must have been considerable to have

tempted them in the first place.[19] Similarly, the lignites of Mull were tried, providing little coal and the trial was prohibited by expense.[20]

All available evidence points to the expense of coal no matter how it was got, whether wrought locally or shipped in. The transport of coal by water most certainly kept prices down in comparison to land carriage, had it even been possible. But, the lack of a coastal coal trade for the Glasgow companies, was due to other factors. The principal of these was probably navigational and demographic, the scattered communities among scattered islands, would have made servicing both expensive and time consuming. These points are compounded by the presence of two coalfields in the area of the Firth of Clyde, these being the Ayrshire and Campbeltown coalfields, far closer to the markets that the Glasgow boats might have served, as for example Campbeltown and Inverary, both towns using coal, which very likely originated from the pits west of the former township.[21] (see Figure 13).

Figure 13.



Market Distribution Map, c1750-1800.

General areas of coalfields in western region.

General area of Glasgow Coalfield.

Principal towns referred to in text.

General area of Glasgow.

Source. G.B.R. 19 September 1792. Shipping movements recorded in the files of the Glasgow Journal 1750-1800.

Coals for Export: Coals to Ireland.

The existance of large coalfields in the lowlands of Scotland contrasted with their sparsity in Ireland, as a result Ireland had to look outward for fuel supply. Demand for wood as a domestic fuel supply in Ireland had destroyed most accessible supplies by the end of the 17th. century, and in rural areas peat remained the dominant fuel throughout the 18th. century. The principal centres of population had on the whole to rely on imported coal, for transport costs made the carriage of peat into town too expensive. As a result large scale importation of coal developed, of which a small percentage came from the Glasgow area, though most Irish coals were imported from the English ports of Whitehaven in Cumberland, with additional supplies from the Ayrshire ports.

The coal trade divided itself between the north and south of Ireland. Dublin was the major source of demand for coal, the continued growth of her population and manufacturing industries in the early 18th. century ensured that this was to continue, though the smaller Irish ports and towns were equally demanding. Ulster presented a growing market for coal, the Hearth Tax Records show that in 1791, 71.4% of houses in Ulster had at least one hearth, though another 15.2% were exempted pauper houses, and about 20% exempted new houses. It may be noted that the percentages do not equal 100% as many hearthed houses were not included. Dubordieu writing of County Down, suggests that many farmhouses had only a

kitchen fire because the other hearths had been closed off to avoid paying the hearth tax. However the percentage of total houses hearth tax in 1791 suggests there was a fair demand for fuel, mostly peat but also in those counties with coastal ports coal was burnt, imported from Britain. (see Table 5).

Table 5.

Irish County Hearth Taxes for 1791.

Counties.	1 hearth.	2 hearths.	Exempted pauper houses.
Antrim	73.7%	6.4%	12.3%
Armagh	82.1%	3.4%	10.3%
Cavan	76.8%	3.1%	15.2%
Donegal	61.6%	4.9%	28.8%
Down	81.2%	5.2%	7.8%
Fermanagh	72.7%	3.4%	19.9%
Londonderry	61.7%	4.7%	25.9%
Monaghan	77.6%	2.8%	15.7%
Tyrone	73.4%	4.6%	17.0%

Source. DUBOURDIEU, Rev John Statistical Survey of the County of Down. 1802. and GAILEY, Alan Rural Houses of the North of Ireland. 1984.

This does not include the many hearthed houses of the gentry nor exempted new houses, therefore the percentages are not necessarily equal to 100. In comparison to Ulster, Wexford had

70.6% of houses with one hearth, 6.3% with two and 16.4% exempted pauper houses. Hence there was a generally consistent demand for coal, even if only to fire the bricks for building the houses, for the low indigenous coal supply would never have maintained the many on site brick burnings as towns developed.[22]

Scotland's marked east/west orientation meant the east of Scotland supplied continental markets, whilst the west served Ireland and America. The percentage division of these coal exports from Scotland to their various destinations is given below.[23]

Table 6.

Table of Total Coal Exports from Scotland, 1755-1795.

Year	Export to Ireland. '000 tons.	% of total.	Export to Europe. '000 tons.	% of total.	Export to America. '000 tons.	% of total.	Totals of '000 tons.
1755	9.6	53	8.0	44	0.5	3	18.1
1760	6.4	55	4.9	41	0.4	4	11.7
1765	13.6	50	12.4	45	1.3	5	27.3
1770	13.2	52	10.7	42	1.5	6	25.4
1775	16.7	48	16.8	48	1.1	4	34.6
1780	12.4	42	16.8	57	0.3	1	29.5
1785	25.3	42	31.2	52	2.9	6	59.4
1790	44.9	55	32.1	38	4.6	6	81.6
1795	40.3	66	18.9	31	2.2	3	61.4

Source. COCHRAN, L.E. Scottish Trade with Ireland in the 18th. century. 1985. p.28.

In the first half of the 18th. century it is probable that Ayrshire

was the main source of the coal for Ireland, but there was steadily growing competition from the Clydeside coal masters. The table below illustrates the division of trade with the Clydeside ports as a percentage of the Ayrshire export.[24] (see Table 7).

Table 7.

Comparative Table of Coal Exports from Ayrshire and the Clydeside to Ireland from 1744 to 1794.

Year	Ayrshire. '000 tons.	Clydeside. '000 tons.	Clydeside as a % of Ayrshire coal sent to Ireland.
1744	7.7	0.2	2.59%
1754	11.2		
1764	10.6	0.1	0.94%
1774	17.5	1.0	5.71%
1784	20.6	3.5	16.99%
1794	33.3	5.8	17.41%

Source. Derived from Table 5 p.28. of COCHRAN, L.E. Scottish Trade with Ireland in the 18th. century. 1985.

Though coal had been exported to Ireland from the Clyde from the early 17th. century, two factors slowed the growth of the trade and mineral movement. The first and most important factor was the considerable domestic demand for coal in the Glasgow area, the principal reason for Glasgow's coal mining throughout the 18th. century. The second factor was the shallowness of the River Clyde so that only small boats could sail easily from the coal quays on the Upper Clyde direct to Ireland. Alternatively, shipment or

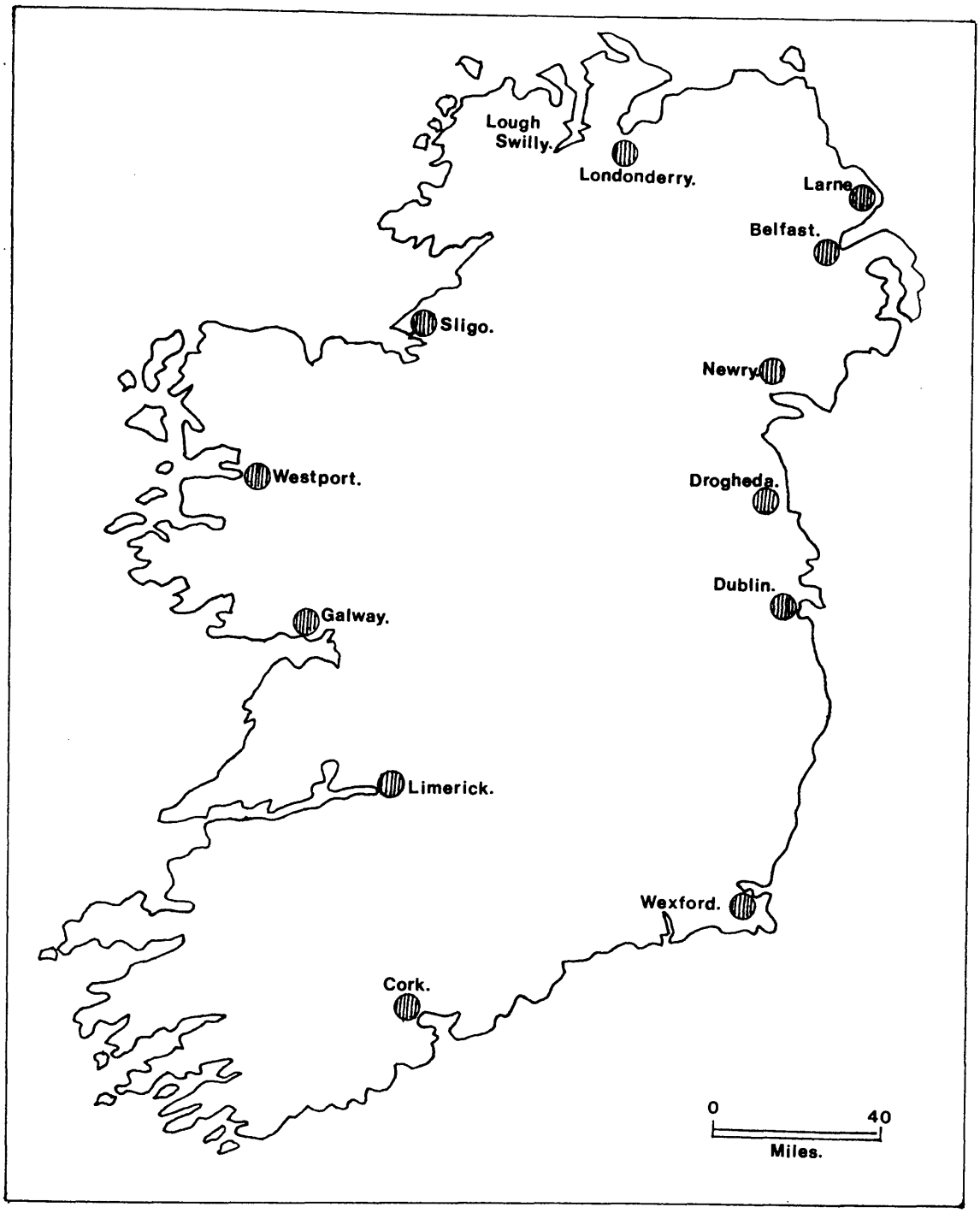
transhipment at the Lower Clyde ports in large vessels was a possibility, but this probably eliminated any real profits in exporting Clyde Coal to Ireland through transhipment costs. It would also seem that as domestic coal prices rose in the 18th. century there would have been little price incentive to export coal to Ireland from the Glasgow area. Nonetheless the Glasgow Burgh Records show the sending of coal to Ireland and the petitioning of coalmasters in that respect; from these it is possible to identify some of the principal exporters of coal to Ireland as James Dennistoun; James Dunlop, Gabriel and Robert Gray; Gilbert Hamilton; James M'Nair and John and Matthew Orr.[25] Though domestic demand dominated output, the westward outlook is further shown in the example of Govan Colliery, where 70% of output went to domestic uses and 10% to industrial, but that still left 20% which probably found its way down the river to the Clyde ports and then to Ireland.[26]

The ships leaving the Clyde with coal for Ireland show a distinctly different trading pattern to those from the Ayrshire ports. Coal was used as a "make weight" for cargoes of lighter goods, this can be illustrated with the example of the Dixons, whose interests in Glasgow coal mines provided make-weights for their cargoes of glass to Ireland and these interlocking business interests go some way to explain the frequency of coal and glass combination in cargoes to Ireland from Dumbarton and Port Glasgow, the export points for the Dumbarton Glass Works. Coal was also used as ballast for bulk

carriers dispatched to the south of Ireland for grain crops such as oats and barley, this Irish produce being processed at Duntocher Mill, according to the Glasgow Journal 4-11 November 1773. Boats carried cargoes both ways and it was good economic sense that they seldom ran empty. The coal trade from the Clyde appears never to have been the specialised trade of the Ayrshire ports, coal was normally part of a mixed cargo.

In the final decades of the 18th. century there was a sudden change in the nature of the trade with more and more specialised coal boats sailing from the River Clyde. This may be impression rather than reality for Glasgow was only designated an official port for customs purposes in 1780, but, there was reason for this change for the problem of restricted coal supply in the Glasgow area had been solved by the development of the Monklands mining district, and the opening of the Monkland Canal in 1790. The flood of coal on to the market brought a sharp drop in prices and a combination of local coalmasters around Glasgow was formed to maintain prices; one way of doing that was by creating artificial coal scarcities and Ireland was nicely placed as a convenient coal dump.[27] This is one likely explanation for the increasing coal trade to Ireland and at least in the Lanarkshire area coal prices soared from about 6/- per ton in the early 1790s to over 10/- per ton by the end of the decade,[28] a considerable increase had the domestic market been the sole outlet and one certain to arouse consumer resistance to high prices.

Figure 14.



The Location of Principal Markets in Ireland, Supplied with Coal from the Glasgow Region in the 18th. Century.

Note. Lough Swilly identified as a port-of-call was probably a transhipment point for the west coast of Ireland.

Source. GIBSON, John History of Glasgow 1777: shipping movements identified in the Glasgow Courier 1791-1800 and the Glasgow Mercury 1778-1796.

The geography of the trade also poses some questions, and the map illustrates some of the ports involved in the coal trade (see Figure 14). Cullen suggests that the Scottish coal trade was heavily committed to the Dublin market and given the geographical location of the Clyde ports concentration on the east coast of Ireland was to be expected. Belfast took about 13% of the Scottish exports of coal to Ireland throughout the century. The growth of population and rise in standards of living goes some way to explain the coal imports to Drogheda, Larne and Newry, and also to Londonderry. Larne may have used Scottish coals for calcining at its great lime works, and coals shipped from Scotland were probably little more expensive than those shipped down the coast from the mining areas of North Antrim around Ballycastle. The Lough Swilly trade is not so easy to explain but it may have been a transhipment point for ports along the west coast of Ireland. Sligo's coal trade was probably related to the beef, pork and butter trade from that district to Scotland, with coal being taken in ballast. The Limerick and Galway trade is surprising for both towns relied on peat because of the expense of imported coals and the relative cheapness of peat. The cost of Scottish coal in Limerick from 1776-79 was about 18/- per ton, and English coals about 20/- for the same quantity, perhaps the difference of 2/- was enough to encourage the purchase of Scottish coals and the Clydeside colliers would have found it more economic to send coals as "make weight" cargo for glass as Limerick was one of Ireland's chief importing points for glass. Clydeside coal had reason to be there but again it was not

the prime cargo. At Port Glasgow the export of glass from the Dumbarton Glass Works to Dublin and Limerick coincided with the demand for Irish grain and other provisions. The 160 ton "Hope" of Dumbarton, owned by William Dixon of the Dumbarton Glass Works was one of the boats on what can be seen from the accompanying table and figure to have been an expanding if fluctuating trade (see Table 8 and accompanying Figure 15).[29]

Table 8.

Table of Coal Exported to Ireland from the Upper River Clyde, 1790-99.

Date.	Glasgow.	Greenock.	Port Glasgow.	Annual Totals.
1790.	7,885 b. 5%	74,349 b. 43%	89,627 b. 52%	171,861 b. 100%
1791.	16,124 b. 12%	45,832 b. 36%	67,788 b. 52%	129,744 b. 100%
1792.	45,133 b. 35%	66,305 b. 51%	18,736 b. 14%	130,174 b. 100%
1793.	49,449 b. 21%	143,191 b. 60%	45,471 b. 19%	238,111 b. 100%
1794.	45,713 b. 35%	40,811 b. 31%	44,458 b. 34%	130,982 b. 100%
1795.	12,218 b. 24%	21,661 b. 44%	15,981 b. 32%	49,860 b. 100%
1796.	31,122 b. 27%	53,681 b. 48%	28,191 b. 25%	112,994 b. 100%
1797.	18,769 b. 18%	50,448 b. 50%	31,846 b. 32%	101,063 b. 100%
1798.	26,120 b. 23%	62,715 b. 55%	25,028 b. 22%	113,863 b. 100%
1799.	34,082 b. 33%	48,050 b. 46%	22,390 b. 21%	104,522 b. 100%

In Bushel Measures = b.

Note. The percentages recorded above are illustrated in Figure 15.

(cont: Figure 15 see p.130.

source identified below Figure 15.

the prime cargo. At Port Glasgow the export of glass from the Dumbarton Glass Works to Dublin and Limerick coincided with the demand for Irish grain and other provisions. The 160 ton "Hope" of Dumbarton, owned by William Dixon of the Dumbarton Glass Works was one of the boats on what can be seen from the accompanying table and figure to have been an expanding if fluctuating trade (see Table 8 and accompanying Figure 15).[29]

Table 8.

Table of Coal Exported to Ireland from the Upper River Clyde, 1790-99.

Date.	Glasgow.	Greenock.	Port Glasgow.	Annual Totals.
1790.	7,885 b. 5%	74,349 b. 43%	89,627 b. 52%	171,861 b. 100%
1791.	16,124 b. 12%	45,832 b. 36%	67,788 b. 52%	129,744 b. 100%
1792.	45,133 b. 35%	66,305 b. 51%	18,736 b. 14%	130,174 b. 100%
1793.	49,449 b. 21%	143,191 b. 60%	45,471 b. 19%	238,111 b. 100%
1794.	45,713 b. 35%	40,811 b. 31%	44,458 b. 34%	130,982 b. 100%
1795.	12,218 b. 24%	21,661 b. 44%	15,981 b. 32%	49,860 b. 100%
1796.	31,122 b. 27%	53,681 b. 48%	28,191 b. 25%	112,994 b. 100%
1797.	18,769 b. 18%	50,448 b. 50%	31,846 b. 32%	101,063 b. 100%
1798.	26,120 b. 23%	62,715 b. 55%	25,028 b. 22%	113,863 b. 100%
1799.	34,082 b. 33%	48,050 b. 46%	22,390 b. 21%	104,522 b. 100%

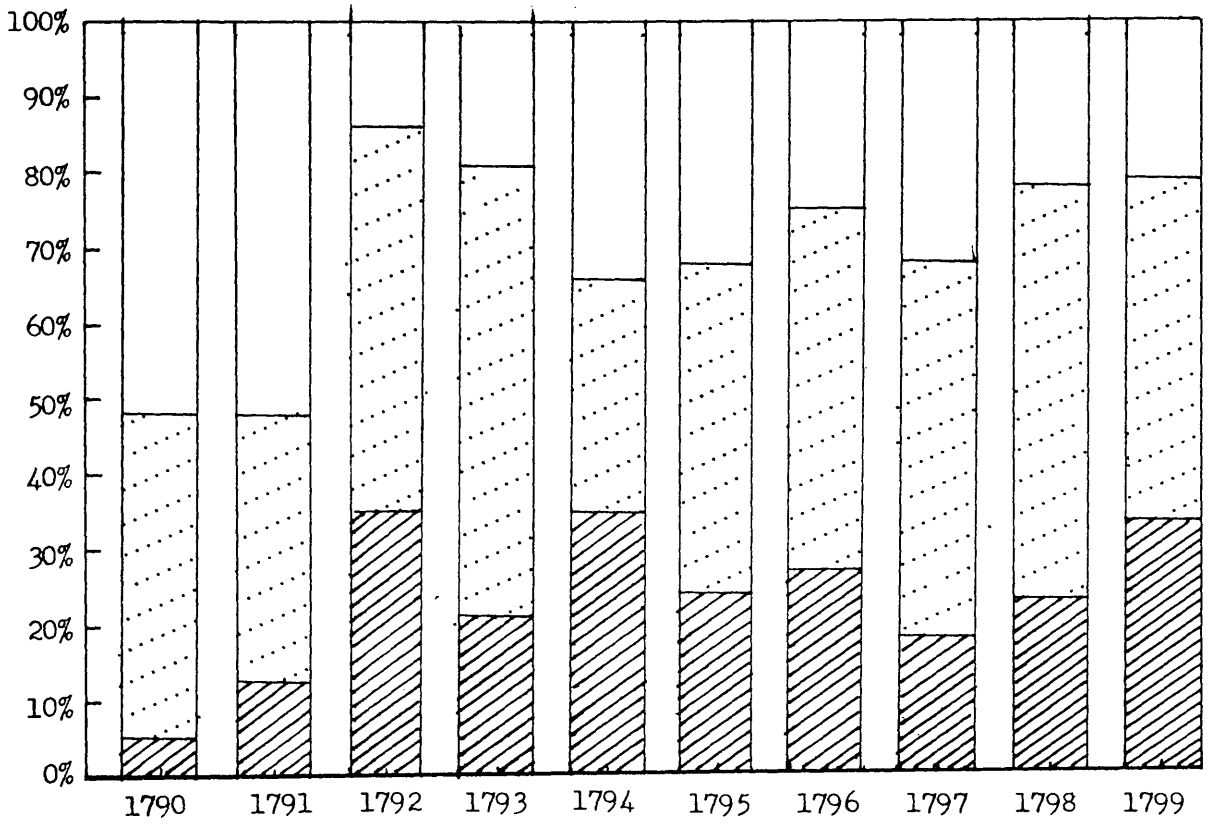
In Bushel Measures = b.

Note. The percentages recorded above are illustrated in Figure 15.

(cont: Figure 15 see p.130.

source identified below Figure 15.

Figure 15:



Coal Exported to Ireland from the Upper River Clyde.

Coal exported from Port Glasgow.

Coal exported from Greenock.

Coal exported from Glasgow.

Source. "An Account of the Quantity of Coals Exported from the Several Ports of Scotland from 5th January 1790 to 5th January 1800; distinguishing each year, as also the Ports from which the same were exported, and the Places to which they were respectively cleared out" in Report from the Committee on the Coal Trade. 1800

In the course of 1794 the "Hope" made four voyages from Port Glasgow to Ireland, two of which were to Dublin and two to Limerick, carrying crown window glass, bottles and coal, and on her return trips grain was included in her lading.[30] Scottish coal exports to Ireland both north and south did not so much reflect a demand for coal, as it did a desire of the Clyde merchants to find a lucrative ballast cargo on the outward voyage and to import grain and many other Irish commodities so valuable to the domestic economy of Scotland. These commodities were frequently advertised in Scottish papers and as an example Alexander Gillespie of Althaman, near Carrickfergus, advertised alabaster for sale in the Glasgow Journal 3 - 10 February 1774, an advertisement which also suggests the presence of coal boats in Belfast Lough from the River Clyde and that their empty holds might be used for his alabaster on the return voyage to Scotland.[31]

Coals to North America and the West Indies.

John Gibson in his History of Glasgow, published 1777, recounts the trade of the city and its mercantile and export basis; in his tables he identifies coal exports from Glasgow, Greenock and Port Glasgow to Ireland, North America and the West Indies. His examples are taken from the year 5 January 1771 - 5 January 1772 and the market shares reveal that Ireland enjoyed about 32% of the trade, whilst North America had 53% and the West Indies 15%. The market share enjoyed by North America is quite dramatic and some account of its mineral trade must be made to explain it. There are two significant features

of the West of Scotland's overseas trade with America. First, the major place occupied by tobacco, both as raw imports and as an export. In 1771, the peak year for tobacco imports, it accounted for 36% of the total value of all imports and for 51% of all exports. In the same year home industry, though stimulated by the foregoing traffic, only accounted for 27% of the value of exports, and linen cloth, both plain, printed and checkered, was the chief item, representing some 20%.[32] The second feature is the dependence of the Scottish Economy on America, and in particular Virginia and Maryland, both for its chief imports and as a market for its industrial products, including coal, as can be seen from the accompanying tables and figures extracted from Gibson's statistics (see Table 9 and accompanying Figure 16).

Table 9.

Coal Exports from Glasgow, Greenock and Port Glasgow,

5 January 1771 - 5 January 1772.

To Ireland: Totals: $336^{1}/_{3}$rd chalders.

Belfast	$273^{4}/_{9}$ths chalders.
Cork	$19^{2}/_{9}$ths chalders.
Drogheda	$4^{5}/_{9}$ths chalders.
Larne	24 chalders.
Londonderry	$11^{1}/_{9}$ths chalders.
Wexford	4 chalders.

To North America:		Totals:	$551^{4}/_{9}$ths chalders.
Boston	$117^{2}/_{9}$ths chalders.		
Maryland	$57^{4}/_{9}$ths chalders.		
Philadelphia	$77^{2}/_{9}$ths chalders.		
South Carolina	$125^{7}/_{9}$ths chalders.		
Virginia	$173^{7}/_{9}$ths chalders.		

To West Indies:		Totals:	$153^{1}/_{3}$rd chalders.
Antigua	26 chalders.		
Barbadoes	$13^{5}/_{9}$ths chalders.		
Granada	47 chalders.		
St. Christophers	$45^{7}/_{9}$ths chalders.		
St. Vincents	11 chalders.		
Tobago	10 chalders.		

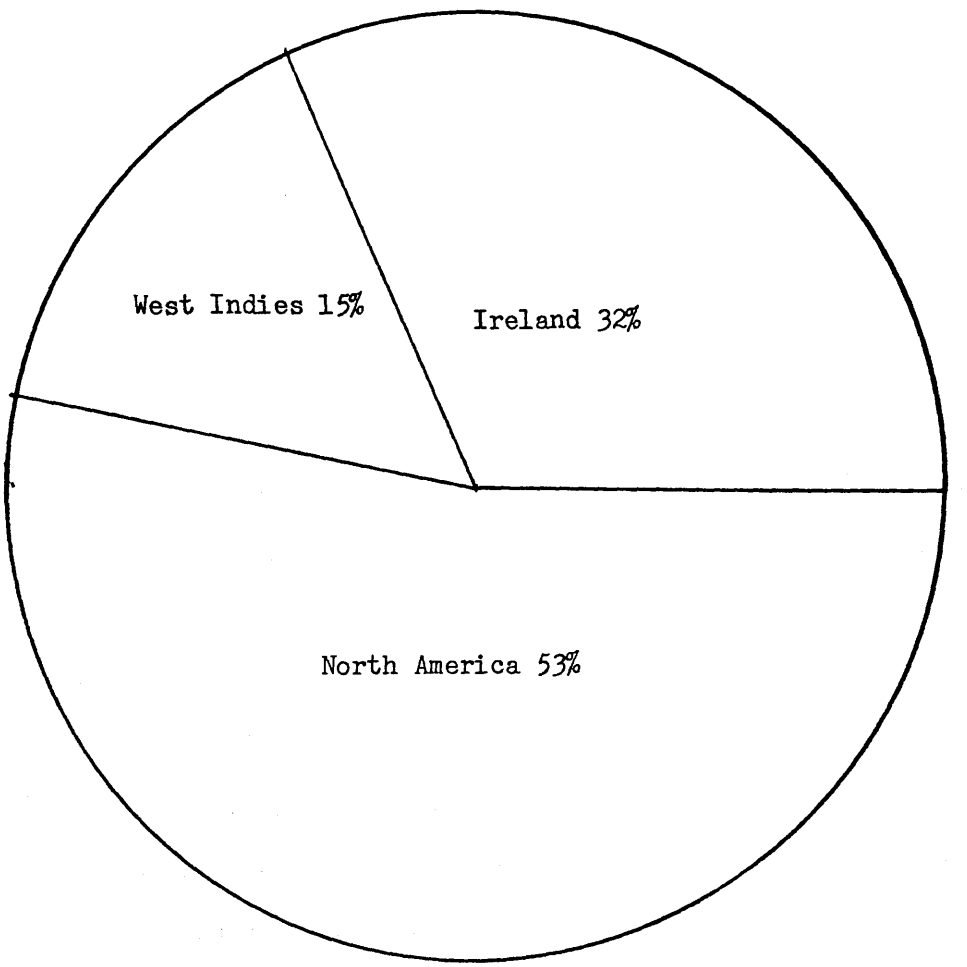
Totals:		Percentages.
Ireland	$336^{1}/_{3}$rd chalders.	32%
North America	$551^{4}/_{9}$th chalders.	53%
West Indies	$153^{1}/_{3}$rd chalders.	15%
Total coals:	$1,041^{1}/_{9}$th chalders.	100%

Note. The percentages recorded above are illustrated in Figure 16.

(cont: Figure 16 see p.180.

Figure 16.

Market Shares of Coal Exports from Glasgow, Greenock and Port Glasgow, 5 January 1771 - 5 January 1772.



Ireland	32%
N. America	53%
West Indies	15%
total	100%

Source.

GIBSON, John History of Glasgow. 1777.

Why did America need Scottish coal when coal had been located before the beginning of the 18th. century in Nova Scotia, Greenland and Illinois. This was probably due to abundant supplies of wood in America limiting the need for coal to the coast, where it was as cheap to ship it from Britain as it was to bring it from the interior, where the cost of carriage did not encourage exploitation.[33] Wood met fuel demands in agricultural areas and it was only improved communications that stimulated the American coal trade.[34] However, Pennsylvania Anthracite was known by 1763 and Obadiah Gore used it successfully in a smithy forge in Wilkes Barre in 1769. The anthracite was also used at the Carlisle Arsenal as well as Jesse Fall's nail manufactury, Wilkes Barre, in 1788,[35] and it is this industrial use that accounts for much of the traffic in coal to the coastal towns. New Jersey had by the final decades of the century, 41 fulling mills, 8 furnaces, 79 forges, 366 sawmills, 508 grist mills, 192 tanneries. Fulling mills were where cloth was cleansed and thickened by being pressed between rollers and cleansed with soap or fuller's earth and the extent of possible coal use is difficult to measure. But other industries such as breweries, distilleries, salt and potash works, sugar houses, soap boilers, candlemakers, and potteries, all of which were part of the process of America's colonisation, consumed vast amounts of coal.

At least some of the coals used were found locally near the surface in digging cellars and wells, but Tench Coxe, the Pennsylvania

Commissioner of Revenue, suggests that coal was still to be exploited in the 1790s, and that the indigenous coal supply came by water from Virginia to Philadelphia. He identifies a small but flourishing coal trade based on Massachusets; Rhode Island; Connecticut; New York; Pennsylvania and Virginia; creating the confusion of an American coal trade which produced 13,023 bushels of coal in the year 1 October 1791 to 30 September 1792, and 14,719 bushels in the following year, for export from American ports. It may have been partly transhipments but even had it been locally produced it did not compare to the massive coal imports of for example 181,885 bushels of coal in the year ending 30 September 1790.[36] There was therefore an opportunity for coal to be brought into the country from outside, in boats such as the "Pearl" which burnt out near Cape Charles, 10 September 1753, as a result of the spontaneous combustion of her cargo.[37] Coxe states that coal often came as ballast or part cargo, and certainly the "Pearl" had carried both passengers and cargo. Ballast also allowed a paying cargo on the outward voyage for American exports on return; as with Ireland it seems that part of the American coal trade originated in the need to keep ships busy both ways so as to pay their passage.

The West Indies Trade was probably similar, wrought iron goods figure in exports to plantations and coal may have gone as part cargo, along with linen goods, herrings, "woolendries" and hardware,[38] and once landed it would have been used for sugar boiling and other industries such as brickmaking.[39]

Thus the marked difference in the availability of domestic coal supplies in Scotland and in Ireland, North America and the West Indies, laid the basis for the growth of a substantial trade in coal from Scotland to these countries in the 18th. century. The west seas orientation of the western mining districts of Scotland meant their domination of the trade, and creates the impression of a far greater trade than actually existed, as limited ballast or "make-weights" could have accounted for much of the 53% of coals to North America.[40]

Minerals Transport by land carriage.

The spatial distribution of mining, as the result of local geology, affected the growth and development of carting and minerals transport. Initially, carting was probably immediate to the locality of the mines, serving very small markets via very poor roads, with both carter and customer at the mercy of the elements. The short distance which coal might be carried is seen when comparing the site of some industries to that of their coal supply. The Snuff Mill, at Netherlee of Cathcart, was constructed both in relation to the fall of water for its 4 snuff grinders, and to the colliery at Bogton, for coal for its fire place for drying tobacco. Its tack notice in 1751 mentions that there was:

"Plenty of Coals Near It."[41]

Similarly, the big corn mill and kilns at Donaldshill, Hillhead, was close to the collieries of Gilmorehill and Partick.[42] The

colliery at Kirklee of Partick probably supplied the domestic demands of the Dunmores and the immediate locality of mills and bleaching greens.[43]

Road development is most easily traceable in agricultural areas and by the 18th. century, there was a well developed system of cart roads in the Ledcameroch district of Garscadden.[44] It may be that the slaking of fields with lime as a manure, from locally wrought and calcined limestone was the fillip. Certainly lime burning consumed large quantities of coal, which had to be taken to numerous well dispersed lime kilns, and then on to the farms.

It is also of note that the first bridge developments, outwith the Royalty of Glasgow, occur in the Kilpatrick District of good farming land. The bridge across the River Kelvin at Garscube, was promted by John Graham of Dougalston, William Campbell of Succouth, John Douglas of Mains, and merchants Thomas Dunmore, Lawrence Colquhon, James Campbell and John Douglas.[45] The majority of the principal contributors held good agricultural and mineral lands and were keen to see their produce distributed to market. The bridge almost certainly carried carts of locally wrought coal and calcined limestone from the immediate estates. The tacksmen of James Graham's Dawsholm Estate had the privilege of selling coal and calcined limestone,[46] and the bridge would have provided an up-river bridging point to markets.

It would seem that carting was still limited, the measure of a cart was about 6 cwt. and it is likely these were used only for

short distance work. This is hinted at in how a percentage of coal went to estate houses in for example Campsie,[47] and the tenants of Bardowie House in Baldernock were obliged to lead coal to the proprietor of Baldernock, as part of their tack.[48] It seems the provision of transport was often in the agreement for the use of land.

The larger carts, those of 9 cwt, probably the so-called "broad wheeled" type,[49] were in the hands of professional carters. The collieries probably paid them a sum to carry their coals. The Barrachnie & Glenduffhills Coal Company gave no discount on coals carted to Glasgow, for it paid for the cartage. Carting was expensive for the coalmasters and they encouraged customers to come to the pit head and take coal in their own carts at discount prices. A discount of 5% was offered at Barrachnie for collecting coals.[50] Customers arranging the up-lift of their purchase from pit head appears to have been common practice, and again would suggest very localised distribution.

There was a division of type of distribution into the localised, as for example at Bogton where the coals were used primarily to calcine limestone at the lime works,[51] and those distributing coal, as for example Colin Dunlop and Alexander Houston who were delivering coals at the Broomielaw from Little Govan, at 2/1d. per cart.[52]

The organisation of distribution created the need for agencies, for example those of George Reid and Robert Davie, who acted for Barrachnie and Glenduffhills;[53] or Robert and William Knox, the agents for Little Govan Colliery, and established in Stockwell Street.[54] Archibald Smellie & Sons coalmasters in the Shettleston area, offered their coal at 17d. per cart at the coal pit, and 2/6d. per cart in town. They took coal orders directly for these could be placed at Richard Smellie's house in Adam's Court, fronting Jamaica Street, though they did also employ an agent, Thomas Falcon at Glasgow Cross.[55]

There were two forms of selling, one by credit and the other for cash. Gabriel Gray supplied coal at the Broomielaw at 2/6d. per cart on credit, and 2/4d. for cash in hand.[56] Richard Cameron, coalmaster at Lightburn, appears to have supplied only for cash in hand, at 2/4d. per cart.[57] John and Matthew Orr, sold their coals at Camlachie for 2/- per cart on credit, or 1/10d. per cart for cash in hand. In Glasgow, their coal was put down for 2/6d. per cart on credit, and 2/4d. for cash in hand.[58] It may also be noted that the Orrs at that time offered calcined lime at 11/4d. per chalder, a reflection of its value compared to that of coal. Their agency was the Glasgow Rope Work Office in Candleriggs.[59] The geographical location of agencies also shows how empires had begun to grow by the 18th. century, with Ivor Campbell the agent at Govan Colliery being assisted by Alexander Nisbet, acting for the same concern but based at Knightswood.[60]

The practice of credit facilities was general but also often abused for the masters at Govan, Cambuslang, Camlachie, Shettleston, Sandyhills, Westmuir and Fullarton, soon found they were not getting paid. As a result they withdrew their credit facilities and would sell only for cash. Those sending carts to the collieries were told that the hillsmen would not fill their carts without being paid or shown credit papers. Payment was to the agents or to the carters, or in the case of the Broomielaw, the boatmen.[61] This occurrence identifies several forms of distribution, firstly personal carting, secondly contract carting either for businesses, coalmasters or their agents, and transhipment by lighter.

Carting was carried out on a six day basis, the breaking of the Sabbath by no means uncommon could and did meet with dire consequences. In October 1792, the colliery managers were being told to honour the Sabbath and to underline the point, Gorbals magistrates seized two wagons, running to the Broomielaw, with coal from Little Govan Colliery. The coal was taken and sent to the Town Hospital,[62] which represented a loss of between 18 - 24 cwt. of coal to the coalmasters.

The magistrates also ruled the price per wagon, and as a result there were regular disputes between the carters and magistrates over pricing. One such disagreement in November 1792 clearly identifies the pricing of coal per 24 cwt. cart in the Glasgow area at that time (see Table 10). It also illustrates the influence that carters had on pricing and also attempts at rudimentary organisation on their part.

Table 10.

Colliery Hill Prices in the Glasgow Area 1792.

Cambuslang	5/6d.
Fullarton	5/6d.
Govan	6/6d.
Green	6/-
Haghill	6/8d.
Lightburn	6/8d.
Rutherglen	5/6d.
Sandyhills	5/6d.
Shettleston	6/-
Westmuir	6/6d.

Note. Price per 6 hutch wagon of coal, a hutch was equal to 4 cwt. hence 24 cwt. carts.

Source. Glasgow Courier 29 November 1792.

Though the above table reflects the selling price at these named collieries, the coal carters bringing the coal to Glasgow sold it at a considerably higher price. Coal carters selling at 8/- per cart from any of the above, could earn 5/6d. - 6/- per day according to contemporary account.[63] Naturally this "profiteering" aroused the customers and aroused the Council to the problem of locally high coal pricing.

The carters on their part organised to strengthen their position with regard to Broomielaw prices. In the presence of John Hood, the

Water Baillie, a group of carters bound themselves to deliver to the Broomielaw boatmen a fixed measure of 24 cwt. at 8/6d. This the carters claimed was the only price at which they could profit, unless the pithead prices fell. The carters also disputed the 24 cwt. cart measure as too great a draught for their horses. They asked that it might be fixed at 20 cwt, instead.[64] This initiative directed the blame for the impasse over prices to the coalmasters, who in their turn were to be approached by the City Magistrates. The fixing of weights was also a point of dispute as it is likely that many of the carts coming to Glasgow were not capable of carrying 24 cwt. This is suggested by a spate of fines for short measures at that time. A few days before the carters' meeting with the Water Baillie, another coal carter had received a hefty fine of £10 Scotch (16/8d. sterling) for running off with a cart of coal, which the Water Baillie had seized on suspicion of being weight deficient.[65] This was perhaps an admission of guilt and it was therefore important for the more honest carters to strengthen their position.

The City Magistrates had obviously listened and approached the coalmasters in December 1792 to force a reduction in coal prices. It is not to be surprised at that the coalmasters attempted to shift the blame back to the carters. But arbitration prevailed and the proprietors of Govan, Westmuir, Shettleston, Cambuslang and Fullerton, chose to give over certain pits to maintain a selling rate of 8/- per cart of 24 cwt.[66] It was this sort of formal arrangement which

led to the establishment of the Society of Coal Carters, and the move to adopt particular measures of sale, with carts of 12, 18 and 24 cwt.[67] Coal carting increased in importance with the opening of better lines of communication, though toll bars were to be the bane of coal distribution to market. Both points are hinted at in the Bellahouston & Dumbreck Coal Company's attempt to open up a Paisley market for its coal, with improved road communication in that area. In advertising its coal the Company took great pains to state that there was but one toll bar on the road to Paisley.[68] Horses and carts became the lifelines for many mines and were often included in colliery sales, as that of Netherfield Coal Works, Carntyne. The sale included a horse and a coal waggon, and a field of barley with which to feed the horse.[69] There were though still problems in distribution for better lines of communication still left much to be desired and provendor made horse usage expensive; for that reason alternative means of transport were still required.

Inland Mineral Movement by Water.

The use of rivers for coal transport in the Glasgow region were limited by their turbulent natures to the River Clyde, the River Cart and the River Leven. Previously it has been shown how coal masters such as Colin Buchanan were able to exploit rivers to open up new markets (see p.162) but such opportunity was limited. Indeed the only other river usage, apart from the Clyde, was restricted to

the Porterfield Coal & Lime Works wharfage on the River Cart at Renfrew.[70] The concern of this section is therefore with the canals that opened in the 18th. century and the role they played in distributing coal and other minerals to market.

Canal development in 18th. century Scotland comprised the Forth & Clyde Navigation and the Monkland Canal, promoted by the same merchant interests but each for its own purpose, though providing a means whereby several collieries around the Glasgow area could get their coals to market. The Forth & Clyde was conceived as a coast to coast link across the narrow waist of central Scotland, and in its course it served various pits along the north flank of Glasgow. The Monkland Canal was designed to open up the coal seams of North Lanarkshire, and though not all plans were realised both canal and collieries were generally successful.

The Forth & Clyde Canal was opened from Grangemouth to Bowling in July 1790, coal revenues show a steady rise from the start of records c1791,[71] though they did not go above 1,000 tons per annum before 1800.[72] The canal was though a popular inducement to invest in mining property on its course, as at Cowdenhill,[73] or Possil, where the colliery used the canal from the outset and had a wharf on it, a little to the west of Lambhill Bridge. Andrew Walker in charge of the mine, stated that coals could be delivered on board vessels at 4/- per cart.[74] The canal also channelled in minerals from the Campsie and Kirkintilloch mining districts and probably opened up the Campsie limestone trade as it became readily available

on the Glasgow market from the end of the 18th. century,[75] with many of the minerals agents handling Campsie limestone having offices and yards at the Canal Basin.

The growth of Glasgow's population in the 18th. century led to a rising demand for coal and the need to move it. The coalmasters were often accused of monopolising the market and the heavy cost of land carriage made it uneconomical to bring supplies from pits far distant of the city. The Monkland Canal was developed to give access to Monkland's coal, and though only about 12 miles in length, it made the exploitation of the coal and ironstone resources in Lanarkshire that much easier. Capital invested in its construction resulted in further investment in the opening of new mines with the promise of potential markets, customers came some way to meet it as evidenced by the enthusiasm with which the crowds greeted the first boat from the eastern coalfields to reach Hamiltonhill Basin, on the completion and opening of the connection with the Forth & Clyde Canal on 17 October 1791.[76] Coal tonnages levies also illustrate the importance of coal, where it was 6d. per cart of 12 cwt, and though the canal proprietors had the option of an additional 2d. per ton per mile, they seldom took it and from 1794 to stimulate coal traffic along the canal only a ½d. per ton per mile was charged providing water was ample.[77] Thus coals delivered in Glasgow were 3d. lower per cart than from rival collieries in the city area.[78] This created problems, for the market in the late 18th. century did not generate the demand for coal that had been expected, and the success of both the mining and the canal caused prices to plummet in Glasgow. The established

coalmasters formed a combination to maintain price levels, so that supply and production were kept deliberately low to inflate prices, and excess coals were dumped on export markets such as Ireland.[79] The Monkland Canal affected the equipoise of mining in the Glasgow area and its opening heralded a new phase in the history of local mining.

However, there were problems, for in 12 miles there was 120 ft. of lockage and the canal was generally too narrow. Thus transit along its course was slow, delays setting up at locks as boats waited to pass through. It was probably not truly exploited till the 19th. century when a series of short cuts to ironworks in the New Monklands brought their trade flowing down the canal to Glasgow.[80] What the Monkland Canal did do was create market pressures which in turn necessitated greater understanding among the coalmasters and fostered the growth of combinations in the coal trade.

Combination in the 18th. Century Glasgow Coal Trade.

By the 18th. century many coalmasters in the Glasgow area came to appreciate the value of better sales organisation and of formal groupings to give them greater influence. These groups of mine owners originated in mutual petitioning over problems such as river levies on coal, but the main factor affecting their rise was the necessity to regulate the sale of coal in Glasgow and how to control output from the mines so as to maintain prices. Essentially the aim was to increase bargaining powers and reduce marketing costs by pooling some of their resources.

The contemporary journals and burgh records identify the petitioning of various groups of coalmasters. The Glasgow Trades House Record mentions a combination of coalmasters who though they remain in anonymity had made the Council take notice by driving up coal prices above what the Council regarded as an acceptable level of between 1/- and 1/6d. per cart in 1760.[81] Senex mentions a similar agreement by which local coalmasters, including the Orrs of Barrowfield, the Grays of Dalmarnock, M'Nair of Greenfield and Dunlop of Govan, forced up the price of coal from 2/6d. to 3/- per cart in 1776.[82] They agreed quotas of of output per colliery probably on the basis of past output and the table below is derived from this:

Table 11.

Table of Colliery Quotas, estimate of output and revenue in 1778.

Collieries.	Output in carts.	Tonnage based on a cart = 9 cwt.	Revenue at 3/- per cart.
Camlachie	33,500 carts.	15,075 tons.	£5,025.
Lightburn	29,000 carts.	13,050 tons.	£4,350.
Govan	28,000 carts.	12,600 tons.	£4,200.
Westmuir	27,000 carts.	12,150 tons.	£4,050.
Stonelaw	23,000 carts.	10,350 tons.	£3,450.
Knightswood	36,000 carts.	16,200 tons.	£5,400.
Easterhill	15,000 carts.	6,750 tons.	£2,250.
Monkland	6,000 carts.	2,700 tons.	£900.

(cont:

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Haghill	6,000 carts.	2,700 tons.	£900.
Cambuslang	6,000 carts.	2,700 tons.	£900.
left on hill	27,700 carts.	12,465 tons.	
	total.	106,740 tons.	

source: Developed from list of average production figures in DUCKHAM, B.F. History of the Scottish Coal Industry. I. 1972. p.235.

The 27,700 carts on hill, or 12,465 tons of coal, were stockpiles to keep the coal prices high. The effective contribution to the market was 94,275 tons of coal; the average output per colliery was about 9,427.5 tons of coal per annum.[83]

It is probable that other members of this combination included Gilbert Hamilton and the Dennistoun Family, who all figure prominently in petitioning for the lifting of river levies on the movement of coal in the River Clyde, as recorded in the Glasgow Burgh Records.[84] But, however successful the combination may have been it foundered with Orrs' business failure and the lessening of the influence of the Grays of Dalmarnock in the 1780s.[85] There were other active combinations and though it is not clear that there was any co-existence with Senex's combination, the Jordanhill Coal Work Society was another 18th. century combination. It consisted of a committee of coalmasters in the Jordanhill, Knightswood and Kilpatrick districts, who controlled the output

and sale of several small collieries,[86] including Knightswood which had featured so predominantly in the 1776 combine. The Jordanhill Coal Work Society was probably territorial being isolated from the immediate area of Glasgow, where collieries in the locality of town fulfilled market needs.

In 1790, the opening of the Monkland Canal knocked the local coalmasters out of their complacency as their monopoly dissolved in the face of new competition. This came from the coalfields of Coatbridge and Airdrie, which had been little worked through lack of local demand and the cost of carriage to Glasgow. The canal changed that, and offered an easy route to market, actively encouraged with low tonnage levies by the canal owners, whereby coals delivered in Glasgow were 3d. lower per cart of 12 cwt. than was possible from the road reliant local collieries.[87] This was not the only problem for the local collieries, for they also suffered bad marketing practices. Perhaps the principal of these was a bureaucracy of selling and ordering agencies, which made the following up of credit agreements difficult and therefore there were many bad debts. Considerations such as these led the colliery owners to form themselves into the major 1790 combine to try and get order out of the chaos.[88]

Robert Gray of Westmuir was the instigator, with James Farie of Farme, William Dixon of Govan, and James Dunlop of Fullarton, being his associates. The Westmuir Coal Company partnership consisted

of the Dennistouns, Gilbert Hamilton, James and Robert Gray. All had had previous involvement in formal or informal groupings of coalmasters to petition the Town Council. Gilbert Hamilton, as a Glasgow coal merchant had probably featured in the 1776 combine. The odd one out of the partners was Archibald Wallace, but it may be that his name simply did not feature earlier, and he was also a Glasgow coal merchant.

The partners established a cartel to buy all saleable coal from each of the participating enterprises, each of which was given a production quota. There were though special provisions for contracts with various industrial users: the Govan Coal Company was to be at liberty to sell direct to the Glasgow Glass Works, though the amount was to be included in the set quota; the Fullarton Colliery was allowed to sell 15,000 carts to the Clyde Iron Works in addition to their quota of 15,000 carts.

The colliery owners did not allude to the New Monklands competition openly, but stressed the difficulties in granting customers long term credit and in the end not getting paid. An advertisement in the Glasgow Mercury for September 1790, thundered about overdue credit, and that as a result coal would be sold only for ready money. Those sanding carts to the collieries were told that the hillsmen would not fill their carts without being paid on the spot.[89].

The Glasgow Coal Company, as the association came to be known, was owned and controlled by the coalmasters themselves; the popular papers of the day suggest that it was as agressive as it was bureaucratic.

There was a distinct administrative entity, a committee of the main coalmasters, messrs Robert Gray, William Dixon and William Hamilton. All of the partners enjoyed shares in the Glasgow Coal Company, whilst the collieries were set quotas, both are given in the tables below:

Table 12.

Share Holdings.

James Dunlop and Alexander Houston (Govan)	four-sixteenths.
Westmuir Coal Company	four-sixteenths.
James M'Nair of Greenfield	one-sixteenth.
Messrs Farie of Farme	one-sixteenth.
James Dunlop	three-sixteenths.
Robert Gray of Westmuir	one-sixteenth.
William Hamilton of Barrachnie	one-sixteenth.
William Dixon of Govan	one-sixteenth.

The coalmasters either held shares singly or in partnership and gained a strong hold on the Company. The quota for member collieries was as follows.

Table 13.

Quotas.

Govan Colliery	50,000 carts.
Westmuir Colliery	50,000 carts.
Camlachie, Barrachnie and Sandyhills,	40,000 carts.
Collieries.	(cont:

Shettleston Colliery	25,000 carts.
Cambuslang Colliery	25,000 carts.
Fullarton Colliery	25,000 carts.

Note. The quotas for the Barrachnie, Camlachie and Sandyhills collieries totalled 40,000 inclusive of all three.

Source. DUCKHAM, B.F. A History of the Scottish Coal Industry. I. 1972. p.236.

The agreement signed on the 4 August 1790, was to last for seven years from 1 January 1791. The parties undertook to bind themselves under a penalty of £100 to support their common cause, but whether it continued for the full term is not clear. It probably crumbled after 1793 as a result of a boom in prices due to bottlenecks in transport and problems of distribution as new collieries opened up along the Monkland Canal. A coal contract sale in 1793 points to the direction of trade by that time, it entitled the holder to receive at a reasonable rate the coal from pits in the Monklands up to 200 cart loads per day for 17 years after 1 January 1793. The contract was sold in July and included coal boats capable of carrying 40 carts weight, about 24 tons actual weight. Coals were sent along the canal to Riddrie Bridge for sale. On the completion of the Blackhill Locks in July 1793 the canal was opened to Townhead.[90] Andrew Stirling the chief proprietor of the canal had commenced his operations at Faskine and was sending 50,000 carts of coal to Glasgow annually. Captain James Christie opened pits beside the canal at Coats and Dundyvan, and he was able to put

30,000 carts of coal annually on the Glasgow market. Together their output was almost equal to half that of the Glasgow Coal Company. Christie sold his coals at ranging prices offering bulk order discounts but selling normally at the rate of 3/- per cart of 12 cwt. Coal sold at Riddrie drawbridge was slightly cheaper being 2/9d. per cart of 12 cwt. Christie took orders at the canal basin or the Tontine Coffee House in Glasgow, which was one of the main business meeting centres of that time.[91] He also took orders through Wright's the druggists in Trongate, which in turn became an agency for Gartsherrie coals.[92] Monklands coals could be ordered at the very heart of the commercial centre of the city and at competitive prices too.

It was pricing that sowed the seeds of dissension within the Glasgow Coal Company, with the decision that price increases should be the sphere of individual concern, and not corporate decision. Perhaps this is no wonder for the equilibrium of the economy was anything but steady. The domestic series in Gayer, Rostow and Schwartz price index (100 = monthly or 1821-25) fluctuated quite dramatically from 80.6 (1792) upward to 115.8 (1796) then down again to 100.2 (1798) and upward again to 161.7 (1801).[93] Coal prices increased steadily, Senex notes them as follows (see Table 14).

Table 14.

Coal Price Yearly Averages 1790-1800.

1790-1792	3/6d. per cart.
1793-1795	4/-
1796	4/6d.
1797-1798	5/-
1799	6/6d.

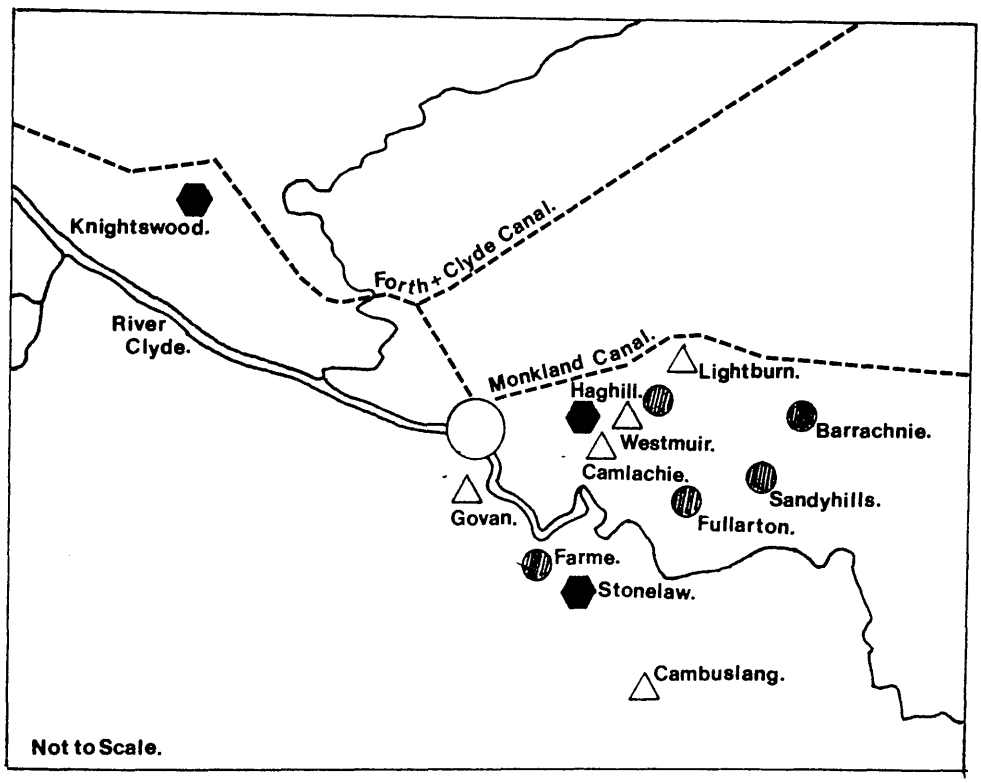
Source. SENEX (robert Reid) Glasgow Past and Present II. 1884. p.63.

Duckham states that coal prices rose from 5/10d. to 10/10d. in 8 years.[94]

It may be assumed that the association fell foul of expanding production in an enlarging market, brought about by the influence of the Monklands coalowners, which could not easily be controlled by one small group of producers. But checks in the price of coal, the crises and recessions of the late 18th. century, could still bring mutual understandings. In 1799, the principal coalmasters, Dixons, Spens, Robert Gray, Farie and M'Nair, were paying "sleeping rents" to persuade John Gray of Scotstoun not to mine his coal at Rutherglen. This was to limit production and keep prices high, and was probably prompted by the depression of 1797. But it also shows how agreement and organisation had become an integral part of the coal trade, how influence and manipulation of selling had become part of the great game of business. Thus by the onset of the 19th. century business organisation on a grand scale was part of the

Industrial process of mining. Collieries participating in the combines of the 18th. century are located on the map below (see Figure 17).

Figure 17.



Collieries Participating in the Combinations of 1776 and 1790.

Key.

⬢ Collieries participating in 1776 Combine.

◍ Collieries participating in 1790 Combine.

△ Collieries participating in both combines.

Source. HAMILTON, Henry "Combination in the West of Scotland Coal Trade, 1790-1817" in Economic History II. 1930.

DUCKHAM, B.F. History of the Scottish Coal Industry. 1972.

Conclusions and Continuity to 1830.

The pattern of marketing experienced in the early 19th. century owed much to the previous two centuries. Pulling together the threads of evidence to 1800 reveals the continuity of marketing experience up to 1830. There were no sudden and dramatic changes, for the geographical character of the Glasgow region had already dictated a pattern. Barriers of drumlins, bogs, and rivers had made road communication difficult and costly, and while for the most part rivers were either too rapid for navigation or estuarine meanderings, they provided the first possible highways to commerce. This was seen in the use of the Upper Navigation of the River Clyde to move coal from an area where the heavy cost of land carriage hampered trade to such an extent that when a tiny cart of coal did manage to make it from East Kilbride to Cambuslang, it was seen as a seven day wonder. The use of the Upper Navigation helped to develop a trade of small ships working to and fro along the shallow estuary of the River Clyde. It was from this restricted trade that the Firth of Clyde blossomed as a centre of commerce and a highway to greater things, with the general improvement of the river with the deepening of its course by Golburn and others. This allowed the use of the River Clyde for coal movement to a far greater extent than had previously been possible and coalmasters such as Colin Buchanan were quick to take advantage and extend their markets beyond their immediate neighbourhoods. However the proximity of the

Ayrshire Coalfield to the Clyde Coast never allowed the domestic market for Glasgow coal to establish in the Firth of Clyde, with the exception of Bute and Rothesay. But there was still good opportunity for export and coal was traded to Ireland, America and the West Indies.

The extensive coalfields of the lowlands of Scotland contrasted with their sparsity in Ireland, as a result Ireland had to look outward for her fuel supply, but in turn she could offer a wide range of domestic supplies. Scottish coal exports to Ireland did not so much reflect a demand for coal as it did a desire of Clyde merchants to find a lucrative ballast cargo on the outward voyage for domestic exports to Scotland from Ireland, such as grain. Thus a two way trade developed to keep boats full which also explains the development of the American and West Indian trades much along the same course.

The use of the local rivers from 1800-1830 was almost exactly a mirror image of previous experiences. Though the presence of a good local canal network must also be recognised as a source of bulk movement of minerals. In the case of river traffic down the River Clyde the same wharfages were evident. Coals were still being sent from Knightswood via the old coal quay at Yoker, next the Renfrew Ferry.[95] Greenock still featured as an export and import centre for coal to Ireland and Irish consummables to Scotland. Coal and glass continued to be exported to Ireland as revealed in the

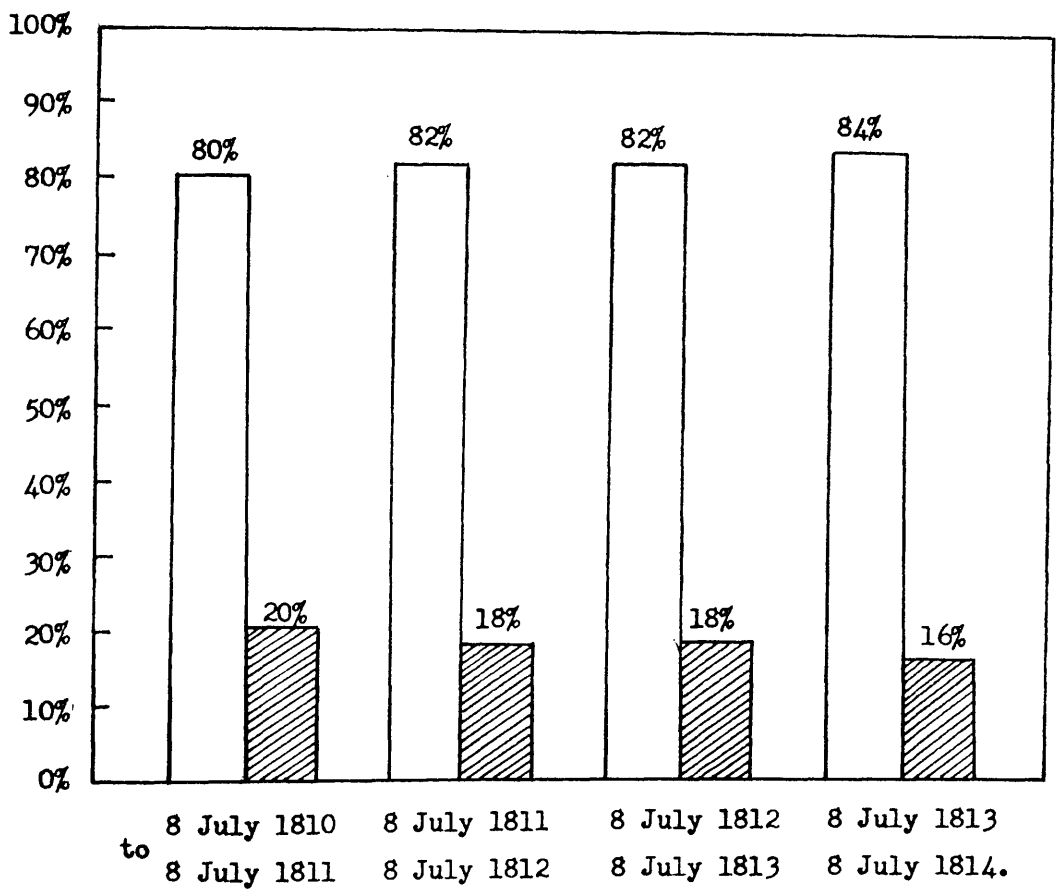
wreck of the sloop the "Resolution" which had sailed from Greenock with coal and glass for Dublin, but foundered on Ballysiris rocks on 2 May 1800.[96] Irish domestic goods came on the return voyages and William Humphrey, who had a coal yard at West Bridge, Greenock, also dealt in Belfast butter, suggesting a trading link in both cases with Ireland.[97] More local traffic also featured with coal scows on the River Cart to Paisley,[98] also the development of a lochside trade as suggested in the advertising of coal storage at the Crinan Canal basins, in Glasgow papers.[99] The navigable River Leven was not ignored either, with coals for calcining the limestone from the Murroch quarries, near Dumbarton, being sailed along its course. This coal is identified in period newspapers as having originated from collieries adjoining the River Clyde and Forth & Clyde Canal.[100] Meiklejohn, the proprietor of the Ruchazie Colliery in 1808, also made use of water borne coal distribution, Ruchazie Blind Coal being shipped along the Monkland Canal and offered at Port Dundas, or the Broomielaw, or along the Forth & Clyde Canal to Bowling Bay,[101] these latter being important export points (see Table 15).

The foreign export trade was also continued, though perhaps more organised in the 19th. century with the advertisement of coal contracts appearing regularly in newspapers. The Commissary General contracts for delivery of coal to Barbadoes, St. Vincent, Granada, Antigua and St. Kitts, are such examples of organised coal export.[102]

Table 15.

Coal Shipments at Broomielaw and Bowling.

Coal Shipped at,	Broomielaw.	Bowling.
8 July 1810 - 8 July 1811	47,100 tons 12 cwt.	11,286 tons 5 cwt.
8 July 1811 - 8 July 1812	50,716 tons 16 cwt.	11,434 tons 15 cwt.
8 July 1812 - 8 July 1813	47,114 tons 8 cwt.	10,445 tons
8 July 1813 - 8 July 1814	52,211 tons 4 cwt.	9,596 tons
totals	197,143 tons	42,762 tons
cumulative total	239,905 tons = 100%	



Key.

Coal shipments from Broomielaw.

Coal shipments from Bowling.

Source

Account of the Minerals etc. in the Public Green, Easter and Wester Common, Petershill etc. p.51. 1836.

The domestic market remained restricted and coal was mainly distributed by carting along toll roads. The tolls give clues as to the very low levels of output from some collieries. Spen's colliery, near Rutherglen, probably put out 2,700 tons per annum, an estimate based on Spen's toll charges of £15 per annum. This worked out on a 1d. per cart of less than 15 cwt. gives 2,700 tons.[103] Quantities of this size did not warrant the shipping charges and transhipment costs of the Upper Navigation, hence the domination of carting for domestic supply. Carting certainly increased in the late 18th. century as communications improved. There was good reason for this citing an early 19th. century coal sale advertisement for Milton, Parish of Old Kilpatrick, which stated:

"as there are a number of Publick Works near the lands, a ready sale may be depended on."[104]

and what better way to supply coal than by cart when the customer was perhaps a few hundreds of yards away from the coalpit. The adoption of formal measures of sale, with carts of 12, 18 and 24 cwt. and the establishment of the Society of Coal Carters, points to the way carting had become an accepted means of transacting colliery business. The cart measure also became an accepted measure as for example in the contracts for coal offered by the Incorporation of Bakers, for the supply of coal to the Clayslap Steam Mill in 1807,[105] similarly for the needs of the Cranstonhill Water Company or the Glasgow Water Works.[106]

But again as a mode of transport it was expensive, the movement of minerals was the most significant problem shared by the coalmasters from 1700-1830. The cash and carry coals of Barrachnie was an attempt to put the onus on others, but it was an onus none could escape and the movement of coal became a business in itself with all the problems that entailed. Costs such as tolls (see Table 16) were passed on in ever increasing price rises (see Tables 17 and 18) to the customer. This in its turn must have generated friction on the market which in turn encouraged collective action on the part of the coalmasters to maintain their interests.

Combinations Reprise.

It is clear that it was shared problems that lay behind the emergence of collective action among Glasgow coalmasters in the 18th. century. These actions were not all intended to control production or prices, for there were many issues, such as river charges, and gaining representation on the Town Council and so on which brought the coalmasters together. But this general concern was directed into maintaining prices and exercising control over production. Between 1760 and 1800 there were at least 4 such combinations known to have operated for brief periods, of which the most dominant was that of 1790. The Glasgow Coal Company not only influenced the domestic market but also affected the trade to Ireland. Its emergence was a recognition by the coalmasters that the coal trade could be pursued more easily by mutual agreement and witnessed the

Table 16.

Toll Rates of Waggons Passing from Coal Mines to the Broomielaw, through the listed Toll Bars, during 1828.

Name of Colliery.	Rate per waggon of 24 cwt. toll inclusive.	Name of Toll	Rate of Toll per waggon.
Wellshot,	3/-	Shawfield,	6d.
Tollcross,	3/-	Gallowgate,	5d.
Carntyne,	2/3d. 2/9d.	Gallowgate,	5d.
Hamilton Farme,	2/9d.	Shawfield,	6d.
Shettleston,	2/9d.	Gallowgate,	5d.
Eastfield,	2/9d.	Shawfield,	6d.
Westthorn,	2/6d.	Gallowgate,	5d.
Stonelaw,	2/6d.	Shawfield,	6d.
Belviedere,	2/6d.	Gallowgate,	5d.
Dalmarnock,	2/-	Gallowgate,	5d.
	The mining company paid the toll.		
Govan,	1/8d. 1/6d. 1/4d.	Jamaica Street Bridge,	1d.
Monkland Canal Basin,	1/4d.	Stirling Road,	1d.

Source.

Account of the Minerals etc. in the Public Green, Easter and Wester Common, Petershill etc. Note No.III. 1836.

Table 17.

Average Price of Coals Per Cart of 12 cwt.

1810	7/-
1811	7/-
1812	7/-
1813	6/3d.
1814	7/-
1815	7/3d.
1816	7/3d.
1817	6/-
1818	5/6d.
1819	5/6d.

Note.

Coals retailed in small quantities were charged 1d. per cwt. extra as retailer's profit.

Source.

CLELAND, James Statistical Tables Relative to Glasgow. p.133-34. 3rd. edit. 1823.

Table 18.

Average Price of Coals per Ton, 1821-30.

1821	8/4d. - 9/4d.
1822	7/11d. - 8/11d.
1823	7/6d. - 8/6d.
1824	7/11d. - 8/11d.
1825	11/1d. - 12/1d.
1826	9/7d. - 10/7d.
1827	6/3d. - 7/3d.
1828	5/10d. - 6/10d.
1829	5/10d. - 6/10d.
1830	5/10d. - 6/10d.

Source.

CLELAND, James Enumeration of the City of Glasgow. p.199. 2nd. edit. 1832. and New Statistical Account Vol.6. "Glasgow" p.162. 1845.

birth of the organised coal trade that continued to grow throughout the next thirty years. Hamilton points out that there was little evidence for mutual accord or combination in the first decade of the 19th. century. Many new collieries had opened with rising prices and a market seemingly open to all comers, then the prices collapsed. The price fall of 1809 alerted the coalmasters to plan and formulate but no agreement was reached, at least till 1813. In that year, after much planning and negotiation a fresh cartel was established. Though Stirling of Faskine, one of the chief coaltraders, remained on the side line.

The agreement was signed on the 15 May 1813, and the parties to it were the proprietors and tacksmen of the collieries in the neighbourhood of the town. Fixed quotas were established for each member, the object being to fix the price of a 24 cwt. wagon of coal at 14/-. The rates of cartage were also established and generally every thing respecting the sale of coal was regulated. This arrangement was similar to the Newcastle Vend and in both cases the aim was to keep the price of coal high in their respective markets. Dunlop played a leading part in the re-birth of the monopoly, though his proposal that the least efficient of the local collieries should be bought out by a joint levy and closed was rejected. However the Combine was not against buying out those collieries that offered a positive investment, namely Faskine and Govan. The purchase of the last had in its turn a major effect on the pattern of local mining, as shown in the case history of Govan.

The Combine also influenced market trends, bounties were paid on coal shipped to Ireland to encourage exports so as to deplete local stocks and maintain high prices. Ireland became a convenient dumping ground for excess production, as shown in the export of 27,820 carts of coal to it in the years 1813-1814. It may be noted that Bowling had become a bounty port and of the 27,820 carts noted, 23,162 carts were entitled to the bounty, pointing to the importance of Bowling as coal port at that time. Paisley was a further safety valve, having been declared a free market it proved an outlet for the coal surpluses of Govan and Fullarton. Output within the cartel, after an initial rise, fell as follows:

Table 19.

Output of Coal by 1813 Combine.

1814-1815	415,162	carts.
1815-1816	357,560	carts.
1816-1817	320,114	carts.

Source. DUCKHAM, B.F. A History of the Scottish Coal Industry. I. 1972. p.237.

The reason for this was falling prices, reflecting in the fall off of sales and the curtailment of production. Industry was depressed in the post-Napoleonic War period, especially the iron industry, an important market of the coal put by the Combine members. The Combine lasted until March 1817, its final years coinciding with this

depression and then an upsurge of activity by the Spring of 1817, which triggered off all the old competitive spirits of the coal owners. However an embryonic organisation was likely maintained capable of expressing joint opinions.[107]

Rapid industrialisation was the principal reason for the growth of the coal industry from c1820-1830. Some indication of the growth may be derived from the tonnages of coal sent to Glasgow along the Monkland Canal.

Table 20.

Tonnage of Coals on Monkland Canal.

1822	176,021 tons.
1823	166,642 tons.
1824	164,533 tons.
1825	190,001 tons.
1826	165,674 tons.
1827	182,348 tons.

Note. The drop in tonnage in 1826 was due to drought and some repairs to the canal which halted trade for about 8 weeks.

Source. Account of the Minerals etc., in the Public Green, Easter and Wester Common, Petershill etc., 1836. p.53.

There were plenty of coal consuming industries in Glasgow. The steam engine was ubiquitous and all chemical works, dyeworks, bleachfields, glass works, gas works and mills tended to consume considerable amounts of coal, which could be supplied from collieries such as Govan (see Tables).

Table 21.

Table of Coal Sold to Glasgow Gas Works Company from June 1826 to April 1827 by William Dixon from the Port Eglinton Coal Basin.

June 1826	110.1 tons.
July 1826	150.9 tons.
August 1826	141.9 tons.
September 1826	74.4 tons.
October 1826	0.6 tons.
November 1826	148.2 tons.
December 1826	1,069.6 tons.
January 1827	200.7 tons.
February 1827	121.2 tons.
March 1827	100.6 tons.
April 1827	151.6 tons.
total	2,269.8 tons.

Note.

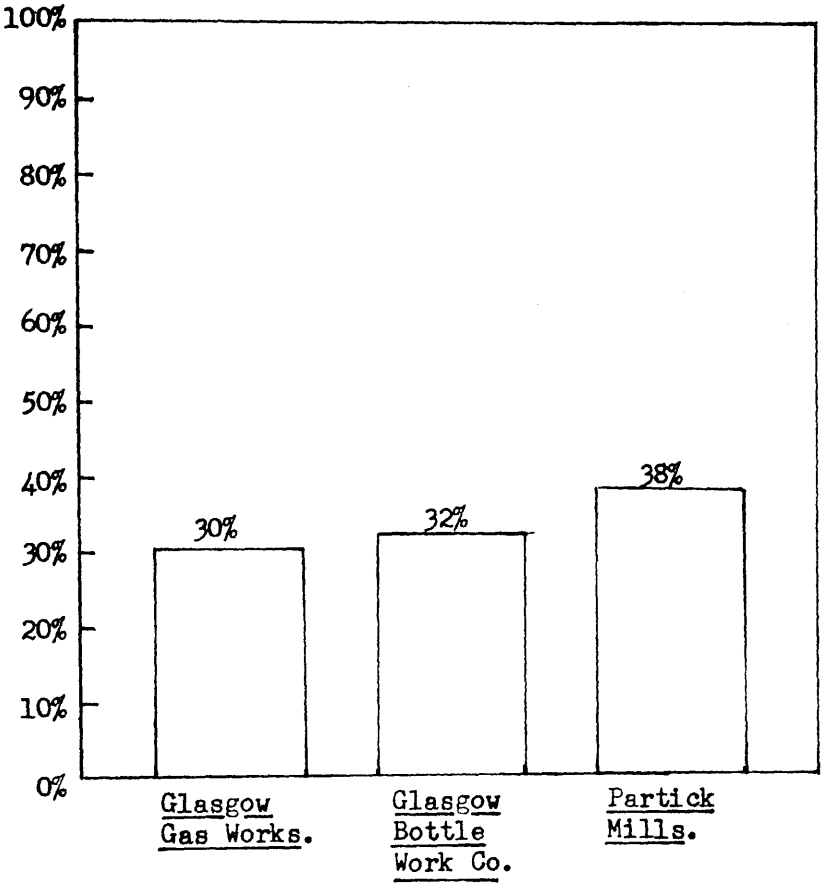
Coal outputs in the Port Eglinton Sales Book are recorded in carts of 12 cwt. Tonnage has been worked out on this measure.

Source.

Glasgow University UGD 1 Di/55/1. Govan Colliery.

Table 22.

Comparative Charts of Coal demand of Partick Mills, with the demands of two other major purchasers of coal from William Dixon at Port Eglinton Coal Basin, over a period of 14 days from 16 June - 30 June 1826.



Glasgow Gas Works bought,	110.0 tons.
Glasgow Bottle Works bought,	117.6 tons.
Partick Mills bought,	140.4 tons.
total,	368.0 tons = 100%

Notes.

Coal outputs in the Port Eglinton Sales Book are recorded in carts of 12 cwt. Tonnage has been worked out on this measure. June was a period when early crops from Hillhead were processed at Partick Mill, which may account for the coal demand in excess of the Gas Works and Bottle Works, which were both annually substantial purchasers of Dixon's coal. This is the only month in which Partick Mills figure dominantly.

Source.

Glasgow University UGD 1 Di/55/1. Govan Colliery.

The fact seems to be that the Glasgow coal industry was an essential adjunct to the general expansion of the local economy in the late 18th. and early 19th. centuries. Its continuity as a service industry from c1700-1830 as the many problems were solved, establishes its importance. These problems ranged from labour shortages and ownership debacles which were solved by an influx of cheap labour and embryonic organisation, to the problems of communication which led to the creation of a network of coal railways in Lanarkshire. Then coal had a dynamic comparable to all the heavy industries and of course intimately linked with iron in the new industrial economy.

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2. G[RAY], G[eorge] A Chapter in Rutherglen History. 1890 p.9-23.

3. The slates probably came from the Camstraddan slate quarries, Loch Lomond. There were strong connections between the Camstraddan slate trade and the merchant mineral owners of Glasgow in the shape of Dennistoun of Colgrain, who held a stake in the slate company. (see Glasgow Courier 22 February 1798).

4. Glasgow Journal 16-23 May 1765.

5. Developed from the evidence of coal prices given in trade advertisements in contemporary newspapers.

6. SMOUT, T.C. Scottish Trade at Eve of Union, 1660-1707. 1963. p.10-11.

7. G[RAY], G[eorge] op.cit. 1890 and ANDERSON, John Coal. 1943.

8. GIBB, Andrew Glasgow: the making of a city. 1983. p.91.

9. HAMILTON MSS. - account of William Lawson, mason in Glasgow, for building a wharf, 1716. and DUCKHAM, B.F. A History of the Scottish Coal Industry. 1972. and TUCKER, Thomas Report upon the revenue and custom in Scotland. 1656 (1825).

10. GIBB, Andrew op.cit. p.71.

11. Glasgow Journal 15-22 August 1771.

12. " 21-28 January 1773.

13. " 26 August - 2 September 1773.

14. WHYTE, Andrew & MacFARLAN, Duncan General View of the Agriculture of the County of Dumbartonshire. 1811. p.9-12.

Lomondside limestone quarries with strong Glasgow connections included Balmaha (Glasgow Journal 3-10 October 1765); Levenside Lime Quarries (Glasgow Courier 13 October 1810); Dumbarton had also an extensive lime trade with merchants such as John M'Aulay (Edinburgh Gazette 21 July 1829 p.211). The limestone was calcined locally and all evidence points to it having been an important customer for Glasgow and especially Kilpatrick District coals.

15. RIDDELL, John F. op.cit. p.50.

16. G.B.R. 19 September 1792.

17. Greenock Advertiser 1803-04.

18. MacDONALD, James Agriculture of the Hebrides. 1811. p.506.

19. Glasgow Journal 21-28 May 1767.

20. " 4-11 May 1769; 9-16 April 1772; 18-25 February 1773. and MacDONALD, James op.cit. p.30.

21. SMITH, John Agriculture of the County of Argyle. 1813. p.292.

Drumlemble Coal & Salt Works was established by the 18th. century (Glasgow Courier 20 January 1798) and with increasing local exploitation at that time, it was a customer for second hand mining equipment from Glasgow (Glasgow Courier 15 September 1798).

22. COCHRAN, L.E. op.cit. 1985

DUBOURDIEU, Rev John Statistical survey of the County of Down. 1802. and GAILEY, Alan Rural Houses of the North of Ireland. 1984.

23. Developed from Table 4 p.28. of Cochran.

24. Developed from Table 5 p.28. of Cochran.

25. G.B.R. 7 March 1745; 15 January 1784; 23 June 1786.

26. PAYNE, Peter L. "The Govan Collieries, 1804-05" in Business History 3. 1960.

27. HAMILTON, Henry "Combination in the West of Scotland Coal Trade, 1790-1817" in Economic History. 2 1930.

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29. Report from the Committee on the Coal Trade. Appendix No.44. 1800.

30. COCHRAN, L.E. op.cit. p.144-145.

31. Glasgow Journal 3-10 February 1774.

32. HAMILTON, Henry An Economic History of Scotland in the 18th. century. 1963.

33. WHEATLEY, H.B. Pepys Diary. Vol.VII. 1904. p.103.

BIRCH, History of the Royal Society 1756-57. I. p.199-201.

34. WRIGHT, C.W. Economic History of the United States. 1949. p.81-82, 307.

35. ADAMS, J.T. (ed) Dictionary of American History. I. 1940. p.79.

36. COXE, Tench A View of the United States of America. London Reprint 1795. p.VI;39;71;254;296;413;422;460.

37. Glasgow Journal 5-12 November 1753.

38. HAMILTON, Henry op.cit. p.263-64; 280.

39. Glasgow Chronicle 23 September 1813.

40. A facet of mining in many of the Clydeside Pits was the quantity of good fireclay taken. This was fired with locally produced coal to produce firebricks. These in turn became an additional cargo with the coal from those pits, which was exported to the United States and the Sugar Plantations. Firebricks were sold at £3 10s. per 1,000. (Glasgow Journal 14 October 1829).

41. Glasgow Journal 3-10 June 1751.

42. " 3-10 March 1755.

43. " 19-26 May 1755.

44. " 11-18 March 1751.

45. " 7-14 January 1754; 11-18 March 1754.

46. " 27 January - 3 February 1755.

47. SKILLEN, Brian The Mines and Minerals of Campsie. 1985.

48. Glasgow Journal 21-28 April 1755.

49. " 19-26 March 1761.

50. " 27 May - 3 June 1762.

51. " 12-19 July 1764.

52. Glasgow Journal 22-29 May 1766.

53. " 27 May - 3 June 1762.

54. " 22-29 May 1766.

55. " 11-18 March 1773; 6-13 May 1773; 13-20 May 1773.

56. " 17-24 February 1774.

57. " 10-17 March 1774.

58. " 10-17 March 1774.

59. " 10-17 March 1774.

60. " 8-15 September 1774.

61. Glasgow Mercury 28 September 1790.

62. " 23 October 1792 onward.

63. Glasgow Courier 29 November 1792.

64. " 1 December 1792.

65. " 1 December 1792.

66. " 8 December 1792.

67. " 28 February 1801.

68. Glasgow Journal 26 February - 5 March 1793.

69. Glasgow Courier August 1800.

70. " 1 December 1791.

71. Chart of Revenue of the Forth & Clyde Navigation from January 1780.

72. Chart of Revenue as drawn out by Playfair.

73. Glasgow Courier and other papers from 1790 onward note the canals proximity in land advertisements.

74. Glasgow Courier 8 May 1798.

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Chapter 9.

The Miners' Position in Society.

The Status of the Glasgow Miners.

Though serfdom was basically extinct from the 14th. century in Scotland, various forms of bondage were employed to limit the free movement of the workforce. It was not a principle of Scottish law that a workman should be forced into one employment for life. Equally it was not a principle of the Scottish mine owners that they should see their financial returns from investment lowered as free movement tended to create higher wage rates and hence drain the owners' income. Higher wages had necessarily to be given where in a mobile labour market more prosperous collieries could filch labour from their less well off neighbours, with lucrative wage agreements. As a result the politically powerful landowner proprietors of the east of Scotland forced the imposition of serfdom on miners from 1606, whereby they were restricted to their workplace and the owner and his agents could claim an almost feudal hold over them. Enforcement of engagements was not peculiar to the coal industry, but in the case of mining, isolation and limited job opportunities meant many miners remained bound to employers for life, particularly if the master refused to licence their departure from the mine, and even if he did so he had still the power to reclaim his men.

In the Glasgow area the political power of the mine owners was less than their eastern counterparts. There were fewer landowner proprietors and neither the co-partneries of merchants nor the legal structure could

force the restraints on miners in the west as had been imposed on those in the east.[1] The lack of legal controls on the mining population can be demonstrated in the general difficulties experienced by the Barony coalmasters in getting their men to work.[2] Similarly, in 1713, Thomas Kennedy, proprietor of Pennel, was working coal and lime at Boghouse, Kilbarchan, when some of his miners were summoned before the sheriff on charges of intimidating rival tenants.[3]

The grey area of miner and master relationships is seen further in the Rutherglen coalfield. James Scott took a lease of the colliery at Rutherglen in 1739, he then worked it for 16 years, after which time he removed the colliery community to another estate. This action upset the other coalmasters and landed proprietors in the area, the question arising as to whom or to what the miners were bound. The local coal masters claimed that the workforce was not bound to the master but to the coal.

The combinations, disputes and desertions of 1750, suggest the men themselves felt little bondage. Colliery politics stopped Rutherglen mining for several weeks from February 1750, resulting in the petitioning for the arrest of the striking miners by the coalmasters on 17 February 1750, but as such the dispute continued on into April.[4] The open defiance of the men against their masters is also seen in a letter from John Smith of the Gallowgreen Colliery, Paisley, to Houston of Johnstone, begging for the loan of some miners as his own men had run off and he could see no way of catching them.[5] The bondage of miners was anomalous in a free society, but the miners of Glasgow

would appear, from available evidence, to have enjoyed some freedom of dissent, and even limited organisation. Organisation among the miners was probably particular to pits or areas and there was no national movement. Early examples of local organisation occur in the miner's guild membership of the Govan Weavers' Society, from c1756, and in miners' societies as at Westmuir.[6]

The degree of servitude was related to the size of the mines, the necessity of constant labour supply, and whether women and children were employed. The levels and limits of some workings were so very restricted as to be one man undertakings, Lapslie suggests this in his account of Campsie.[7] The peripheral areas, such as Kilbarchan, probably enjoyed a similar form of exploitation. But the labour demand of large mines, such as in the Barony and immediate to Glasgow, necessitated the employment of women, where each miner had to provide his own bearers, as often as not his wife and children.[8] The mines around Jordanhill employed women from an early date, and there is the story that 3 women were killed by a roof fall in the mine at the end of the 17th. century. The discovery of old workings in the 19th. century, revealed the passage of bare foot women by their prints.[9] Bondage became complete where the whole family as wage earners were dependent on the mines for livelihood.

The Glasgow Journal mentions that on Monday 9 January 1764, 24 colliers were jailed for refusing to work unless with a wages advance.[10] This was probably a result of "bad house-keeping" and a binge over the

New Year, and the best one can say of the status of the Glasgow miners is that, although akin to serfdom, it was not normally so severe. The miner was bound in servitude to his master; expressly excluded from the provisions of the Habeas Corpus Act of 1701; and generally ostracised by workers outwith his community. However his earnings were relatively high when compared with wages in other occupations, and it was usual for him to be provided with a house and coal.

The Miners' Pay.

The Estate papers of William Cunningham of Craigends provide interesting but incomplete financial returns for the Craigends Colliery during 1764-65. These show the pay and productivity of the miners and identify wages as a significant cost in the colliery economy. The miners were paid by output per week:

Table 23.

Miners' Wages at the Craigend Colliery, Kilbarchan.

Miner's name,	Week ending,	Loads,	Paid.
John Hughes sr.,	26 November 1764,	30½	5/7d.
James Caldwell,	-do-	49	7/9d.
Robert Orr,	-do-	39½	7/1d.
John Hughes sr.,	3 December 1764,	37½	6/9d.
James Caldwell,	-do-	47½	8/5d.
Robert Orr,	-do-	44	7/10d.

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Miner's name,	Week ending,	Loads.	Paid.
John Hughes sr.,	10 December 1764,	35½	7/4d.
James Caldwell,	-do-	42½	8/6d.
Robert Orr,	-do-	37½	7/8d.
John Hughes sr.,	17 December 1764,	23½	4/3d.
James Caldwell,	-do-	30	5/4d.
Robert Orr,	-do-	26	4/8d.

Source. Cunningham of Craigends Papers. S.R.A. TLX 61-62.

The total wages of the 3 miners was £4 1s. 2d. or 6/9d. average on output over the time. The total number of loads was 443 or an average of 37 loads, the actual measure in avoir du pois is not stated. It may be noted that John Hughes sr., worked almost to average on the week ending 3 December 1764. The mending of an underground road in early December 1764 may account for the lower returns of the week ending the 17 December. The percentage output of each man was:

John Hughes sr.,	28.6%
James Caldwell,	38.1%
Robert Orr,	33.3%
	100.0%

Accounts of workings at Craigends dated January 1765, give further details and show that wages actually exceeded the amount gained for the coal sold on the market, the accounts are detailed in the following table (see Table 24).

Table 24.

Accounts of the Craigend Colliery, Kilbarchan, 1765.

Wages,	£20	6s.	
Wages of men clearing coal from the pit,		1s.	
4½ stone of candles,	£1	10s.	6d.
Leathers,		5s.	
Work at the machine (?)		3s.	4d.
Smithy work,	£1	1s.	6d.
Filling in an old pit,		7s.	6d.
Debit,	£23	14s.	10d.
Coals sold,	£19	14s.	6d.
Balance	£4	0s.	4d.

Source. Cunningham of Craigends Papers.

S.R.A. TLX 61-62.

The most significant expense was the cost of labour, followed by that of lighting the workings, the separation of the wages paid to the miners and those taking out coals suggest that the latter was contracted on an occasional basis, perhaps one day per month.[11] Hamilton states that the Scottish average daily wage of the miner about 1765 was 2/6d. or almost 15/- per week, presuming that a 6 day week was worked. The Craigend men were therefore comparatively poorly paid, though there must have been considerable deviation at local level, however in comparison to the average 6d. or 8d. earned by a day labourer, the miners were well off.[12]

The Old Statistical Account allows further comparison of wages between miners and with other working classes. Cambuslang employed 42 men below ground and 20 above at the time of the survey, which records that the miners were provided with house and coal at 6d. per cart, though no measure is given, and that they got 2/2d. per day, or 13/- per 6 day week. The surface workers were similarly provided with house and coal, and were paid 10d. to 1/2d. per day, or 5/- to 7/- per week.[13] It becomes clear that there were great local differences, for the Campsie miners were highly paid, the 46 miners earning 18/- per 6 day week. This was equivalent to the most skilled artisans of the printfields, the block and copper-plate makers and printers. Again comparing them with labourers the Campsie men were well paid at 18/- as against 7/- for the same 6 days work of a labourer.[14] Similarly in the Barony Parish the miners were paid slightly over twice the amount of a labourer and roughly equivalent to or slightly more than a journeyman weaver. The following table illustrates the comparative price of labour in the industries of the Barony:

Table 25.

Some Comparative Wages of Labour in the Barony, c1795.

Day labourer, winter,	10d. - 1/- per day.
summer,	1/2d. - 1/4d. per day.
Journeyman weavers,	10/- - 14/- per week.
Harvest reaping by men,	1/4d. - 1/6d. per day.
by women,	1/-

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Miners,	2/9d. - 3/- per day.
Domestic servants, men,	£10 per annum.
women,	£3 - £5 per annum.
Ploughmen,	£10 - £12 per annum.

Source. Old Statistical Account XII. 1795. p.117. "Barony Parish."

The general impression of the miners is that of a reasonably well paid working group, though as to whether their working conditions really allowed any comparison, is debatable.

Political Activity 1770-1810.

In the conditions that they served and their general socially ostracized position, it is really little wonder that striking became a tool of protest to miners. The newspapers of the day chose only to report the management side of matters and the real reasons for many of the late 18th. century strikes can only be guessed at. There are a number of quite major industrial disturbances, with as examples the mass desertion of M'Nair's Greenfield Colliery in December 1773, when 80 miners left the mine.[15] Similarly, 22 men left the Knightswood Colliery in protest against conditions and low wages, in July 1794.[16] There appears too to have been the occasional act of industrial sabotage, probably by disenchanted workers. An example of this was the cutting of the engine ropes that held the pump, 90 ft. down the shaft, at Corsehill, an action that threatened but did not close the workings.[17] These stoppages probably had a more devastating effect on the miners than their masters, again taking the example of the

Barony miners whose wages stood up in comparison to others, it seems they seldom got more than £30 per annum due to stoppages of one kind or another,[18] when they might have expected c£46 per annum, as against c£36 per annum for the weavers.

The miners' emancipation was slow, the Acts of 1775 and 1779, did little other than release them from written servitude, for actual servitude persisted as did the stigma of their calling. This is seen in contemporary reports of the time, the newspapers evinced little sympathy in accidents, unless they were dramatic and caught the public imagination, when for a few days the coffers of money and sympathy would open. The miners were not alone in the ready dismissal of their sufferings, but where stigma really appeared was in relation to combinations. The papers were jubilant when in 1792 military might crushed local striking miners. Coal supplies had become disrupted in early January 1792 and on the 28th. of that month a military raiding party seized 16 of the "ringleaders" taking them to prison and the strike foundered.[19] The management response to political violence was rapidly reported. Appeals for information on recalcitrant miners appear regularly in contemporary journals serving to indicate major labour troubles. On 2 April 1799 matters had come to such a state that after an attack on the coal grieve at the Govan Coal Company's works, 66 miners deserted both Govan and Polmadie.[20] This appears in the Glasgow Courier 4 April 1799 with no mention of any possible cause and only condemnation. The papers

chose to report what was bad, the liberating of the Miners by Act of 1799 got little mention, Lord Cockburn remarking that the matter was not even mentioned in the Scots Magazine; people cared very little about the miners.[21] Several owners and industrialists in the neighbourhood of Glasgow, even objected to the bill,[22] so too did some of the miners, though for different reasons. The miners organised against restrictive clauses dealing with the fixing of wages by the Justices of the Peace and the enforcement of the 6 day week. Some 500 of them banded together in Lanarkshire, subscribing 2/- per head for a lawyer to lobby for their interests at Westminster. This Society of Coal Hewers made its meeting place in the School House at Westmuir, the president was Peter Wilson.[23] It was another Westmuir man Hugh Dunbar who acted as the treasurer for the miners' group, whose ambitions were realised on the 13 June 1799, when the Bill without the clauses became law.[24] It ended the last bonds of legal serfdom in Scotland, but it still had clauses relative to combinations, and the miners remained far removed from gaining any political or legal acceptance in their struggle for improved conditions. An example of this problem can be seen again with the strike at John Pettiegrew Wilson's Green Coal Work, Shettleston, in October 1799. A number of the men struck, and Wilson petitioned against them. An advert appeared in the Glasgow Courier accusing them of desertion, calling for their arrest and indicting 21 men,[25] of whom one was later charged. The miner David Robertson was brought up before the Justices of the Peace, charged with combining contrary to

the statute 39 George III Cap.81. for which Robertson could have been imprisoned for 3 months. Wilson's intercession on his behalf reduced the sentence,[26] though the reason for this move is unclear. Typically others were less sympathetic to their employees.

Andrew Faulds of Fullerton took John Love, a Tollcross miner who had worked for Faulds, to court over not leaving his company house once Love had left his employment in April 1800. Love countered Faulds claiming that he should have received notice of eviction by Whitsunday and as a result the case was dismissed. Faulds then presented a bill of advocation to Lord Balmuto, ordinary, who instructed the Sheriff substitute of Lanarkshire to remove Love and for Love to pay the expenses. John Love next presented a bill of suspension, and the case was debated before Lord Craig, ordinary, who decided on Love's removal with expenses. This case was identical to a decision in the case of the Duke of Queensferry against some of his miners, 11 March 1756, which found there was no necessity of legal warning to remove miners and other employees from company owned houses. Miners remained tenants at will into the 19th. century.[27]

Miners' emancipation remained in token more than in fact, with colliery owners like Dixon still laying claim to them and offering financial rewards when they ran off.[28] The ambivalence of the coal industry is further shown in Bald's writings of 1808, stating that:

"Many of the colliers have of late, particularly within these eight years past, betaken themselves to the work of common labourers, at half their original wages [as for anyone from other occupations becoming miners] they would spurn the idea even with double the wages."[29]

The Scottish coal miners were dissatisfied with their lot, the restriction of job opportunity contributing most to this feeling. In recognition of this frequent opportunities of employment in more advanced coalfields, for example around Swansea in South Wales,[30] were offered by employers after ready labour around this time. But though the miners may have been comparatively well paid in relation to other labouring groups, it did not compensate for their being "attached to the soil" nor the dreadful conditions of stagnant ventilation, damp, poor illumination, cramped workings, accident and inefficiency, all of which played their part in contributing to physical disabilities and often premature death in the industrial environment.

Labour Issues. Aspects of the 1826 Strike.

Labour activity was neither nationally uniform nor legally enduring. The problems faced by the miners in the first three decades of the 19th. century were, wages, output levels and under weighing. The miners faced a day to day struggle to raise or to maintain wages. This was due to the conduct of the coal trade which was inherently unstable with a large and fluctuating percentage

of production near the margin of profitability and a large number of producers anxious to keep down wage costs. Cutting wages was the easiest means by which to do this, capitalists could only look to early returns, wage bargaining was therefore restricted to the immediate rather than the future.

The strikes of 1825-26 were set off by the onslaught on wage levels, which in turn provoked combinations by the miners. The general attitude to the miners is illustrated in a letter to Ludovic Houston of Johnstone from one of his business partners, dated 10 November 1825 it said of the local miners combination:

> "The present public feeling approves warmly the dismissal of the Quarrelton Colliers and trusts you will be able to do without them."[31]

The frequent references in contemporary journals reflect the same approach to the miners' aspirations. This again is shown in December 1825 when Wilson of Hurlet employed 45 general labourers to work a pit as strike breakers. It was recorded that not one of the men had worked underground before, but were being instructed by an experienced miner from the Quarrelton Pit. The 45 men were paid at 18/- per week, this rising to 20/- and higher as their experience increased. The willingness of some experienced miners to instruct blackleg labour is a reflection on the division of interests in the mining community. The early months of 1826 show the same strike breaking techniques employed by men such as Dunlop at the Clyde Iron Works Collieries.

In April 1826 Dunlop brought down the wages at the Clyde Iron Works and the men immediately struck; he broke the strike by importing local weavers who at that time would have worked for anything, as a result of the trade depression. Attempts to parley by the local men were ignored, though the Clyde Iron Works was directly affected by the loss of local fuel and a general loss of £2 per ton on iron was experienced.[32]

The progress of the 1826 strike was one of lock out, eviction and guards placed on the "villages" for those wanting to work. Ordinary labourers were offered jobs, and taught to work coal for "liberal wages" and the "unassociated" miners were offered employment at strike bound pits.[33] The blackleg labour was often assaulted by those on strike, becoming more frequent as the strike progressed, culminating in a riot at Tollcross in May 1826. One of the village guards was attacked and badly beaten by a group of strikers, who were then involved in a running fight with other guards. Some of the strikers were caught and jailed in the Bridewell.[34] These actions did not halt the fall in prices and wages. Gray of Carntyne dropped his selling price to 2/- per cart and Harvie of Westthorn took his rate still lower to 9d. per cart. Reductions were also made at Stonelaw and passed onto the miners in still lower wages.

The reactions of the men were varied as to the wisdom of taking industrial action. This has already been shown with regard to the experienced miners teaching labourers to mine at Hurlet; the same division of interests occurred at neighbouring Cowglen. In May 1826 Wilson had lowered his prices with a reduction from 5/- to 4/- in wages

and given the men a 24 hour ultimatum, some of the younger men struck, but the older men generally accepted Wilson's terms.[35] This inconsistency in attitude was often based on a wish to protect jobs. Where mines became unremunerative, where wage costs exceeded income then the mine would have to close, the miners had a natural interest to see that operations continued. Indeed the workforce adapted so far as they could to the circumstances that capital embarked should be made remunerative; and that employers had the same right to manipulate capital as workmen had a right to manipulate their labour. These opposing forces of interests are shown once again in the example of Govan.

In 1826 a Free Labour Society, organised in direct opposition to the combinations was formed. The Govan men blamed the unions for supporting strikes and providing no aid to the men when they were ill. This Free Labour Society was more typical of the old friendly societies, and had been formed:

> "for the purpose of supporting each other when visited with sickness or accident, and for their legal and individual protection from threats and intimidation of the combined, while exercising their just rights of working with whom, and on the terms considered best for their individual interests. This society to be called the "Govan Colliery Friendly and Free-Labour Society."[36]

In the 1844 Commission Reports on the State of Population in the Mining Districts, it was claimed that the aims of the Society had been more than successful. However, the growth of this society may be seen in the light of the sectionalism of the mining industry of the Glasgow area, where individual mines were more concerned with narrow local affairs and friendly benefits, retreating from the prospects of political and social revolution. The pompous title of the Govan Colliery Friendly Society tends to obscure the very evident reality of separate, more limited, trade union interests and organisations of one colliery.

The progression of industrial action after 1826 failed to mirror the ideals expressed by the Govan men. On 4 March 1837 there was serious rioting in Barrhead, following fights between striking miners and blackleg workers, in which 4 persons were injured. What is interesting is the popular reaction to what turned out to be a totally unrelated incident and that was the finding of a dead man down an old shaft close to where the riots had taken place. The cries of murder and calls for justice against the miners was eventually met with the admission that the man was a habitual drunkard, who had probably fallen down the shaft returning from a drunken foray.[37] The social experience of scapegoating the miners continues to this day.

The Miners' Position in Society. Some conclusions.

The foregoing provides many pointers to the position that miners held in society. In Scotland a rigid form of bondage, akin to serfdom, was general in the 18th. century. Thus the position of the miners in society was circumscribed, dominated by masters who bound them to the mines by enforcing long-term contracts and imposing penalties for any breach of engagement. The newspapers of the 18th. century evidence the totality of the masters' hold on their men, with miners jailed for any political action. This did not however stifle objection and contemporary sources report mass desertions from many mines, and the difficulty with which masters could get their men to work. The evidence of strikes or desertions in the Barony Parish, at Rutherglen and Paisley, suggest some independence of thought on the part of the miners. This coupled to the major strike at M'Nair's Greenfield Colliery, Shettleston, in 1794, the political agitation of 1799 at Govan and Westmuir, suggests some political awareness. It may also be noted that the most active groups of miners were at those large collieries such as Govan and Westmuir which featured in the masters' trade combinations. This may only be coincidence but identifies the importance of these mines at that time.

But, there is seldom enough evidence to show how these strikes and actions ended, and when the state of servitude extended to include the miners' wives and children, there is no disputing the serfdom of the miners to 18th. century society. It is likely that most political action collapsed in defeat in the face of economic necessity of earning enough for food, clothing and lodging.

The earnings of the miners were relatively high in comparison with other wage earners. In Campsie it has been shown how the miners' wages were comparable to the skilled artisans of the local textile trades. What evidence there is comes mostly from the Old Statistical Account and suggests a variety of wage levels within the economic guidelines of each parish. Suffice to say where coal and other minerals were in demand, such as in Campsie with the limestone and printfield industries, the men were well paid. But, in Kilbarchan, where there were few mines and a relatively large population, the men were paid rather less. This was due to the smallness of the mine and that labour supply was ample, thus owners had no need to attract others with high wages. Robert Bald hints at this factor, that due to the unpopularity of mining, coal masters created artificially high wage rates to attract labour from other industries. The same tactic is suggested in attracting experienced local miners to emigrate to new mining areas, the Swansea coalmasters offering attractive inducements to miners to move to South Wales. More locally in the case of Campsie, the coal and minerals masters competed with the textile industries for labour, so offered good wages to attract employees. It must though be stated that some mineral works and printfields were in common ownership, as was the case with Kincaid's enterprises, but there is nothing to suggest any interchange of the labour force between the two industries and the argument of the need to attract labour to the mines probably

holds sway. Hamilton remarks that it was probably the expansion of the coal industry in the late 18th. century and the need to attract labour to it, that brought about the miners' emancipation. There is some evidence to this effect in a letter dated 18 February 1772 and published in the Edinburgh Advertiser 21-25 February. The pseudonymous correspondent states very clearly the then current thinking among the local coalmasters. A meeting in Edinburgh a few days previous had resolved for the freedom of the Scottish miners, who under Scottish Law were bound to a pit once they had worked a full thirteen months there. This reason alone was enough to put off potential employees. The writer stated how in England where the miners were free and common labour dearer than in Scotland, coal was wrought more cheaply as the mine owners had little problem with their men. Scottish mine owners had had to import English miners to overcome their own shortfall in labour supply. Why English miners were so keen to come north was probably the promise of jobs. This is also seen in the case of the Scottish lead miners who were similarly free and therefore faced with the problems of finding employment. They considered it lucky to get a job that provided them with 1/4d. per day. Coal miners could gain 2/6d. or more per day and the writer states how the proprietors suffered greatly from the insolence and idleness of their men. The letter goes on to stress that freedom would have increased the labour supply on the market and made for more moderate wage agreements, on the argument that miners would have been glad of

employment.[38] Certainly the eventual involvement of coalmasters in general bringing serfdom to and end, suggests that the chief considerations were economic rather than paternalistic. Miners were obviously required and feudal restrictions were no attraction to them, hence their emancipation. Thus the considerations affecting miners' position in society were economic rather than social in origin. Therefore they remained the pariahs of the then contemporary society as evidenced from the unrest of the 19th. century and beyond.

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Tenant at will was an archaic 16th. century legal term, describing a tenant who held at the will or

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Chapter 10.

The Value of Life - An Accident Profile, 1730-1830.

The Evidence.

The analysis of mining accidents in the 18th. and early 19th. centuries is fraught with real difficulty. The newspapers chose to report disasters that they knew were news worthy, they do not chronicle the daily life of the miners. There is therefore no proper enumeration, and though mining grievances sometimes made news, they concerned society, as with the habit of leaving old shafts open as death traps for the unwary, rather than the interests of miners as a working group.[1] The principal cause of accidents can be divided up as follows:

1. Ventilation Failure.
2. Falls of Strata.
3. Falls of or down the shaft.
4. Sundries and new Technology.

Each are considered in turn in relevance to the 18th. and early 19th. centuries and some effort made to identify the main cause of accidents in the Glasgow mining area within the parameters of available evidence.

1. Ventilation Failure.

The term ventilation failure covers both suffocating gases and the effects of Methane (CH_4), an explosive gas encountered quite often by the 18th. century and referred to in the Old Statistical

Account, principally to the fiery Hurlet Coal Seam.[2] Similarly, both the Govan and Rutherglen collieries were affected, with fatal explosions consecutively on 26 August 1755 and 28 May 1770.[3] It is interesting to consider whether these accidents were caused by blasting, which suggests some technical expertise on the part of the miners, or whether the miners walked into the gas accumulations with lighted candles. One obvious solution to the problem of Methane was to remove the gas before blasting, or entering the workings. The unenviable task of dealing with it went to the fireman. The fireman would cover himself in sackcloth soaked in water and crawl towards the gas. Once the fireman was in place, he lighted a candle which was then attached to the end of a long pole. Then as he lay as flat as possible on the floor of the passageway he would thrust the pole and lighted candle into the pocket of gas. The explosion would then pass over the body of the fireman as he lay prone on the floor, the damp sacking acting as protection against the flash fire from the explosion. This dangerous system did not always work and often brought burn injuries to the fireman, as happened at Govan on Tuesday 1 May 1770.[4] It was not an adequate answer to the problem and explosions wrecked other collieries, as at M'Nair's Lightburn Colliery on 29 June 1787,[5] similarly at the Green Colliery, Shettleston, on 9 April 1799.[6]

These are isolated incidents but whether the sudden increase in the number of pits and their depths brought a new regularity to the number of explosions is another question. It seems more likely

that Methane accumulated with poor ventilation in fiery seams which were not worked continuously. The explosions mentioned all took place in the early part of the week and as miners worked six days, the Sunday day of rest allowed ventilation to stagnate to danger levels. Early 19th. century accidents show the same factors, the first of which was at Renfrew on Tuesday 5 September 1804. The colliery had been out of use for some time and an inspection party of four, which included the colliery proprietor, were caught in an explosion some distance underground. They were fortunate for though bruised and with minor burns, all escaped serious injury.[7] Less fortunate were the victims of the Hurlet disaster of Monday 22 April 1805, when 17 were killed in a particularly vicious explosion that wrecked the colliery and shut it down for many days.[8] Explosions also took place at Westthorn Colliery on Wednesday 17 August 1808,[9] and at Dalmarnock on Monday 6 April 1829.[10] Each have the common denominator of being early in the week and relentless in their destruction.

Ventilation can be summarised as the control of air movement, and bad ventilation could be just as relentless as fire, for it could making working impossible and often so suddenly as to give little chance of escape. On Friday 22 June 1770, John Sellars going into workings at Govan realised he was being overcome and called for help, a bucket was lowered and he got in but as it was being hoisted up Sellars collapsed out of it and down the shaft to his death.[11]

John Sellars' death gives a clue to the ventilating technology of Govan at that time, for it appears that he had expected to be able to work with adequate ventilation, only to be overcome when he found the opposite. The most frequent form of ventilation was then a furnace set at the foot of one of the shafts. The hot air would rise up this upcast shaft, and the fresh air would be sucked down a second downcast shaft to take its place. At first the air was simply allowed to pass along the working faces, allowing gas to gather in the wastes or old workings. Sellars had ventured beyond the limit of ventilation and there are many accounts of this happening throughout the 18th. century. Lapslie recounts similar fatalities in unused or unventilated areas of the mines around Campsie, with the suffocation of 3 miners in July 1783, and another 5 in February 1785.[12] The traditional method of mining in Campsie contributed to this form of accident, with the minerals wrought by lengthy day levels driven in till the miners could drive no further due to lack of air, an air shaft then being sunk at the limit of natural ventilation. The first air shaft was often the limit of working, the men then mining across to the rise from the level and proceeding therefrom by room and stoop.[13] The irregularity of support pillars meant that air passing through the works was low powered, and rock falls which were common could simply wreck the air flow. A great deal of the ventilation of 18th. century mine workings was left to the process of nature and

the mines lay fallow for periods as no one could get in to work them due to the state of the air.

The early 19th. century shows no change in this pattern of tragedy which included many gases, such as Carbon Monoxide (CO), or the suffocating combination of Nitrogen (N_2) and Carbon Dioxide (CO_2), gases which showed little mercy as in disasters such as that at Barrowfield in the early hours of 16 April 1827, when 4 out of 10 men overcome in old workings died.[14] However, gases were not the only dangers to which the miners were subject.

2. Falls of Strata.

A considerable portion of accidents in the Glasgow area were attributable to either the fall of the roof or collapse of the working face. The dislocated nature of much of the strata was the common cause, similarly the shallowness of the workings with a high proportion of workings in unstable ground slightly above rock-head. But, a principal cause was the inadequacy of extra support, for the mines were worked by piece therefore they were worked for the immediate and not for the future and therefore there was an indifference to long term safety aspects.[15] Early 18th. century examples of accidents attributable to falls of strata occur in mine workings at Partick, on 12 August 1751,[16] and at Cathcart in limestone workings on 5 June 1764,[17] Similarly, on Tuesday 21 June 1768, 2 men were injured in a fall of stone at

Hagtonhill limestone quarries, one of whom died later from his injuries.[18] In each instance the numbers involved were very small, but in November of 1768 a major accident attributable to strata failure took place at Cracklinghouse Quarry.

This important quarry owned by Hutcheson's Hospital, worked both freestone and coal. In August 1744, the quarry had been the site of major trials for coal under Robert Craig.[19] On 9 November 1768, the quarry face collapsed at about 2 p.m burying 8 men, all of whom died; the enormity of the accident caught the public imagination, it taking 5 hours or longer to get to the bodies, the last being got the next day. This accident, which was attributed to heavy rain, illustrates the limited knowledge of ground support then prevalent, it shows too how the elements played their part in disaster. The main interest of the accident is the speed with which £144 5s. 7½d. was collected for the families of the dead, from a society not noted for its compassion.[20] It may be that the accident at Cracklinghouse attracted attention due to its local importance as a provider of building stone. Generally, there was little concern and similar strata related accidents at workings in limestone near Duntocher Mill;[21] in coal mines at Govan,[22] Jordanhill,[23] and Watehills,[24] near Duntocher, attracted very little attention.

Roof falls were common and this is hinted at in the indifferent reporting in newspapers. However, they must have represented a major economic burden, though the miners could be replaced, but when a roof fall at Fullerton on 14 June 1797 killed 2 horses,[25] this was a

significant loss as horses were expensive to replace. Evidence suggests that it was policy to remove horses from areas where roof falls threatened.[26] The use of horses underground could though on occasion actually contribute to roof falls, as shown in an early 19th. century accident again at Fullerton. It would appear that horses employed at this colliery carried coal pannier style and across the back, while passing through the underground ways. On 9 January 1805 a boy was killed in a roof fall after the basket on the horse he was driving hit a roof support and a large stone fell on him.[27] Children were the regular victims of roof falls at this colliery,[28] and likewise the horses,[29] fatalities which suggest the local instability of strata and poor efforts at support, both common problems throughout the working coalfield.

3. Falls of or down the Shaft.

There were distinct forms of this type of accident, firstly the falling in of shafts, of which at present no 18th. century examples have been discovered for Glasgow, the second was miners' falls in shaft, and the third was that of the public into old workings.

Accidents most commonly affecting the mine occurred in the shaft, as the point of access and egress the existence of the mine hinged on its survival. Winding was generally inadequate and primitive and contributed directly to accidents, often by the failure of equipment. When two men were descending the shaft at the Race Colliery, about five miles west of Glasgow, on Monday 14 September 1747, the bucket chain

broke away and both were tossed out to their deaths.[30] There were no fail safe mechanisms and such primitive technology contributed to many similar accidents as at Rutherglen,[31] and elsewhere. Pit sinkers were also often the victims of fall down the shaft. In an accident at Westmuir in May 1774, a pit-sinker was killed;[32] more dramatically, when two pit sinkers got into a bucket to go down a shaft at Camlachie they went down at speed as someone had not attached the horse to the winding gin. Both survived the fall of 204 ft. with little injury.[33] Ropes failed for other reasons most likely from the miners' habit of carrying their sharp picks over their shoulder as they descended in the open buckets, overloading was another cause, and both were used to account for fatalities at Fullerton in May 1800.[34]

Shaft accidents during winding could also be caused by debris falling from the pit mouth or from the opposite bucket, and knocking a miner from his precarious position in or astride buckets. An unusual incident of this kind happened at Govan, in 1774, when a dog fell down the shaft and knocked a miner from the basket to his death.[35] Commonly, baskets or buckets collided in the shaft, for they did not run on guides, and at Camlachie, a woman was killed when she was thrown down the pit, from an ascending bucket colliding with one coming down.[36]

Falls down shafts from the surface or from intermediate points were also common. At a pit in Shettleston 23 February 1797, a boy

employed driving the gin horse, fell in to the pit and was killed. In his fall he also injured two men working at the pit bottom.[37] The most remarkable aspect of falls down the shaft from surface is the number of times it happened to members of the public, from which arises the question whether human life was considered expendable in respect of the cost of filling up old disused shafts.[38]

Shafts had to be treated with respect and an accident on 12 May 1803 mutely illustrates this. A young man was killed sliding down the rope in to the Barrachnie pit, he had chosen it as an easy short-cut but fell off. A stair-pit was the normal method of access to the colliery and many such accidents were the result of human disregard for rules.

The 19th. century took its steady toll of mining casualties and shaft accidents were too often the cause. The causes have already been stated though one actual shaft collapse has also been located. This was at one of Dunn's pits at Duntocher, on 7 June 1829, which caused a fatality.[39] The maintainence of safe access to mining in all its aspects was to remain a problem for the colliery managers.

4. Sundries.

Sundry causes of accidents were many and varied and were often the result of bad management, or from causes outwith the immediate control of the miners. Surface plant caused accidents, as for example the collapse of a lime kiln at New Kilpatrick, killing one

man and injuring another, both of whom had been standing loading a cart under the arch of the kiln.[40] Another major cause of disaster was innundation of workings, with which primitive natural drainage and even mechanical aid could not cope.

The presence of water in underground workings was a natural problem, caused by springs and seepage along the interfaces of strata. Drainage was probably accomplished in early mines by a bucket on the end of a rope dropped down the shaft. Drainage of day level workings was accomplished by leading the water through the works by channels cut for the purpose on a gradient. Drainage could be assisted with drainage adits, for example the pits to the north of the Glazert, at Campsie, were 60 to 90 ft. in depth and as workings radiated out from the shaft bottom, adits were driven from the nearest low ground to drain the mine. These were often driven in from the nearest stream bed and the fact that shafts were commonly sunk near declivities with stream beds suggests that some consideration was given to the possibilities of adit drainage when sinking.[41] There are many instances of such adit drainage schemes of the 18th. century and they created a considerable degree of interest, their presence often being quoted in contemporary reports of mine workings. The Glasgow Journal noted the presence of a water level or adit to drain the coal workings of Wester Mailling of Wester Cunshlie [Queenslie], by Provan.[42] The same journal notes that the Lightburn adits could not cope with excess water after an innundation and it seems likely that adits could only

cope with a modicum of natural seepage underground.

Innundation was caused by the holing of wastes or natural pockets of water below ground, or even close to the surface. Naturally flooded old workings were frequently encountered by the 18th. century, due to the failure to hold good plans and carry out regular surveys, and their holing often brought disaster. The disaster at Lightburn, which was worked on two seams by 1760, illustrates how colliery operations were threatened by large amounts of water. On Thursday 11 December 1760, miners in the upper level holed a waste full of water, which promptly flooded the lower workings and drowned six men and a boy.[43] As previously mentioned it took some time for the water to be run off by the water levels or adits, and the Lightburn experience illustrates clearly how miners were at the mercy of poorly planned and managed workings. The failure to carry out regular surveys and hold good plans meant that miners were more often than not running blind. Though even where water was being drained from known wastes disaster could strike.

Bencloich was being drained by three miners on 25 February 1788, they had holed through into a water filled area of older workings and were engaged in draining it in the company of two men who had come to watch. The water had been draining back to the pit bottom quite successfully, when with little warning there was a sudden surge and the water flashed through the workings, rising 6 ft. up the shaft. It immediately subsided killing all below in the sudden vacuum.

It was five days before the bodies were recovered, during which time the mine was allowed to drain and the ventilation to correct itself. Presuming that mining had ceased till the wastes were drained, this suggests that no operations had been possible for over the five days, which must have been a financial strain for such a small colliery.[44]

Similarly, the disaster at the Lochlibo Colliery, in 1792, was due to water but from a different source, where mining through weak ground following a coal seam at a shallow depth below Lochlibo, brought the loch water in on the workings. On Thursday 29 March 1792, a total of seven people, some of whom were again sightseers, were down the then newly begun mine, when all were drowned as water flashed through the workings, when the loch waters breached the weakened roof strata. As a result the workings were a total failure and could not be pursued due to the low level of pumping technology. Technical ability only allowed water to be cleared out in a second working of the area in the 19th. century.[45]

The limited pumping technology of the 18th. and even the early 19th. centuries must have left many mines at the mercy of water. Frequent references are made to the difficulties that it caused, especially considering that there was normally 60 ft. of water at the bottom of the main shaft at Govan Colliery,[46] a problem in which it was not alone.

Accidents attributable to the new technology evolving in mining over the period of review to 1830, have proved hard to trace. This does not deny their existence but because they were often pit head related they were not considered so news worthy as underground disasters. There is also the problem of how to classify accidents on account of the lack of complete evidence. This may be shown with an accident at Renfrew Colliery, 29 May 1805, when the oversman and his son were killed in a fall down the shaft.[47] The accident was due to the engine tow giving way but was not attributable to the engine, in effect it was a shaft accident, just as if a gin rope or chain had given way. It is therefore not truly due to new technology.

Mining radically altered in its complexity from the late 18th. century and as surface plant evolved into the 19th. century, then accidents attributable to the new technology can begin to be traced. Initially pit head movements would have been by barrow along roads laid with deals,[48] slow and cumbersome each item having to be moved on its own. The introduction of tramways improved this and allowed free low friction movement even where unintended. What may be an early reference to a pit head tramway accident took place at Fullarton Colliery in 1806, when a labourer employed there to deal with wagons, was hit from behind by one moving on the gradient and knocked down the shaft to his death.[49] Steam engines also caused deaths as at

Dungeonhill, when Robert Jenkins employed in the erection of a new steam engine was killed after being caught in its motion.[50] But the picture of deaths caused by new technology in mining is not clear till the 1830s and then the enumeration of mining accidents recorded from the middle of the 19th. century.

The percentage of accidents from various causes between 1740 and 1830 are tabled below, occurrence and the nature of available statistics does not allow comparison but does set out the pattern of accidents for the three periods of review.

Table 26.

Causes of Accidents, 1740-1830.

Nature of Accident.	1740-1769.	1770-1799.	1800-1829.
Shaft accidents,	40%	63%	52%
Falls of strata,	40%	17%	27%
Flooding accidents,	10%	6%	—
New technology,	—	—	6%
Methane,	10%	11%	12%
Ventilation failure,	—	3%	3%

Source. Glasgow Courant; Glasgow Courier; Glasgow Chronicle; Glasgow Journal; Glasgow Mercury; Herald & Advertiser.

Evidence of 18th. and early 19th. century mining accidents does not allow very definite conclusions in the instance of Glasgow, but in general comparison to elsewhere fatality rates appear to have been lower. The explosions of the Great Northern Coalfield, and the

levels of disaster elsewhere, had no real counterparts in the Glasgow experience. That there was an absence of large scale explosions in the area at that time indicates that the scale of mining had not then over reached the thresholds of depth and technology which were the underlying reasons for the disasters of the Great Northern Coalfield of north east England. Though the fact that Scottish mine owners seldom had to meet the expense of devising elaborate ventilation schemes as in the north east of England around Tyneside, can be set against higher labour costs and poor production on account of ill ventilated working environments. Management decisions probably contributed the most to accidents. The failure to survey or to up-date plans criticised by Lapslie among others, often meant miners straying in to bad ground with roof falls, failing ventilation and at worst innundation from surface water, through subsidence of weakened strata, as for example at Lochlibo. Similarly, old workings full of water from natural springs, were often encountered in blind headings, and could drown an active mine.

It may be that the slow progress of technology to cope with the problem of water and ventilation, so often commented on in relation to Glasgow, was due to the fact that in general colliery operations were seldom threatened by these factors. It is significant that it was thoughtworthwhile to record the fiery nature of the Hurlet seams in the Old Statistical Account, for experience of them was thought

to be of some interest to the general reader. Mining was pursued at such low intensity that the stoppage of a day or so was no great burden, which if so suggests that human life was considered very expendable compared to the expense of installing safety checks. However this was a vicious circle for even the stoppages of a day or so after an accident created the conditions for another.

References to: Chapter 10 - The Value of Life - An Accident Profile, 1730 - 1830.

1. Edinburgh Advertiser 18-21 February 1772.
2. Old Statistical Account Vol.VII. 1795. p.79.
3. Glasgow Journal 25 August-1 September 1755; 24-31 May 1770.
4. " 26 April-3 May 1770.
5. Glasgow Mercury July 1787.
6. Glasgow Courier 9 April 1799.
7. " 13 September 1804.
8. " 23 April 1805; 25 April 1805; 30 April 1805.
   Herald & Advertiser 13 May 1805.
9. Glasgow Herald 19 August 1808.
10. " 6 April 1829.
11. Glasgow Journal 21-28 June 1770.
12. Old Statistical Account Vol.XV. p.334n. 1795.
13. Old Statistical Account Vol.XV. p.331. 1795

CAMERON, John Parish of Campsie. 1892.

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14. Glasgow Herald 20 April 1827

15. Report from the Select Committee on Coal Mines. 1852. p.5.

16. Glasgow Journal 12-19 August 1751.

17. " 31 May-7 June 1764.

18. " 16-23 June 1768.

19. SENEX (Robert Reid) Glasgow Past and Present. I. 1884. p.539.

20. Glasgow Journal 3-10 November 1768; 10-17 November 1768.

21. " 14-21 February 1771.

22. " 3-10 October 1771.

23. " 14-21 July 1774.

24. " 21-28 November 1771.

25. Glasgow Mercury June 1797.

26. Wilson, &c. v. Alexander &c. House of Lords 12 August 1807.

27. Glasgow Courier 10 January 1805.

28. " 15 April 1809.

29. Glasgow Herald 18 April 1806.

30. Glasgow Courant 14-21 September 1747.

31. Glasgow Journal 9-16 November 1769.

32. " 26 May-2 June 1774.

33. Glasgow Mercury May 1787.

34. Glasgow Courier 29 May 1800.

35. Glasgow Journal 10-17 November 1774.

36. Glasgow Mercury 19 October 1786.

37. Glasgow Courier February 1797.

38. Edinburgh Advertiser 18-21 February 1772; files of the Glasgow Journal and Glasgow Mercury, 1740-1817. Old Statistical Account Vol.XV. 1795. p.334n.

39. Glasgow Herald 15 June 1829.

40. Glasgow Journal 10-17 August 1769.

41. SKILLEN, Brian op.cit. 1985.

42. Glasgow Journal 13-20 September 1756.

43. " 11-18 December 1760.

44. Old Statistical Account Vol.XV. 1795. p.334n. and Glasgow Mercury 27 February-5 March 1788.

The accident at Bencloich appears to be the same as has been credited to Neuk Colliery in 1789, by Lapslie and others. Bencloich was confirmed from the issue of the Glasgow Mercury cited above. It has not proved possible to confirm an accident to Neuk in 1789. The general description and number of fatalities are identical and as Bencloich and Neuk, latterly known as Sculliongour, were neighbouring workings, the record may well have got mixed up.

45. Glasgow Courier 31 March 1792; Glasgow Argus 18 September 1843.

Lochlibo was worked successfully for many years in the 19th. century. The access point to these new workings below the loch, was from a new deep shaft on the lochside toward Shilford Mill. It was fitted with a powerful

pumping engine illustrated in Charles Taylor's Levern Delineated 1831. Pit workings on the lochside seem to have continued especially down toward Lugton on Mure's Caldwell Estate. These pits were too close to the lochside, and water movement once again breached weak strata and flooded the workings on 3 July 1833. Three men down the pit at the time barely escaped, and all the mining equipment below ground was lost. A direct result was the cessation of all workings and the eighty men employed there became redundant. It can be assumed that a disaster of this magnitude was an economic blow to the community of Uplawmoor. The accident is recounted in the Glasgow Herald 5 July 1833.

The Lochlibo Coal Company then turned its attention to the rise of the seam, and the woodland area to the north east of Uplawmoor became the centre of mining activity. Operations were so intense that a horse gin was replaced with a steam winder. It seems that it then proved possible to finance further investigations along the seam dip and below the loch. A powerful pumping engine was used to drain the workings flooded in 1792 and the breach was sealed in 1843. Once the waters had been totally drained, miners went in to clear out the old workings. A skeleton was recovered from the pit on 9 September 1843 and interred later at Neilston, a

reminder of the original disaster, and noted in the Glasgow Argus 18 September 1843. The real interest of this account is how the new found technology of the 19th. century enabled miners to cross the thresholds of depth, technology and danger, which had been denied them before 1830.

46. Glasgow Courier 3 August 1805.

47. " 1 June 1805.

48. " August 1800.

49. " 12 June 1806.

50. " 11 September 1823.

Chapter 11.

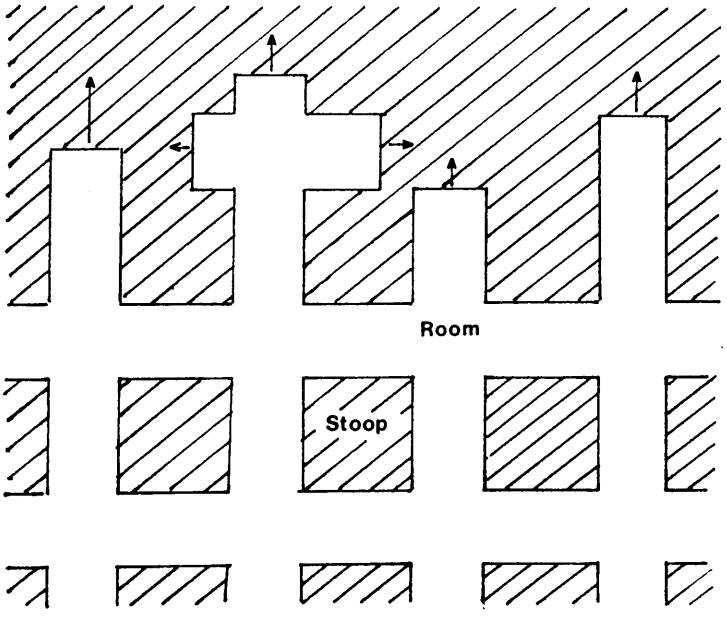
Aspects of Mining Technology, 1700 - 1830.

Basic Underground Technology.

The technology of coal exploitation showed little advance in the early 18th. century on the hacking and gouging tools of the previous hundred years. The tools that broke open old wastes containing old tools in 18th. century Jordanhill, were little better than the iron shod wooden tools and wooden shovels that the men found there.[1] Obviously the type of equipment would have been governed by the scale of working, and this becomes more obvious in the following discussion on pumping mines and extracting their minerals to the surface. But the most obvious change in 18th. century mining in comparison to the earlier workings, was the development of room and stoop workings in relation to the cleats or joints in sedimentary strata. In the coal measures there are two distinct systems of jointing lying at right angles to one another, thus there are two directions in which coal can be worked with any ease. The more or less vertical joints, in conjunction with bedding and lamination planes, cause the coal to break up into cubical or rectangular blocks. The more developed the system of jointing the easier it is to work the coal - coal is more easily worked when the working face line is parallel with the main joints. When at right angles the face is more diffcult to work. That room and stoop systems developed in relation to this jointing suggests that technology developed to match geology. Being at right angles they were of assistance to the miner in cutting up the seam into

square or rectangular pillars, any other direction was known as the cross cut. The benefit of room and stoop working was that galleries were driven in coal so that an immediate return was made for the expenditure. As a form of working it was more productive than random driving along seams, but its disadvantages proved to be multifold for it affected ventilation and did not always guarantee support, other than by leaving at least 50% of the seam intact for that purpose, which was not an economic proposition. Figure 18 (below) illustrates the general form that this method of working took.

Figure 18.



The room and stoop pattern shown in Figure 18 can only be taken as an example for it was in the nature of things that there was little conformity in patterns of support. This is shown very clearly in a number of mining examples, especially the Green Coal Company's mine, where basic ignorance of underground technology on the part of the management took the colliery beyond the safety threshold. In this case support pillars were gradually reduced in size from an initial five yards square to as little as a yard square in some cases, predictably the roof of the workings caved in, on 8 March 1797, and the coal seam was lost.[2] Technical ignorance could and often did occasion serious financial loss. The quite erratic nature that roof support could take is further evidenced in the Campsie mines of Balglass and Torphin. The room and stoop patterns of these mines are illustrated in Figure 19 (below).

Figure 19. (a).

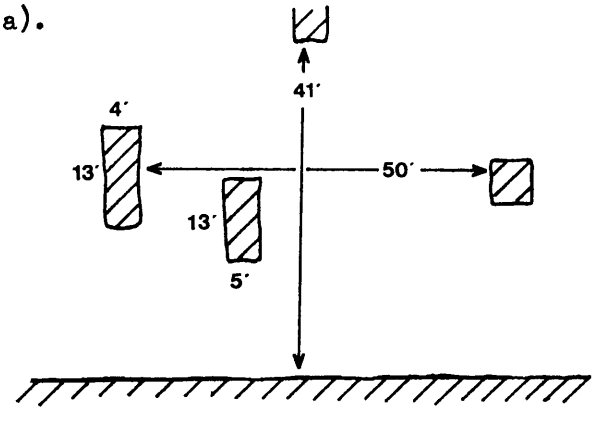
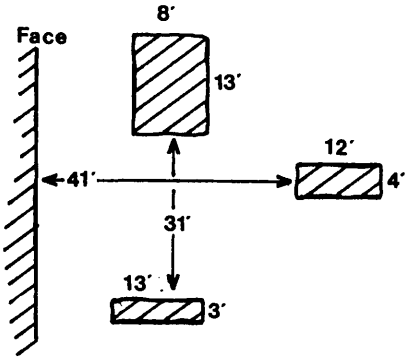
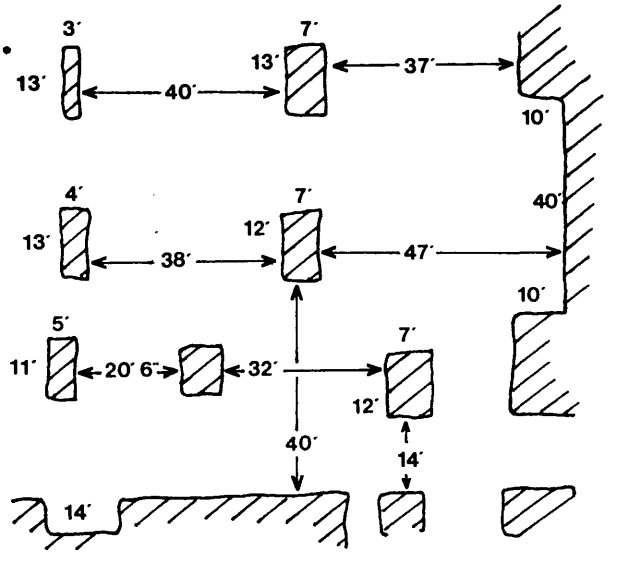


Figure 19.

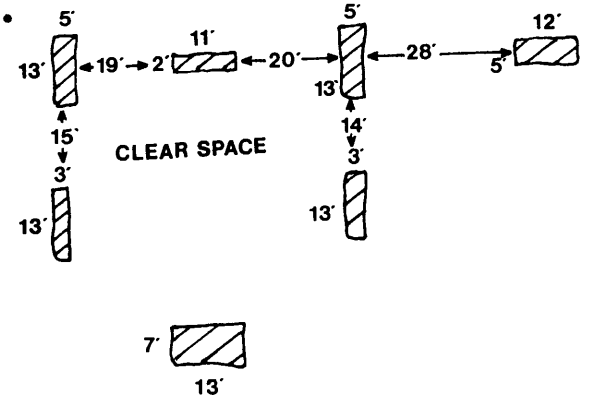
(b).



(c).



(d).



Note. Measurements in feet and inches as stated on each drawing.

Source. SKILLEN, Brian The Mines & Minerals of Campsie. 1985.

The stoop patterns illustrated in Figure 19 must be set in context as probably atypical, but they bring out an important point about the technology of support throughout the coalfield. This is that by the very divided nature of the strata of the area, local variations became practice to answer local rather than regional needs. That what are cited as standard room and stoop patterns in mining text books, were seldom possible in the Glasgow experience.

The Technology of Minerals Extraction: Raising the Coal.

Winding up to the surface was effectively the main constraint on minerals and stone production in mines or quarries, for unless the output could be brought out cheaply and easily, there was little incentive to improve on other methods of working. This problem is seen in the 18th. century exploitation of freestone along the banks of the River Levern, near Neilston. The outcrop of stone was at the bottom of the river banks, which were precipitous and it was only with the greatest of difficulty that stone could be brought to the top of the banks and thence to Neilston. This in turn led to a shortage of local building stone in the village, where as a result building was very expensive.[3] Similarly this seemingly simple problem of moving materials about affected limestone workings. Hand barrows which were portered by two men, were the common method of removing limestone from quarry faces and mines in Renfrewshire to c1770. It was only then that wheel barrows were introduced, a labour saving device that seems to have been introduced at least into

Renfrewshire with the building of the Forth & Clyde Canal. Crawford identifies this as the source of introduction and there were too connections between the limestone industries of Renfrewshire and Dunbartonshire, from whence the idea may have come. Wheel barrows were certainly used in William McDowall's drainage scheme for the Lochwinnoch area, c1773, and their use must have made the surface exploitation of mineral or other excavations that much easier.[4]

As shallow seams and outcrops were worked out so mining went deeper and the problems of winding became more pressing. Handlines and windlasses were the first forms of winding, and windlasses feature frequently in colliery sales, as for example that of the Milton Pit by Provanmill where 3 windlasses can be identified as having been in use.[5]

In an effort to encourage the exploitation of their lands, some estate owners financed the building of winding gins, as for example Sir John Maxwell of Pollok, who financed the gins placed for the Arden Coal & Lime Work, near Eastwood, in 1792. The gins wound on a 42 ft. deep shaft, working a 4 ft. thick coal seam.[6] The output level probably dictated the introduction of horse gins, as would the shaft depths encountered in following seams. Depths varied from the 42 ft. as cited above and similarly at Neilston,[7] to over 200 ft. even by the mid 18th. century.[8] The large collieries readily employed them, as at Govan,[9] Hamiltonhill,[10] Hutchison,[11] Hillhead of Scotstoun,[12] this latter colliery, near Rutherglen, illustrating a

common practice of dependence on steam for pumping and horse power for winding.[13] Historically the gins, the ropes and the frames, were the common meat of many colliery sales. The horse gins were often large, like that of Westmuir which was 21 ft. in diameter. It is mentioned in 1791,[14] at a time when women coal bearers were still employed at that colliery,[15] and this combination of manual and mechanical minerals removal probably remained a common practice until well into the 19th. century.

No example of wind power has been found as employed in winding,[16] whilst steam power came late to winding and from Duckham's work it would seem only a few engines were so employed. Barrachnie Colliery had had an engine from c1799,[17] it receives mention in 1801,[18] and thereafter their numbers grew, mostly at the expense of the horse gin.[19]

The Early Technology of Mine Drainage.

In draining the early mines, a level, permitting the water to drain off naturally, was always preferred where the topography allowed. But the effectiveness of such natural drainage around the Glasgow area was limited, both on account of the relatively flat landscape and the clay and shale nature of much of the surface deposit. The former retained water and the latter allowed the percolation of water through its broken interfaces, this coupled to the relatively high water table of many areas around Glasgow, precluded effective level drainage. Where it was most commonly found was in hilly country around the Campsie and Kilpatrick districts, Dawsholm, Kilbarchan and the areas to the east of the city.

These water levels drained into stream beds close to the mine workings, but they could not cope as shallower seams were worked out and deeper ones exploited so that mining went below natural drainage level, and as it did so, so new ways had to be found to lift the water.

Primitive forms of mechanisation were early attempted, in 1733:

"a machine for drawing water from the coalfield which cost £300,"

was erected at Camlachie.[20] It was probably a bucket and chain horse gin, similar to the type employed by John Gray at Shettleston, where:

"he was much incommoded with water and employed many horses with horse gins."[21]

But, only a small volume of water could be cleared, and this to a limited depth.[22] Horse gins were also expensive to run, when considering the upkeep and stabling of several horses. The collieries were though plagued by water and various attempts were made to drain them, often with elaborate water levels as at Wester Mailling of Wester Cunshlie [Queenslie],[23] or with windmills and water wheels. There is the occasional mention of "bobb" engines, as at Glenduffhill in 1763,[24] one year before the supposed first steam engine at Shettleston, which suggests there may have been water-balance pumping engines. But what can be said with certainty is that wind power was used to a limited extent for the drainage of underground and quarry workings for coal and limestone. An example of the former can be illustrated by John Gray's windmill at Westmuir Colliery in 1737, where it was to drain the water:

"until the windy Saturday 13th. January 1740 when it was blown to pieces and never again refitted."[25]

Gray had been disuaded from the purchase of a steam engine by the cost, and by a further drawback, that the steam engines consumed a disproportionate amount of the very coals which their use made accessible. Similarly, economic considerations affected the use of a windmill at the Blackhall Limestone Quarry, near Hurlet.[26] In that instance the coal was probably destroyed by the presence of a dolerite sill close to the old Blackhall quarries.[27] The lack of an immediate supply of fuel would have cost the lessee the price and carriage of coal from Hurlet, it was therefore more economic to install a simple windmill pump.

Water powered mine drainage in the West of Scotland never enjoyed the level of development that was reached in the coalfields of Clackmannan and Fife, and it was really only in Renfrewshire where topography and local drainage characteristics favoured the development of the water powered mine. But there was also another reason and this was to do with ownership, for it was in Renfrewshire that landowners had the strongest hold on mining. This favoured water power, for in the case of a lessee arrangements would have been necessary with the landowners to obtain a supply of water even before the use of water power could be considered, and this would have been expensive. Where landowners such as William Cunningham of Craigends worked coal on his own lands, in the Parish of Kilbarchan, and held the water rights, then water

became a cheap source of power, and he used a water engine to pump his colliery at Craighead.[28] Similarly, William McDowall of Castle Semple, in partnership with George Houston, another important land owner, used water power in their joint enterprise working limestone at Crossford. There a large over-shoot water wheel pumped the workings, supplied with water by a launder from a nearby stream.[29] It may be noted that McDowall also worked the limestones around Cathcart, where water power could have been adopted, but wasn't perhaps for the reason that he held no water rights in the area. But, no matter how successful water powered mines were, they were generally uncommon and their notability is shown in their featuring on Ainslie's 1796 map, which identifies two such workings near to Lochwinnoch.[30]

The organisation of water supply coupled to the expense of laying launders and fitting machinery, restricted water power to owner occupier mines in most instances. Though an example where the expense was borne by the lessees rather than the land owner, occurs in Renfrewshire. The proprietors of the Arthurlie Works, near Neilston, apparently leased and operated a tiny water powered mine at Crofthead, some distance upstream from their works, as a way of keeping the bleaching industry supplied with coal. It was pumped by a small water wheel close to the Arthurlie Burn.[31]

Though water powered mines were a feature of Renfrewshire, and the Upper Ward of Lanarkshire at Douglas Water, they remained a novelty in

the west, and gins and water buckets continued to be a feature of colliery sales, such as at Milton by Provanmill, in 1771.[32] Perhaps topography did not always favour water catchment but it is probable that the scarcity of water powered mines was more often due to the fact that collieries and limestone mines were generally worked under lease and that water rights were a significant burden to the lessee. Where water power was inadequate or difficult to obtain, horse gins were employed for all purposes. Their expense must have been considerable when for example a colliery like Govan employed 12 horses for that purpose alone, with all the necessary upkeep that that entailed,[33] alternatives were thus readily sought and these included the Newcomen steam engine.

Steam Pumping.

The first efficient pumping engine was designed by Thomas Newcomen. The engine worked on a piston coupled to one end of a beam swung on a central pivot, the other end being connected to the water pump. The water pump was supported down the shaft by ropes, lifting water from a sump at the pit bottom, to which the pit waters were run by runnels laid at a slight gradient throught the mine. The surface engine piston was raised by the weight of the pump and then depressed by atmospheric pressure after a vacuum had been created in the cylinder by the admission of steam, which in turn was condensed by the injection of cold water. Suffice to say the pump was part of the mechanism of the engine. The first of these engines to be built

in Scotland was at Elphinstone Colliery in Stirlingshire c1720, and the second was at Edmonston in Midlothian. They were not introduced to the Glasgow collieries until c1764,[34] though their importance was recognised as early as 1760, when the Trades House was considering leading a subscription to buy a steam pumping engine, stating that:

> "no inhabitant of Glasgow will be so blind to his own interest as to refuse generously to contribute."[35]

The first engine was probably erected at Shettleston c1764, the Carntyne area had an engine by 1768 and thereafter their numbers grew rapidly.[36] By 1769, a steam engine was in use at Bankhead of Kelvinside, draining the mine in about 2 hours daily use,[37] and at Kelvinside Miln Holm engines were also employed.[38]

The first steam engineswere too small, under boilered and very extravagant of fuel, as heat loss would have been quite considerable.[39] The Newcomen engines were far from perfect as is suggested by the willingness of mine owners and lessees to try other forms of drainage. In the closing decades of the 18th. century very much larger engines emerged; at Hillhead of Scotstoun a large 24 in. diameter cylinder steam engine was in use by 1774 with pumps 8 in. in diameter.[40] Similar large engines operated at Camlachie, where by 1789 a 42 in. diameter cylinder engine was working 300 ft. of 12 in. diameter pumps.[41] The Barrowfield Colliery was using an engine with a 22 in. diameter

cylinder at the end of the century, the engine pumping 120 ft. of 8 in. pumps.[42] The early 19th. century continues this pattern of large engines and probably also an increase in portable engines.

In Renfrewshire, where coal mining developed relatively late in comparison to the eastern districts, excepting the few examples already mentioned, steam engines became the natural choice for drainage, especially due to the relative depth of some of the coal seams. This can be illustrated when considering the exploitation of the Lochlibo area, where coal could be worked very near outcrop under the loch but at such a shallow depth as to put the workings at risk from innundation as in fact happened in 1792. Thereafter the seam was followed toward Uplawmoor, where it was at a considerable depth and drainage only became effective with an engine. The Oupley Coal Works, which probably worked the area of Uplawmoor Wood, used a steam engine with pumps $7\frac{1}{2}$ in. diameter and 105 ft. in length, though the engine was powerful enough to work to 120 ft. A set of smaller pumps were also used and these were 5 in. diameter and 99 ft. in length.[43]

The limited production of many mines must have militated against the use of steam power on the grounds of cost and coal consumption. But steam power was an increasingly effective alternative to water and wind power, or gins, for raising water, especially where the

geology dictated the following of deeper and deeper seams as at Lochlibo.

The technology of drainage runs hand in hand with the limited technology of support. The use of steam engines illustrates this clearly and provides the first pointers as to why their use in one area was widespread and not in another. Engines worked moderately well where they were established on working collieries, their duty being to maintain pumping rather than begin the process, which most small engines which worked well on a going colliery failed to do when they were faced with innundation, or the work of clearing a mine which had been flooded for a number of years. Andrew Walker of Gairbraid, states that an engine at least double the strength would have been needed to clear a flooded pit, as had been employed when the same pit was operating normally. The problem was that such a powerful engine when:

> "drawing off the water has a tendency to make the roof fall in, (a fact which is well known to every coalmaster), so unless the roof is actually composed of rock, it is clear that a considerable part of it will come down when the water is taken off after the coal has been long under water."[44]

Walker's statement shows that it was not an unknown occurrence, secondly it suggests a reason for the popularity of engines in the eastern mining district, where the roof of workings was often of sandstone or at least strong shale. In general the shallower

workings had a roof of clay and till which crumbled as water was taken off, and in extreme conditions pumping could probably bring about a roof fall and the closure of the mine to any further exploitation.

Once again the conclusion emerges that the technology developed to match geology, all the steam engines listed in Table 27 (below) were at collieries close to or below rockhead, where roofs were of good quality or depth precluded simple winding or pumping schemes.

Table 27.

Chronological List of Mine Engines around Glasgow, c1760-1830.

Names of Mines.	Numbers of Engines.	Date.	Source of Reference.
Shettleston,	1	c1764.	OSA /Duckham.
Corsehill,	1 pumping (?)	c1766.	GJ 23-30 January 1766.
Carntyne,	1	c1768.	Senex.
Kelvinside,	1 pumping,	c1769.	GJ 19-26 October 1769.
Blawarthill,	1 pumping,	c1774.	GJ 24 February-3 March 17
Rutherglen,[1]	1	c1776.	OSA /Duckham.
Cambuslang,	1	c1787.	OSA.
Elderslie,	1	c1788.	GM 2-9 April 1788.
Green,	1	1791.	OSA /Duckham.
Lochlibo,	1	1791.	OSA.
Barrachnie,	1 pumping, 1 winding,	1792.	OSA.

Names of Mines.	Numbers of Engines.	Date.	Source of Reference.
Fullarton,	1	c1793.	OSA.
Govan,	1 pumping, 1 winding,	c1793.	OSA /Payne.
Knightswood,	1	c1794.	GC 6 May 1794. Richardson's Map.
Skaterigg,	1 - 2	c1794.	GC 6 May 1794. Richardson's Map.
Dumbreck,	1	c1795.	Richardson's Map.
Langfaulds,	1	c1795.	Richardson's Map.
Eastmuir,	1	c1800.	GC 8 January 1800.
Possil,	1	c1800.	Court of Session.
Barrowfield,	2	c1800.	GC 6 August 1801.
Westthorn,	1 pumping,	c1801.	GC 24 December 1801.
Rutherglen,	1 pumping,	c1803.	H&A 26 December 1803.
Renfrew,	1 winding,	c1800.	GC 30 April 1805.
Cowglen,	1 pumping,	c1806.	GH 17 January 1806.
Williamwood,	1 pumping,	c1806.	GH 21 February 1806.
Dumbreck,	1 pumping,	c1806.	GH 6 June 1806.
Jeanfield,	1 pumping,	c1806.	GH 1 August 1806.
Eastmuir,	1 pumping, 1 winding,	c1807.	GH 6 July 1807.
Baljaffray,	1	c1807.	GH 13 November 1807.
Ruchill,	1 pumping,	c1810.	GH 21 May 1810.

Name of Mines.	Numbers of Engines.	Date.	Source of Reference.
Blackdyke & Holmes,	1	c1816.	GCh 9 April 1816.
Bankier,	1 pumping,	c1819.	GCh 3 July 1819.
Easterhouse,	1	c1821.	GCh 17 July 1821.
Barrowfield,	1 - 3	c1821.	GCh 7 August 1821. GA 9 May 1836.
Cuilhill,	1	c1821.	GCh 11 September 1821.
Williamwood,	1 pumping, 1 winding,	c1821.	GCh 10 December 1822.
Dungeonhill,	1	c1822.	GCh 11 September 1823.
Wester Barrachnie,	1 pumping, 1 winding,	c1823.	GCh 20 March 1824.
Belviedere,	1	c1823.	GCh 28 September 1824.
Belviedere (Craig's Pit),	1	c1823.	GCh 2 October 1824.
Quarrelton,[2]	1 pumping, 1 winding,	c1824.	GCh 10 January 1826.
Kelvinside,[3]	1	c1827.	GCh 8 August 1827.
Belviedere,	1 pumping, 1 winding,	c1827.	GCh 23 November 1827.
Barraston,	1 pumping,	c1828.	GH 23 March 1829.
Belviedere,[4]	1	c1830.	GCh 4 August 1830.

Reference abbreviations.

GA = Glasgow Argus; GC = Glasgow Courier; GCh = Glasgow Chronicle; GH = Glasgow Herald; GM = Glasgow Mercury; H&A = Herald & Advertiser;

OSA = Old Statistical Account; Duckham = DUCKHAM, B.F. A History of the Scottish Coal Industry. 1970; Senex = SENEX (Robert Reid) Glasgow Past and Present. I-III. 1884; Richardson's Map dated 1795.

Notes.

1. Gabriel Gray of Scotstoun erected this engine.
2. In both instances the steam engines at Quarrelton were of Bolton & Watt manufacture.
3. The Kelvinside engine was additionally geared for the role of pumping and winding.
4. The Belviedere engine was an atmospheric and geared for pumping and winding.

The dates quoted for each entry reflect the date of evidence seen. Numbers refer to engines of unknown use but were most likely pumping engines.

Table 25 records those engines that have been identified from contemporary records, very often sales advertisements for coalfields or the engines themselves. It is therefore unlikely that they reflect the real number of engines in use in the area at that time. Those mines identified with engines were on the whole important enterprises, such as Belviedere. There are of course exceptions most notably the collieries of the Kelvinside area. These were probably not large but had an almost constant water problem from water percolating along strata interfaces from the nearby River Kelvin. This is hinted at in the

instance of the Bankhead Colliery which had a powerful engine capable of draining the mine in about 2 hours daily, which suggests that it had that daily task. Therefore though engines relate to large scale operations, there were times when even small enterprises needed them to survive; especially where there was market opportunity which could finance the outlay and encourage the development of the mine, as again in the case of Bankhead, located a mile or so north of the River Clyde and Pointhouse.[45]

The number of engines present in the neighbourhood of Glasgow by the early 19th. century was considerable. There are no really accurate figures but it is possible to compare the Glasgow experience with the estimated numbers of engines employed at other Scottish coalfields, as in Table 28.

Table 28.

County List of Engines in the Scottish Mining Areas, c1800.

Ayrshire,	17-18.	Stirlingshire,	3-4.
Lanarkshire,	14-16.	Clackmannanshire,	2-3.
Fifeshire,	14-15.	Perthshire,	3.
Mid Lothian,	9-10.	Renfrewshire,	2.
West Lothian,	4-7.	East Lothian,	1.
Dunbartonshire,	4-7.	Dumfrieshire,	1.

Source. Developed from Duckham p.85. and evidence of Table 25 above.

The majority of engines tabulated under Lanarkshire, were in use in the mining district to the east of Glasgow, ranking it in importance, at least in technical investment, on a par with Ayrshire and Fifeshire. In its turn this technical investment brought the use of waggonways to the Glasgow district.

The early coal railways.

The coalfields of the 18th. century were still to a certain extent self sufficient, but it was inevitable that the larger ones would have had some influence on the practice of the smaller. Glasgow's waggonway experience was rooted in that of Tyneside and the definition of the Tyneside Waggonway applies in part to the Glasgow experience, for it was a generic term describing a broad gauge system with large waggons. That Tyneside practice spread to Scotland was to be expected due to its close geographical proximity, and the many Tyneside mining men who came on contracts or visits. There were those who settled, including the Dixons from Sunderland, and it was with John Dixon's arrival in Glasgow, that the Tyneside Waggonway came to Scotland. The early waggonways around Glasgow followed the English pattern of providing rail links from pits to the nearest navigable water. John Dixon's wooden railed Knightswood line, developed c1750, is an example for it provided a link from the colliery at Knightswood to the then nearest navigable point on the River Clyde, and thence shipped John Dixon's

coals to his Dumbarton Glass Works,[46] a major saving on overland transport costs.

The Knightswood waggonway survived until the late 18th. century, a reference to it is made in the sale of the 182 acre farm lands of Knightswood, together with the coal seams, which were all proferred for sale by John Dixon in 1799, to quote:

> "There is an excellent waggon road from the present coal pit to an established colliery [coal yard] at the ferry of Renfrew about a mile distant."[47]

It is interesting to note that Dixon owned the farmland across which the waggonway ran to the Clyde, suggesting that the problem of wayleave that probably defeated other schemes did not apply in in this instance. However, it may be that decisions whether to build or not were taken on rational economic decisions, for the extra competitive advantage gained would not have been sufficient to off-set the competition of better placed collieries. But it would seem that getting coals to the river influenced the building of both this waggonway and that at Govan, more than any other cause.

Between 1775-78 John Dixon's son William built a second coal-to-water waggonway, from Govan to Springfield on the River Clyde, parts of which were later incorporated into his son's Polloc & Govan Railway. The Govan waggonway was in the Tyneside ganre, with wooden rails and large waggons on the broad gauge just as at Knightswood,

and both lines allowed the Dixons to capitalise on their colliery outputs, with the direct connection to navigable waters and hence a wider market. Golborne writing in 1781 mentions that two thirds of the river tonnage was due to coal, stating that the coal trade would be improved by deepening at the Knightswood quays and up-river to the Broomielaw.[48] The value of the waggonways in moving great quantities of coal easily, offered real potential for the river coal traffic, as Golborne's projects were carried to fruition.

Iron railways.

The emergence of the iron railway in the Glasgow context is not all that clear but it probably followed a similar course to other areas. Iron rails of all kinds arrived in the 1790s and the first few years of the 19th. century. It coincided with the Revolutionary and Napoleonic Wars, when the price of wood soared, and with the intensification of the iron industry as a result of the wars, iron proved itself far superior in technical and economic terms, for though the initial cost was obviously higher than for wood, the subsequent maintenance and replacement bills were vastly smaller. In the Glasgow experience the iron railways took more than one form, for both plateway and edge rails appear to have seen use. Certainly if the regular colliery auctions of the early 19th. century are any guide then Bankier,[49] Craigenfeoch,[50] Heatheryknowe,[51] Provanmill,[52] and Westthorn,[53] had developed iron railways by the first decades of the 19th. century. Westthorn had 4,500 yards of cast iron tram rails

in 4 ft. lengths, weighing about 15lbs. per running yard by 1811, this was probably edge rail for the 70 hutches had wrought iron axles and cast iron wheels, quaintly described as:

"fitted to the rails."[54]

In comparison, Heatheryknowe employed metal plateways and other similar operations included Port Dundas. Port Dundas had about a half mile of flangeless iron plates for carrying coal and general merchandise originating with the Forth & Clyde Canal. The engineer was John Baird of Shotts Ironworks, which illustrates a possible source for the production of plateways and also underlines the increasing ties betweens coal companies, iron works and early railways.[55] It also introduces the facet of canal and railway communication as for example at Hurlet.

The Hurlet Railway was developed in the 1820s to link up the Hurlet collieries and chemical works with the Glasgow, Paisley and Johnstone Canal. It was an interesting preference for the original idea had been for a:

"collateral cut from the said canal to the coal works at Hurlet in the County of Renfrew."[56]

but instead:

"a railway - is on the property of the Earl of Glasgow, commencing at the Hurlet extensive coal and lime works, and extending to Paisley Canal, a distance of about 2

miles. It is formed of flat bar iron 2¼ inches deep, by ¾ inches thick, and the rails in lengths of 9 feet, each rail supported at every 3 feet by a sleeper and cast iron chair. The joinings are formed by a cast iron dovetailed socket suitable to receive the jointed end of the bar, and a dovetailed glut or key, by which means the several rails are joined as if into one continuous bar."[57]

The canal would have offered greater mineral haulage per horse but such a collateral cut would have been expensive, and barges required two men and a boy in attendance, whereas one man could lead a horse hauled train along the waggonway. Therefore basic economies dictated the waggonways conception, the reduction in numbers of horses and employees to the transport of minerals was a consideration in the labour intensive alum and mining industries.

The waggonways and railways discussed so far all connected with other modes of transport, most were coal-to-water, but not coal-to-point of sale, of which there seems to have been but one Glasgow example. This was James Nimmo's "iron railway" running from his colliery in Barrowfield to Orr Street, Mile-end, Calton. The office and sales point were both there, managed by William Burns, who either sold the coal there or organised its dispatch via the Barrowfield Coal Company's agencies at Gallowgate, Ogilvie's Glass Warehouse and the Broomielaw.[58] What dictated the decision for a tramway? It

seems most likely that the answer was high local demand with the colliery's proximity to east end industry. The tramway allowed the bulk movement of coal to a centralised point with regard to the brickfields of Calton and the mills of Mile-end. In this it set a pattern of rail use for the future, in promoting the bond between mining and general industry, by allowing the easy transport of coal from colliery to the doorstep of industry.

Conclusions.

Technical progress in mining developed slowly through the 18th. century, the first pointer to greater expertise was the relation of room and stoop patterns to the natural jointing of strata. Technology developed to match the difficult patterns of local geology where some coal or limestone seams were deeper than others, and means had to be found to reach them for their successful exploitation. Topography even played its role when it is considered that the price of building stone in Neilston was affected by the problems of getting stones up the steep banks of a nearby river. It is a reflection on the technology of the period that the arrival of wheel barrows made a significant contribution to the ease with which minerals could be extracted. Landowners keen to encourage mining brought improvements through investment in machinery, as in the instance of Maxwell of Pollok with his gins, or the Renfrewshire landowners and their water powered mines; the latter a clever adoption of a topography that encouraged water catchment, to form a cheap source of power for pumping

mines. Local topography also allowed the use of water levels but these were restricted both by capacity and depth. They did not allow for the expansion of mines, which mechanical means encouraged, whether with simple windmill pumps, horse gins or steam engines.

Ownership appears to have played an important role in mining technology in the 18th. century. The never ending wrangling over water rights did not encourage the widespread use of water power, and where it was used as in Renfrewshire it seems to have been principally at owner operated mines. The majority of steam engines traced as in use to 1830 appear to have been at leasehold mines, their erection often stipulated in the lease, as at Gorbals in 1762.[59] Their excessive cost probably limited the rapid expansion of steam engines, Andrew Walker's engine at Lambhill cost him £500 working on a mine that could never have been economic.[60] The Belviedere engine of c1823 cost twice that amount.[61] It was cost that encouraged mine owners to try other forms of power such as wind power. But the whimsical elements were soon ignored as steam technology gave the miners some control of their environment, probably the most significant aspect of mining technology in the 18th. and 19th. centuries. It may also be said that in mining the past was the enemy of the future, for there emerged an uneasy coexistence of old and new mining methods to dog the economy of local mining for many decades.

The most significant step in technology after steam pumping and winding was the development of rail transport. At such an early

stage in railway development it is difficult to draw conclusions on its local role. What however is obvious is that the local pattern of Glasgow owed much to the Tyneside experience with coal-to-water type links as the first steps towards distribution. It was quickly realised that a competitive advantage could be gained over other collieries where bulk access to market could be achieved, though only where all collieries were about the same distance from market. This probably accounts for why waggonways designed to assist market distribution were limited in respect of the number of collieries actually in the Glasgow area. The collieries which possessed them were major distributors and waggonways allowed them to capitalise on their output, without heavy local investment, as in canal building, or the curtailment of profits in keeping communications open. It cost less to weed a railway than it did to dredge and clear a canal.

The change from wooden railways came with the response of industry to the demands of war and the necessary rise of the iron industry, iron proved itself more economic in the long term, as it did not require replacement as often as rotting wooden rails. Wooden rails would have succumbed to the brutal environment of pithead and mine, and the growth of pithead and mine railways coincides with the local introduction of iron plates and rails. Due to their long life iron rails found rapid favour in the early 19th. century; plateways in the absence of locomotives to smash them also fulfilled a purpose as a

light, manoeuvrable communications system, responsive to the constantly changing needs of the colliery, for as one pit shut then the rails could be lifted and taken to a new pit. The rationale for the construction of waggonways and plateways was in the long run based on the economy of communication and the realisation that a horse could haul far heavier loads on the low friction railways, than had ever been possible by the rutted and pitted roads of the locality of so many pits in the Glasgow area.

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Chapter 12.

Aspects of commercial geology in relation to the rise of the West End of Glasgow, c1790-c1905.

The 19th. century migration of the Glasgow middle class westward limited opportunities for minerals exploitation in that general area. The westward spread of housing began in the late 18th. century when the middle classes were forced out of their traditional homes above the counting houses and shops of the old town by a combination of factors. Those factors included changing fashion dictating the separation of home and work, and the unpleasantness of the central business district as a result of the middle class enterprise in fostering industry. A result was a pattern of expansion through Blythswood and westward. Blythswood was imitative of Edinburgh's New Town (1767-1835) and though commenced c1790 its value as a land speculation only became clear in the early years of the 19th. century. Parcels of land were sold with enthusiasm, as:

> "The increase in value which had taken place in building grounds in this quarter, and the advantageous local situation of the lots of ground now to be sold [to the south of Sauchiehall Street] render them a desirable purchase for builders and others."[1]

The building boom brought an increase in surface values, and also a rise in demand for sandstone and clay. The raw materials of building stone and bricks enjoyed increased importance and were offered for exploitation. Prime areas included Dundas Vale of

Lawrence Phillips, where the clay and freestone was offered as lots on the sale of his sequestered estate, in 1825.[2] The proximity of the Dundas Vale clay and freestone to the areas of new buildings were an obvious attraction, so too the quarry in Bell's Park, Cowcaddens, and similarly Archibald Hamilton's offering of clay for brickmaking at North Woodside was baited as:

> "most advantageously situated by its vicinity to the new buildings at the West [Blythswood] end of Town."[3]

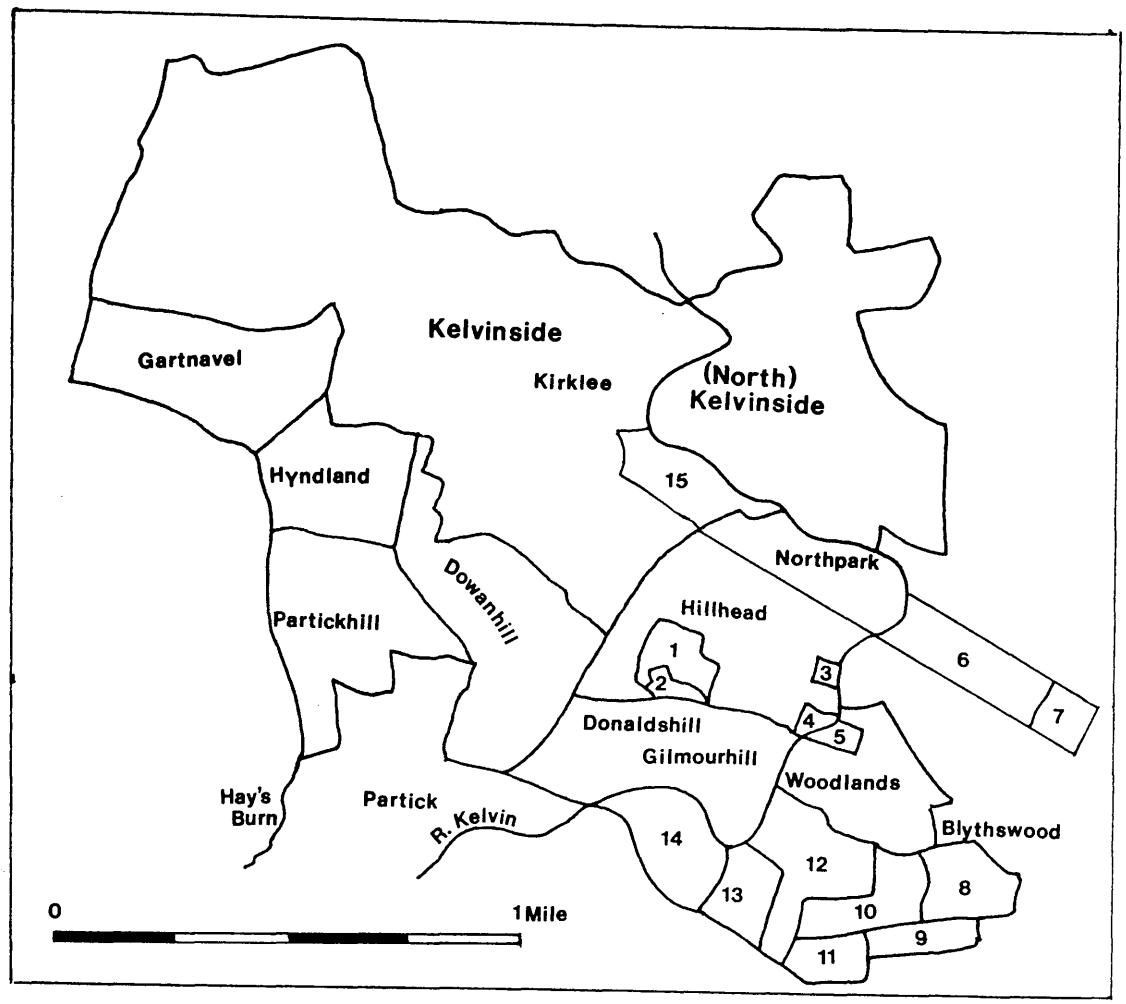
The need for building material expanded as even before the completion of the 479 acre estate of Blythswood in 1837, there was need for further westward expansion. This expansion encompassed the West End proper, about 1,520 acres extending to Gartnavel and bordering along the River Kelvin, that excepting North Woodside was a physical block to the agricultural and industrial territories to the north west. The acreage consisted of 23 estates spread across drumlins, consisting of farms and woodlands and several coal workings. These were old and principally on Upper Possil Coal, latterly Knightswood Gas Coal and Jubilee. Once the economic value of the ironstone was realised this too was worked in the area.

Why the area became a middle class development may be accounted for by its topography. The drumlin landscape was too steep for surface industry and working class houses to be established cheaply. Building and provision of roads over drumlins was then expensive and difficult. This was one reason why the west had been slow to develop

for so long as alternative, flat, cheap sites, remained available, the industrial developers and housing speculators shunned the area. But drumlin country from the very features that inhibited working class houses, favoured middle class growth. The middle classes of merchants, manufacturers, lawyers, and bankers among others, could afford the spacious expensive housing developed in contoured sweeping driveways, that progressed westward. Hence the steady development of the area as a residential district of good quality, where lands such as Balgray[4] could be advertised for villas, with views to the Campsie Hills or the River Clyde and westward. On the eve of development in 1830, the West End's 23 pastoral estates ranged from properties of 2 acres to the 472 acres of Kelvinside, though most averaged 10-30 acres. These were held by the country gentry like the Buchanans of Dowanhill, or the Stirling Crawfords of Hyndland; or by Glasgow lawyers and merchants such as the West Indiaman Robert Bogle of Gilmorehill and the East Indiaman John Fleming of Claremont; and the bankers and accountants such as Henry Paul of Woodside.

This is the stage, a setting for expansion, and it is now proposed to review the principal estates in relation to urban expansion and commercial geology. (Figure 20 places the various estates in relation to one another).

Figure 20.



Location Map of Estates which later comprised the West End of Glasgow.

Key:

1. Lilybank.
2. Saughfield.
3. Ashfield.
4. Westbank.
5. Cliff House.
6. North Woodside.
7. Burnbank.
8. South Woodside.
9. Sandyford.
10. Claremont.
11. Botanic Gardens 1816-
12. Kelvingrove.
13. Kelvinbank.
14. Clayslaps.
15. Botanic Gardens 1841-

Note: Some form of mineral extraction, quarrying or brick making has taken place in many of the areas shown.

Source: Post Office Directories, Glasgow, 1826-47.

Woodside.

The proximity of Woodside and Claremont to Blythswood, meant their rapid deployment for surface feuing with the continued westward expansion. The proprietors of South Woodside, Allan Fullarton and James McHardy, were able to encourage building, as the area was:

> "in contact with the newest and most fashionable part of Glasgow."[5]

They were also fortunate in their proximity to brickfields near Anderston, owned by James Gillespie,[6] and to the brickfields of North Woodside which together with many freestone quarries in the area of Woodside, provided a surfeit of building material. Thus

> "The lands of South Woodside were , from the state of the surrounding property, effectively secured against any kind of nuisance."[7]

All that the middle class, and the contractors and builders who catered for it, desired in a suburb was to be seen in South Woodside, principally communication with an existing built-up area in Blythswood, and this is the reason why North Woodside took on a life of its own.

North Woodside consisted of meadows and woodlands, together with a few quarries and a dormant mining industry. This supposition is supported by an accident on 17 January 1804, when a man fell into disused workings and was not rescued till the 20 January, when his

cries were heard by two women, pointing to the general desolation of the little frequented northern woodlands along the flank of the River Kelvin. The low levels of activity are further evidenced considering that it was the same pit that acted as a "prison" for Lieutenant Spearing, some 35 years before.[8] North Woodside was in a state of quietus and little more than a country seat firstly for Baillie Henry Paul, the first manager of the City of Glasgow Bank, and similarly once it passed to the hands of John Bain of Morriston.[9] The 28 acre estate was then too far from town for development at any profit to speculators. Mining was probably not economic as accessible seams had already been worked, and the successful exploitation of nearby Hillhead meant there was no local demand at that time.

Kelvingrove was in a very similar state, once again providing little more than a country estate for the merchant William Dennistoun, who acquired it in 1806. Dennistoun unlike messrs Paul and Bain, did probably try for coal seams in his area, but minerals which should have been attractive to potential developers proved otherwise due probably to the local industrial inertia. This inertia is suggested by a number of local business failures, particularly in the brickmaking industry, presumably with the fall off in trade as demand slackened with the completion of much of Blythswood, Woodside, and Claremont. John Gunnith, a quarrier and brickmaker established along the Kelvin, went into liquidation in 1826.[10] This was followed by the failure of John Pollock at Woodside,[11] and the failure of his partnership on an

adjacent clayfield with a man named Clough.[12] The colliery at Kelvinholm failed at the same time, perhaps when the demand for coal for brickburning and local industrial use failed. The 9 hp. steam engine when it was offered for sale was described as little used, suggesting that mining had long been restricted.[13] Dennistoun appears to have had quite extensive trials and bores made along the River Kelvin to ascertain "workable" clay and sandstone. In the process two seams of coal were found on his estate,[14] but what was then done is not all that clear for though the Kelvingrove Quarry was worked till about 1832 to prove the stone,[15] there seemsto have been little effort made to carry on minerals workings in the area. It was offered for lease, together with adjoining brick clays, but within a year all the minerals working equipment on the estate was up for sale.[16]

This attitude to mining was perhaps no wonder with the change in attitude to surface land use. John Baird, the Glasgow architect, was encouraging the sale or letting of Kelvingrove towards Claremont for villa building.[17] Though once again little came of it for the estate remained almost in limbo and Colin McNaughton who bought the estate from Dennistoun treated it simply as a country seat, and did not pursue feuing or mining. Once the Corporation acquired about 100 acres of the estate from the Trustees of McNaughton, between 1852 and 1867, no further consideration was given to its mineral exploitation. The land bought was mostly the vacant grounds to the east of the River Kelvin close to Claremont, of which 18 acres of land became housing to

offset the costs of the Kelvingrove Park, which arose to meet the social pretensions of the growing middle class.[18]

Hillhead.

In the early part of the 19th. century the 60-70 acre estate of Hillhead consisted of farm lands, producing early crops for sale, both in Glasgow and Partick. It had also a thriving mining industry under the proprietorship of John Gibson of Partick, who leased and worked collieries to the north and east of Gilmorehill.[19] The Gibson Family were even then long established superiors, descended from Andrew Gibson of Hillhead who had acquired it by purchase in the early 18th. century, from the Blythswood Estates.[20] The Gibsons' historical involvement in mining is not clear, but bearing in mind their land ownerships, which included Partick that was mined to crop in the 18th. century, it is likely that it was at least from that time. Certainly by 1813, the collieries then extant were well established, working at varying depths and fitted with both pumping engines and horse gins.[21] But what is surprising is that the leases as offered at that time were so short, being only for 6 years and suggesting that either the pits had no longer an assured future, being near the end of their economic lives, or that some consideration was being given to other land use such as feuing. However, mining operations continued over a wide area from a few feet below surface to a maximum depth of over 100 feet. The coals worked were Splint and Soft coals, the latter probably a Gas Coal, which was

used by the Glasgow Gas Light Company. This Company was dependent on good cheap coal for its own profits were dependent on coal prices, and fell when coal prices rose. In 1825, the Company had 2,000 tons on stock at 18/- per ton, or £1,800 invested in fuel,[22] a proportion of which came from Hillhead. The colliery was also well placed:

> "being situated in the immediate neighbourhood of Glasgow, and the village of Partick, there is always a constant and steady demand for the [coal] output."[23]

An appraisal of the area in September 1826 spoke highly of the local mineral potential,[24] and workings probably continued for a few years, but petered out especially with the surface feuing interests of Walter Gibson and others in anticipation of improved city communication with the Great Western Road. He advertised how Hillhead was laid off for villa development in 1829,[25] and also produced a feuing plan on the supposition that his property would soon be connected to Woodside. This proved wrong and Hillhead in the 1830s was still too far from the City to prove an attractive speculation other than for some country villa development.

Surface use attracted others to Hillhead and the immediate area, institutional buyers such as the Great Western Cemetery Company, that bought Gilmorehill and Donaldshill (48 acres) from Robert Bogle in 1845. They hoped to convert the area to a western necropolis, an idea on which none were too keen and the cemetery company soon

became a land speculator, asking about £59,750 for its estate. It was ultimately bought by another institution, the University of Glasgow, for £81,000 in 1864.[26] Surface values came to exceed any potential mining profits from increasingly aged mines, and this is really when feuing became established and mining was no longer locally considered. Hillhead was plotted out on a grid system c1850, when R.M. Kerr, the Glasgow lawyer, became its owner, and it was he who developed Hillhead with the first terraces in 1852, with Glasgow's increased prosperity and the approach of the townlands up through Woodlands to the edge of Hillhead.

Hillhead changed with surprising rapidity into feuing territory par excellence, and minerals workings near exhaustion were abandoned and filled in. The extensive quarries of messrs James Stewart and Robert Cruickshank, on the north east side of Byres Road, were filled between 1860-70,[27] and set aside for feuing. But building experience rapidly taught caution with the real threat of subsidence from old mineral workings, both coal mining and quarrying, the latter from inadequately packed made-up ground. What is notable is that surface and building values were such that it was considered to be worthwhile even where major engineering to provide support became necessary. The Free Church, Kelvinside, was built over known coal wastes, and the tower was given special support with 40 ft. long iron pillars punched down throught the waste on to rockhead. The foundations for the tower were effectively placed to 60 ft. below ground, a costly

exercise.[28] Similarly buildings at Belmont Crescent were affected by 1871 with subsidence,[29] and again remedial measures had to be taken. The deliberate filling and packing of workings became a proprietorial exercise, as with the filling and fencing off of the quarry to the rear of Sandringham Terrace by its feu-holders c1875.[30] The Hillhead Burgh Commissioners encouraged investigation, and granted £5 towards the cost of boring carried out on behalf of the Glasgow Landlords Association.[31] Similarly the Victoria Park Feuing Company financed many bores to the west of Byres Road,[32] as did Barlas the local building contractor.[33] Subsidence became a major issue in the development of Hillhead, principally though not entirely from old mineral workings, as surface heights were radically altered in many areas with man-made ground. It cannot be proven but the Hillhead experience probably affected the development and the approach to minerals and surface use in the Kelvinside area, which will be considered in the following pages.

Kelvinside.

Kelvinside was purchased by the Dunmores in 1760, a "Virginian" merchant family who used the estate as a social cachet, and worked the local minerals to some extent. In 1785 the Dunmores sold the estate to Thomas Lithan, who having made his fortune in Bengal invested in this country seat. The 472 acres of Kelvinside consisted of farms and woodlands, bleaching fields and mills, and old mineral workings. On Lithan's death in 1807 his wife remarried to Archibald Cuthill,

a local lawyer and land speculator in Blythswood. He kept Kelvinside as his country home until his death c1826 and, on his widow's death c1830 the lands passed to her brothers and nephews, the legal and mercantile Mowbray Family of Edinburgh and Leith.

It was a common pattern of the period to mention the proximity of coal in land leases, and the very absence of even a suggestion hints that mining in the early 19th. century was locally defunct. There is no mention in the lease of the 90 acres of Kirklee and Chapel Farms,[34] nor of Kirklee Cottage and neighbouring bleachfields.[35] Similarly, industrial needs did not require coal, for it is neither mentioned in the leasing of Messrs Glen and Inglis's Garrioch Mills,[36] nor in the leasing of Walker and Perrat's two bleachfields by the River Kelvin.[37] The advertisements do though introduce the presence of Montgomerie and Fleming, who as Glasgow based lawyers acted as Mowbrays' agents, and who played an increasingly important role in the management of the estate after Mrs Cuthill's death.

Once the estate passed into the hands of the Mowbrays, there was an immediate attempt to sell it, organised by Montgomerie and Fleming and the Edinburgh lawyers Mowbray and Howden. There is no mention what-so-ever of coal and the attempt to sell off feus on the lands, emphasised the natural beauty of their properties. The sale totalled about 100 acres, and analysis of the lots gives some idea of the Mowbrays' hopes for development of their lands, speaking as they

did of the:

> "beauty of [the] situation [as] not surpassed in this part of the country; it is now very retired and as the west end of Glasgow is extending rapidly in that direction, it will soon be in contact with the principal streets at the west end of town, and in consequence become much more valuable."[38]

But the Mowbrays failed to attract any great interest as the built up area was still too far east of the properties.[39] These properties also included North Woodside Park, and only in this instance was any mention made of economic geology, as there was:

> "Freestone in the lands, which the feuars or purchasers [would] be entitled to use for erecting buildings and so on, on those lots."[40]

There was though no mention of the nearby colliery already referred to under Woodside. The outcome was just as above with little real interest being shown by feuars, and the same can be said of the Farm of Horselethill. This 7 acre farm was surrounded by plantations, and:

> "a more beautiful situation for a range of villas, or building ground, [could not] be got."[41]

But the attempt to feu parcels of ground was a failure, and the Mowbrays sold the estate to their agents, the aforementioned Montgomerie

and Fleming, and their associate J.B. Neilson, in 1840. Neilson, who was related to Montgomerieby marriage, was probably attracted both by the gas coals of the area and principally the ironstone made commercially profitable by his hot blast smelting process. Though it is just as likely that Neilson was looking for investment for his small fortune made from the lease of his patent rights, land being a good speculative investment. The three partners paid £52,495 for the estate based on bank loans and personal investments. In 1845, they took in the 104 acre Gartnavel Estate, formerly part of Kelvinside for £10,450 and at that total cost of £62,945, they had obtained 576 acres of land.[42]

Why did James Beaumont Neilson really get involved in Kelvinside, for such land speculation must have been very risky, especially as his two partners Montgomerie and Fleming were not wealthy men? It is probable that Neilson's professional capacity as first foreman and then manager of the Glasgow Gas Works, from 1817 to 1847, focussed his attention. Apart from the ironstone there was a good gas coal running through the area, which was already exploited in Hillhead for gas making, and as there were two economic minerals mining was an attractive proposition. Gas coal prices fluctuated wildly,[43] but show a steady fall from 1848, when it was 18/9½d. per ton, to 1853 when it was 9/9d. per ton, when Kelvinside was productive enough to send 562 tons of coal to the port of London,[44] Geddes certainly states that the Glasgow City & Suburban Gas Works was a

consumer of Kelvinside Gas Coal,[45] so that mining was then probably intense, which is further hinted at by double seam workings near Kirklee and toward Horselethill,[46] and that Gas Coal was worked from at least six pits.[47] It is probable therefore that the re-exploitation of the area first fastened on the Gas Coal, and then as it was worked rapidly out it became the turn of the ironstone to be mined when its own value was fully appreciated.

Though keen to exploit minerals, the mining was short lived and it and local quarrying soon gave way to feuing as a superior residential area as urban sprawl rapidly encroached on Kelvinside. Kelvinside was a bold conception in town planning and:

> "From the first it was resolved...to make the suburb of Kelvinside the best residential district of the city."

for Mathew Montgomerie, who was the most dynamic of the partnership, had:

> "an implicit belief that the best class of houses in the rapidly expanding suburbs of Glasgow must ultimately come to be built on the line of Great Western Road...by far the handsomest throughfare in Glasgow."[48]

To carry out the scheme, Decimus Burton of the Regent's Park scheme and similar London urban projects, was appointed. He envisaged lines of terraces along Great Western Road with villas grouped to the rear.

But such a scheme was too exorbitant of land, and was soon revised by the Glasgow architect James Salmon.[49] Development though slow, for in the first thirty years few feus were sold, did though shift emphasis away from minerals working to the exploitation of land. It was planned to keep mining to the perimeter of residential feuing, and to keep it going, which was little wonder considering that in 1872-73 gross annual mineral values for the area totalled £2,958 2s. due in part to large reserved areas as around Kelvinside House,[50] or those areas then only opened up for exploitation, such as Gartnavel. Gartnavel itself was valued at £600 per acre in 1867, and was tenanted by the ironmaster Addie of Langloan. Gartnavel consisted of 104 acres and was therefore potentially worth £62,400 but total extraction was probably impossible and such a hypothetical amount could not stand up to increasing surface land values, such as J.W. Anderson's acquisition of 16.65 acres, in 1868, for £15,556, which if multiplied for mineral value as at Gartnavel, shows that mineral values were considerably less than surface values.[51] Mining may also have been seen to have had little potential or future, so that ownership interest would have been more on annual income from feu duty than the option of a lordship on minerals. Messrs Smillie and Goodall paid an annual feu duty of £421 on 6.96 acres, and high lordships would have been necessary to gain the equivalent income from the minerals outputs of small pits. Feuing and house building therefore became popular, but the hazards of old wastes from exhausted

Gas Coal workings appear to have been known and appreciated, for quite unlike Hillhead, and probably as a result of experiences both there and with constructed property on the estate, on-site investigation developed early as revealed in the notebooks of the boring contractor Messrs Henderson.[52] These reveal boring for remedial work but more interestingly they show on-site investigation for institutional buyers such as the Kelvinside Academy,[53] the feuars of Montgomerie Drive [now Cleveden Drive] and builders such as William Young who feued a fresh steading every few months in what is now Cleveden Crescent, between 1873 and 1878. At least some primitive consolidation took place in the shallow gas coal workings in response to terrace development, but what is most obvious is the apparent dictation of a remarkable open planned development of "pleasure gardens" and open ground in relation to old shafts and what must then have been known workings. It is perhaps dangerous to draw conclusions but the spread out development of Kelvinside reflected the realities of subsidence already then experienced in the grid patterns of Hillhead. The fallacy is that Hillhead was a reflection of the traditional rectilinear patterns of Blythswood Hill, and "pleasure gardens" may just have been a fashion.

The mineral leasees that remained worked the western areas of Kelvinside for ironstone, and included Addie of Langloan; J. Dunlop & Company; R.&.J. Moves, house factors who leased a small clay pit; and R. Cochran & Company, earthenware manufacturers,[54] the last of these

leases expired in 1881. As a direct consequence of these workings great quantities of colliery rubbish remained in the area some being used to fill old sale quarries opened on the local sandstone during feuing, but this rubbish was too extensive to bury and became a nuisance to both the proprietors and the feuars of the estate.

The problem arising from minerals rubbish is seen in the case of James Hislop et alia, feuars on Montgomerie Crescent and Drive [now Cleveden Crescent and Drive], versus James Brown Fleming. He was the son of the original second partner, John Park Fleming, and nephew of Mathew Montgomerie; by the period of the case in 1880 he was principal trustee of the Kelvinside Estate. Fleming had been faced with the problem of how to get rid of 260,000 tons of flammable rubbish. It would have apparently cost £30,000 to cart clear and burning was the cheap alternative, but with the resulting air pollution, Fleming's feuars took him to court, firstly in the Lanarkshire Sherrif Court and graduating to the Inner House in 1882. Fleming burned the blaes for cheapness and also benefitted by selling the slag for road metal, as well clearing the land for further feuing. He had not contravened the law of feuing, though the court in handing down its opinion, said:

> "is there any reason why the superior [Fleming] should be allowed to enhance the value of his ground at the expense of the vassals, who came here by his invitation."

It is surprising that so little came of Fleming's creation of an

industrial nuisance in an area, which at least in theory, was supposed to be clear of it in advertising for land feuing.[55] Fleming's fire raising was of course on the western periphery of the built up estate where there was little incentive to build, both from the distance from the city for personal travel and the continued presence of colliery bings. It is of course also a case that building and feuing in the area petered out at that time, and the industrial morass of Kelvindale attracted a new industry. This was the Kelvinside Brick Company, which was formed in 1891 to work the ironstone mine bings, as the pit rubbish was mainly a fireclay which could be made into bricks. The realisation that colliery rubbish could be made into bricks saw a major increase in brickmaking as an adjunct to colliery enterprises. The bing material was combustible and as such assisted the process of brick burning, the process being therefore reasonably cheap. Blaes was not plasticky like clay and had to be crushed to powder, placed in moulds and the brick then formed under very considerable pressure. The bricks were then fired in Hoffman kilns. Blaes bricks sufficed where the more expensive clay bricks were uncalled for, such as interior walls and gable ends.[56]

The Kelvinside works was situated on Balgray Hill, and it is interesting to reflect how at the beginning of the century the area had been advertised for villa building;[57] little had been done which serves to emphasis how spread out both historically and geographically

had been the development of the area. In 1895 the total output of blaes bricks was 40,000 per day, a fair proportion was used in the interior walls of tenements around Hyndland, feued out between 1890 and 1914.[58] The brickwork's products also saw use in walling in Kingston and elsewhere.[59] By 1904, a weekly output of 220,000 bricks was being achieved, at which time the bing materials around Kelvinside became exhausted and the industry ceased. The Kelvinside Brick Company then transferred its operations to leased bings on Garscube Estate and to Cleghorn, the base of its subsidiary the Cleghorn Terra-Cotta Company Ltd.[60]

The blaes brick industry played a surprisingly important part in the minerals and domestic development of the West End of Glasgow. In their choice of raw material they cleared the area of unsightly bings, and where attached to working collieries they saved the cost of bing deposit, thus avoiding ground rents and surface damages, besides which there was no royalty to pay. Thus the industrial landscape disappeared rapidly and the principal aspect of the development of the West End is how totally it overwhelmed surface evidence of its industrial past.

Conclusion.

The most significant aspect of the West End is the change in land use over a comparatively short time span, when western Glasgow turned from open fields and woodland to streets and houses, between c1830 and 1914. This in turn affected mineral exploitation in the area. When

the country was open and pastoral minerals normally won in the competition for land use, on account of their ability to assure continuing revenue rather than seasonal income to proprietors and tenants. The farmland around Hillhead provided early crops and was perhaps only a paying proposition in the early months of summer. The mines of the area enjoyed an all year demand, both domestic and industrial. The demand for gas coals encouraged the almost total extraction of the area, and the Glasgow Gas Light Company was a major customer. The rise in land values in the area coincided with a period when the mines of the area were probably nearing the end of their economic lives. Opportunity for mining expansion, had there really been any, was ignored in preference to high feu duties and surface land values. It is only with the demands of the then new iron industry for ironstone that many of the western district mines were again wrought. It may be that had J.B. Neilson not invented the hot blast process that made ironstone commercially profitable, mining in the Sheepmount and Kelvinside districts would not have resumed after the close of the 18th. century. It seems certainly the case that mining in these two districts had ceased in the early years of the 19th. century, as there is no mention in contemporary land adverts when such advertisements of the proximity of coal were common. That local demand had ceased or was being supplied from other sources is hinted at too in the cessation of the old collieries then still extant around Hillhead and Kelvinholm c1827-30.

The minerals workings of the area could not escape their history and it is significant of a declining trade that there were too many companies and too many small concerns, turnover as suggested in short leases at Hillhead was high, and those that might have sought minerals rights soonfound competition too strong from the property developers, who as speculators showed greater determination to get their way so that there would be no risk of loss to their investments.

The ironstone attracted in powerful minerals masters such as Addie and Dunlop, who could offer attractive options to the proprietors. It is also a case that the seat of their operations was far enough away at that time from domestic properties as to offer no real environmental problems. Suffice to say the approach to minerals changed from one of coal to iron, which was a key factor in the development of the West of Scotland, and the need to sustain the supply of raw material encouraged local ore extraction where it was possible.

Building itself brought about a change in exploitation of local commercial geology, with the influence on stone and clay for brick making increasing as demand rose locally for building materials.

The speed of change is also shown in contemporary experience of subsidence both in Hillhead and Kelvinside. This in its turn brought about site investigations, which provide local insight as to who were involved in the development of the area. The considerable number of

institutional and denominational names in relation to trials in the western districts is a particularly notable factor of the Henderson Bore Tables.

Mining brought other problems, principally environmental, with colliery rubbish. This in its turn created further industry, the blaes brick makers, who in their use of colliery rubbish cleared the surface for other purposes.

Consequently commercial geology was less significant in the area after its exploitation for urban development rather than agricultural purposes.

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14. Glasgow Herald 18 January 1830.

15. " 27 April 1832.

Stone from the Kelvingrove Quarry was used in the construction of at least one house on Brisbane Terrace, Largs, identified from the Glasgow Herald 27 April 1832. But as to how long the quarry operated is not clear. The sale of boring and pumping machinery about the 20 April 1833 suggests that minerals workings had ceased.

16. Glasgow Herald 15 April 1833.

17. " 8 April 1833.

18. SIMPSON, M.A. op.cit. 1977. p.56.

19. Glasgow Chronicle 9 April 1812.

20. BUCHANAN, Dr. Leslie "Notes on Hillhead" in Glasgow Herald 8 December 1928.

21. Glasgow Chronicle 2 September 1813.

A remarkable disparity in depths of known workings in the Hillhead area is shown in bore tables. This

was due to the hill of Hillhead rather than inclined workings following seams to greater depths. The workings as such appear to have been only slightly inclined accounting for the need for pumping engines, as artificial drainage was never possible. It may well be that the need for heavy pumping equipment meant that mining was never economic in the area with the "artificial" depths created by topography.

22. Report of the Committee of Management of the Glasgow Gas Light Company, 1 June 1825.

23. Scots Times 18 March 1826.

24. " 23 September 1826.

25. Glasgow Herald 13 July 1829.

26. SIMPSON, M.A. op.cit. 1977. p.60.

27. CRUICKSHANK, J. Sketch of the Incorporation of Masons and the Lodge of Glasgow, St. John Ferguson. 1879.

28. Builder 11 June 1864. p.434. No accurate cost is here available.

29. Hillhead Burgh Minutes 9 January 1871.

This refers to buildings to the east end of Belmont Crescent, which were reported in the Burgh Minutes as suffering subsidence from old mineral workings.

30. Hillhead Burgh Minutes 12 July 1875.

31. Hillhead Burgh Minutes 10 January 1887.

32. Henderson Bore Tables, 11 March 1875. ML. 424006.

33. Hillhead Burgh Minutes 7 June 1888 and continuing.

34. Glasgow Herald 6 March 1829

35. " 24 April 1829.

36. " 18 December 1829.

37. " 1 March 1830.

38. " 16 August 1830 - Lot 1.

39. SIMPSON, M.A. op.cit. 1977.

40. Glasgow Herald 16 August 1830 - Lot 2.

41. -do- 16 August 1830 - Lot 3.

42. SIMPSON, M.A. op.cit. 1977. p.57.

43. Report by James McLelland re. Messrs Okell &c. v The City & Suburban Gas Company. 1860.

44. Report by James McLelland op.cit. 1860. Mineral Statistics.

45. GEDDES, John Report on the minerals in the Kelvinside and Gartnavel Estates. 1867. SRA TD/556.

46. Evidence of on-siteinvestigations, principally the bore journals recording strata along Kirklee Road and to Westbourne Gardens.

47. GEDDES, John op.cit. SRA TD/556.

48. SIMPSON, M.A. op.cit. 1977. p.60.

49. GOMME, Andor and WALKER, David Architecture of Glasgow. 1968.

50. GEDDES, John op.cit. SRA TD/556.

51. GEDDES, John op.cit. SRA TD/556.

Taking approximately a multiplying factor of nine surface value at Gartnavel might well have totalled over £90,000.

52. Henderson Bore Books. The Mitchell Library.

53. Henderson Bore Books. Kelvinside New Academy site investigation 1877.

54. SIMPSON, M.A. Middle Class Housing and the Growth of Suburban Communities in the West End of Glasgow. 1830-1914. B.Litt. Thesis. Glasgow University, 1970. p.83-115. and the Kelvinside Estate Papers. S.R.A. and lists of the mines and quarries in the United Kingdom.

55. Hislop &c. v Fleming and Trustees of the Kelvinside Estate.

56. McLean, Angus Local Industries of Glasgow. 1901. p.209.

57. Glasgow Herald 20 February 1829.

58. SIMPSON, M.A. op.cit. 1977. p.60-61. also fieldwork evidence.

59. Fieldwork evidence with relation to brick walls demolished near the south bank rotunda of the old Clyde Harbour Tunnel.

60. British Clayworker December 1895 p.230; February 1905 p.358.

Chapter 13.

Conclusions.

Mining in the Glasgow area originated sometime in the 13th. century. Its development was in response to growing local demands arising from Glasgow's position in the West of Scotland which enabled the city to take advantage of new trading opportunities. The development of mining was slow being restricted either to areas where the seams were readily accessible, or to where markets were close to the mine. This explains why areas such as the Kilpatrick District, where the seams came near the surface, were exploited and the output sold locally, and why mining closer to Glasgow markets developed so early.

The coal trade slowly expanded and by 1556 a small export trade is identified which developed in the early 17th. century, though it was still restricted and localised to the immediacy of ports and shipping points.

Expansion in mining really increased in the 17th. century, with the sinking of shafts in Gorbals and the granting of mineral rights to open up new areas for exploitation. Mining proved practicable in Gorbals, Kirklee, Partick and the districts east of the town. There is evidence for rising demand in the purchasing policy of the Town Council and its acquisition of mining territory immediately south of the town in Gorbals. Links between the merchant community and the growth of the coal trade are also discernable with Walter

Gibson of Balshagray and his connections to the Partick mining district. Demand remained highly localised yet proved sufficiently strong to allow mining to weather the severe economic problems that beset the economy in the late 17th. century.

Expansion in mining came as Glasgow responded vigorously to the trading opportunities made possible by the political and economic union with England in 1707. Glasgow's rapidly growing population and the rise of many small service industries to the colonial and domestic trade, stimulated the need for coal. In turn this necessitated greater organisation and encouraged specialisation in mining as a business venture. Opportunity was taken to build on past experiences in mining and there was continuity in ownership and exploitation. The 18th. century link between merchants and mining was critical for the development of the industry, left to its own devices and its traditional patterns, mining would never have emerged from 17th. century huskering to regional significance.

The available evidence points to several forms of ownership, the section on early 18th. century coalmasters develops the theme that the active exploitation of coal was generally left to tenants and where land owners continued to be involved as with John Walkinshaw of Barrowfield, they were not always successful. It is of note that Walkinshaw employed the

experienced coalmaster William Douglas of Glenbervie, to organise mining in the Barrowfield Estate and it may therefore be concluded that there were already mining specialists in the Glasgow area in the early 18th. century. Barrowfield was sold to the City Magistrates who in turn sold both that estate and neighbouring Camlachie to John Orr, another experienced coalmaster. This suggests that this was a move on the part of the Magistrates to ensure continued exploitation of coal in those areas, to supply Glasgow's domestic demand. The conclusion emerges that decisions were being taken to formalise mining, a move that became possible in the tobacco period.

The Tobacco Lords played an important part in the development of mining. They gained experience in mining as a business extension, in partnership with experienced coalmasters and other merchant investors. The businessmen contributed the finance and the coalmasters their expertise, forming small partneries which worked the mineral estates of local landed families. They gained control of these regional estates eventually by purchase, carrying on the traditions of exploitation practised by the landowners they superseded. Together with the landed aristocracy and the lowland lairds, these merchant lairds formed a small band of powerful families with extensive control of the land, which in turn had its influence on mining's development, notably in wayleaves, but also in financing. Capital found its way into

mining from trade, but how close connections were between merchants and mining is not easy to evaluate. The increase in colonial trade did though encourage mercantile investment in the deepening of the Clyde an important act for the development of coal exports. It is also possible to identify merchant mining groups, the most important of which was the Dunlop, Houston, Gray and M'Nair group. There were outstanding individuals such as Gilbert Hamilton or William Dixon, but in a speculative and often unprofitable industry mining was seldom a sole involvement, businessmen diversified their interests as widely as possible. The number of co-partneries which shared in mining and other industries is impressive, in particular the prominent tobacco houses of Cochrane, Murdoch and Buchanan (see Appendix 1: Select list of Coal Masters and their connections to other companies).

The activities of the minerals masters are highlighted in Chapter 2 and in the district studies, and show how mining devolved, a trend shown in Messrs Dennistouns' diversification into the limestone trade at Camseskan, Cardross and to the slate trade at Camstraddan. The financial potential of economic geology became recognised at a regional level.

Colonial merchants obviously played a dominant role, particularly in the Barony where they had their estates and exploited local coal. Then there is a second level of businessmen who had diversified into mining or were probably self made coalmasters. Estate owners leasing for exploitation remain, especially in the country areas

around Campsie and Kilpatrick. There the coal trade was dominated by the limestone trade. The lessees, who were often local farmers or lime masters, used the coal principally for calcining limestone and followed the practice of selling what was surplus to their own requirements on the open market as a source of additional funding.

Patterns of ownership were further enhanced by the influence of early "industrialists" principally bleach field owners and textile traders. These men actively encouraged exploitation to ensure their fuel supply, tempting coalmasters with lucrative offers, as with Robert Hay's financing of trials on the Pollok Estate to encourage its exploitation (see p.42). There were other "industrialists" who chose to do their own mining of which Dunn of Duntocher was an example (see p.53).

Merchant capital found its way into tanning, boot and shoe manufacturing, rope and sailcloth making, ironworks, glassworks, coal mines, breweries, textile factories and dye works, creating many and diverse links to mining. Even to early banking there is a link, for the partners of the Thistle Bank had interests in minerals below their estates (see p.94).

The evolution of leasing takes place with the organisation of mining and its development into a formal and complicated document reflects the growth in the coal trade. Common patterns

developed in leasing, with the stipulation of specific duties which could include the use of machinery and the fixing of output quotas. Rents and lordships could be set to encourage mining, decreasing as mining got deeper and to the better coal seams, which could be expected to bring a better return on the market. Rents and lordships reflect the aspirations of owners for the highest financial returns possible, though there are obvious exceptions where owners failed to appreciate the potential of their mineral holdings as with ironstone.

The evidence presented suggests that the buying and selling of mines and coalfields was dealt with by estate factotums. Agents could be lawyers, suggesting a well defined legal framework, they also fulfilled an important role as the landowners' town representatives and as go-betweens within the merchant community, with whom they shared the same names such as Bogle a powerful merchant administrative group. Edinburgh lawyers occur in relation to coalfield sales around Glasgow but are not nearly so common as with other Scottish Colliery sales. It may be concluded that Glasgow's mining organisation was more localised on account of the high regional domestic demand. It may also be that it reflects the status of the landowners as Writers to the Signet tended to represent the gentry. The links that developed between Glasgow mine owners and Glasgow lawyers

certainly show how mining had become institutionalised.

What evidence there is on management structure in mining suggests a business elite of experienced coalmasters, who in some casesbecame the confidants of the landowners. A case in point was John Loughrey who worked for the Kincaid-Lennox Family for many years. Management duties tended to be carried out by experienced workmen, who undertook management around the estate, at the pit head and below ground. There appears to have been a division into teams with a manager to each section. This pattern is also shown amongst the miners, with experienced men leading groups of workers, including other family members, in contracting out particular underground duties such as cutting out rooms. This pattern emerged on account of the prevalence of oncost labour in Glasgow mines, such as that of the Green Colliery, Shettleston.

The growth of the iron industry shows the pulling together of many of the above themes, they are no longer disjointed and ownerships begin to become unified with the elements of production. Thus powerful iron masters such as the Dunlops emerge and coal production and the iron trade become interlinked, a partnership which affected mining's progress throughout the 19th. century.

The geographical character of the Glasgow region had a profound influence on the growth of the minerals trade. Barriers of drumlins, bogs, and rivers made road communication difficult and costly, and while for the most part rivers were too rapid for navigation or estuarine meanders, they provided the first possible highways to commerce. This is seen in the use of the Upper Navigation of the River Clyde to move coal from an area where the heavy cost of land carriage hampered trade to such an extent that when a tiny cart of coal did manage to make it from East Kilbride to Cambuslang, it was seen as a seven day wonder. The use of the Upper Navigation helped to develop a trade of small ships workings to and fro along the shallow estuary of the River Clyde. It was from this restricted trade that the Firth of Clyde blossomed as a centre of commerce and a highway to greater things with the general river improvements made by Golborne and others.

Coals importance for domestic and industrial purposes saw distinct trade patterns emerge. These are traced in the thesis and show the important role played by the River Clyde in coal distribution to markets. In the early 1800s 70% of the output from Govan went for domestic use, while 10% passed to industry, the remaining 20% was either exported to Ireland or shipped to other Clyde towns. Many of the West of Scotland limeworks were favourably located in respect of the River Clyde and her

tributaries, that they might that more easily be supplied with coal from the Glasgow mining district, for calcining their local limestone. The importance of the Clyde is shown further in the development of a coastal and lochs trade, which encouraged a Kilpatrick District coalmaster Colin Buchanan to sell his coal along the River Leven and to Loch Lomond.

The River Clyde also acted as a channel for coal to Ireland and the colonies; an important conclusion which emerges from available evidence of shipping movements is that coal tended to form ballast cargoes rather than complete holds. Glasgow coal exported to Ireland clearly reflects the desire of Glasgow merchants to find a lucrative ballast cargo on the outward voyage in exchange for Irish domestic commodities. The thesis presents the argument that coal formed part of a trade, rather than a trade in its own right as for example with Ayrshire coal bound for Ireland. The two way trade that always kept boats full explains the development of the American and West Indies trades much along the same course.

Carting seems to have increased in the late 18th. century as communications improved, further evidence is seen in the adoption of formal measures of sale, with carts of 12, 18 and 24 cwt. and the establishment of the Society of Coal Carters.

It is clear that it was shared problems that lay behind the emergence of collective action among the Glasgow coalmasters in the 18th. and early 19th. centuries. These actions were not all intended to control production or prices, for there were many issues, such as river charges, and gaining representation on the Town Council, which brought the coalmasters together. But this general concern was directed into maintaining prices and exercising control over production. Between 1760 and 1813 there were at least 5 such combinations known to have operated for brief periods, of which the most dominant was that of 1790. The Glasgow Coal Company not only influenced the domestic trade but also affected that to Ireland. Its emergence was a recognition by the coalmasters that the coal trade could be pursued more easily by mutual agreement and witnesses the birth of the organised coal trade that became established in the 19th. century.

The early 19th. century probably saw little real change in market forces. Though industrial customers become identifiable comparative use of coal with large industrial concerns of the century before is not possible on account of there being few records. What records that do exist such as the Canal Basin Sales Book of the Govan Coal Company, suggest a change from selling through town agencies to a more direct coal company /customer relationship, a developing trend whereby coal companies tended to have company

offices strategically placed in the centre of Glasgow; examples included many of the Monkland collieries which had established town offices in direct competition with local colliery owners.

An important conclusion is that colliery and mine owners took investment decisions in machinery, so that their pits could respond more easily to demand. Landowners keen to encourage mining invested in machinery, or wrote clauses into leases that included machinery within the agreement for mining.

These decisions recognised the two main problems affecting local mining, the raising of coal and the problems of water. The first of these was overcome with horse gins and a few steam winding engines. The number of these engines is inconclusive but it is likely that some engines at least were capable of both winding and pumping, and tend to be categorised as the latter as this would have been the dominant role.

Pumping machines of various types, both horse, wind and water powered occur, the first steam pumping engines appear in the eastern district. A reason for their deployment was that they were cheaper to run than the feeding of relays of horses to work gin pumps. The size of these early engines can only be guessed at as the first cylinder sizes that could be found dated from c1770. These were 24 in. diameter cylinder engines and by

the early 19th. century they had more than doubled in diameter. This reflects the increasings depths of workings and the need for larger engines, which are generally recorded in the eastern district and in the Cambuslang and Rutherglen areas. This would suggest that by the early 19th. century mining was being concentrated in those areas as they proved most productive. Pumping engines appear to have cost between £500-£1,000.

The problems that had to be overcome are hinted at in the causes of accidents, that flooding was generally overcome is shown by the rapid decrease in this type of accident after 1770. Ventilation technology would seem also to have been successful, though there were obvious exceptions. Methane does not seem to have been a problem in the comparatively shallow early mines, though the Hurlet seams were fiery and as mines got deeper then the danger of explosions increased. The principal cause of accidents in the Glasgow area was related to the shafts. The high percentage of accidents traceable in the 30 years from 1770 to the 19th. century, reflect an increase in mining rather than any failure in technology. The technology of support was probably less understood and was a principal killer. The number of accidents attributable to this cause fluctuate and reflect the considerable geological differences found throughout the coalfields. They are more common in mines working above rockhead, where support was poor, they were most common in the period 1740-1769 when workings were still shallow.

The dangerous underground life effectively limited recruitment, and it is a reasonable conclusion that the inadequacy of labour supply hampered Glasgow's response to market opportunities. The labour force was composed partly of independent workers and partly of serf labour, local coalmasters could not afford the cost of a tied labour force. The Glasgow miners enjoyed a considerable level of independence on this account. The chapter dealing with their position in society traces their politicization and shows the growth of agitation throughout the period of review. It is quite obvious that they were the pariahs of society, especially in its industrialisation. There are a number of conclusions that may be drawn out, firstly that the miners were comparatively well paid in comparison to other local industries, and this was presumably to maintain labour supply: strikes that can be identified occur generally in the areas of intensive mining: that there was a recognition on the part of mine owners from at least 1770 that free miners would increase the labour supply on the market and make for more moderate wage agreements, the idea being that miners would be glad of a job. The principal conclusion that emerges is that factors affecting miners' standing in society were generally economic.

The abolition of serfdom in 1799 coincided with the beginning of Highland and Irish immigration to the lowlands, creating a pool of labour for the mine owners. High wages dissolved with

the influx of migrants to the mining areas for employment. The accidents of geography which set industrial revolution so close to substantial rural communities also encouraged the lowland population to look to mining. The underlying propensity to look for secure jobs, the unskilled nature of much of the workforce, were resource factors that as technology developed, answered necessary job opportunities and served the needs of the employers. The colliery community that could have been counted in hundreds, if even that, around Glasgow in the early 18th. century, probably increased to a thousand or more by the early 19th. century. Evidently no single type of influence explains what was really happening in the colliery labour market, for Bald (see p.235) comments on the dissatisfaction of the mining community, reflected in problems of labour control. The most likely conclusion is that the transition to intensive mining was the culprit, hinted at in the identification of most serious labour disputes to areas of intensive mining. The emphasis on tasks to be completed rather than on time spent on working; the regulation of both wages and pace of work by customary standards rather than by calculations of what the market would bear; the irregular rhythm of labour on account of geological difficulties alternating between bouts of intense work and periods of low productivity, all caused problems for the Glasgow mining area. They created heavy physical work,

demanding violent and irregular effort, for which the old labour force, conditioned by a historical work-discipline, was no longer so well adapted. Mining increased in tempo, revealed in rising output in the early 19th. century. Though this would have carried the management and workforce naturally along, it engendered a reaction against increasing physical demands on the part of the mining industry. So long as it was not necessary to co-ordinate the movements of miners with the operation of new schedules and new technology, it could be tolerated. But once a threshold had been reached then new directions in labour supply and even in mining had to be followed to maintain production. Hence the whole of Glasgow's mining began to falter, the old mines immediate to the town could not respond to the physical demands placed on them by the upward trend of output.

Demand needs consolidated mining into new patterns, which included the more responsive of the Glasgow district mines such as those at Govan and Cambuslang, and around Shettleston. But the mining centre actually moved to the districts of Monklands, Bothwell, Shotts, Cambusnethan and Carnwath. This was made possible by improvements in communication, the lack of which had been the Glasgow district mines' raison d'etre in the early 18th. century. The same improvements in communication opened up the Renfrewshire and Larkhall districts to exploitation.

Glasgow's mining period up to 1830 was a time when resources were ruthlessly exploited rather than developed, the poorly organised mines of so many districts show this. The best seams became exhausted and the possibility of extracting other seams was lost. Technology could have conquered many of the problems but financial returns from failing reserves and in the face of stiff competition and geological problems, could not have sustained the investment necessary.

The demand for money meant that when coal reserves began to fail other sources of income were approached. The principal of these was feuing with the growth of the town. Surface land use succeeded mining for estate income, and it is the case that many of the early mines ceased by 1830. This left a legacy of void migration from abandoned workings causing subsidence and damage to surface users. There is evidence to suggest that as a problem it was recognised and may account for the extended estate development of the West of Glasgow. In inner city areas where demand dictated intensive land use it was a different case and the legacy remains.

Mining did not cease completely, it became a tidying up operation, working support pillars and cleaning out seams in advance of the expanding town, often with the consequences noted above.

In the first thirty years of the 19th. century a new dynamism affected at least some of the colliery districts about Glasgow.

Improvements in industrial techniques initiated by Neilson's hot blast and the new utility this gave to Mushet's discovery of black band ironstone created demand conditions for ironstone mining to the west of the town. The economic advantages of possessing rich iron ores and coal in the same locality were appreciated, but cost and quality and land use difficulties placed serious limitations on any general exploitation of blackband ironstone or remaining coal close in to Glasgow. Localised mining continued in the Glasgow district into the present century but had never the dynamic qualities of the 18th. century, when Glasgow's mining had been at its peak.

Appendix 1.

Select List of Coal Masters and their connections to other companies.

CAMERON, Richard

Richard Cameron, partner in Buchanan, Hastie & Company, 1765-77

Coalmaster at Greenfield, c1773.

Coalmaster at Lightburn, c1774.

Source: Dell; Glasgow Journal 9-16 December 1773; Glasgow Journal 10-17 March 1774.

CRAWFORD, William

William Crawford, partner in Shuttlefield Factory Co., 1743.

Cochrane, Murdoch & Co., 1750.

Involved in the sale of the colliery at Kirklee of Partick, 1755.

Source: Dell; Glasgow Journal 19-26 May 1755.

DUNLOP, Colin

Colin Dunlop of Carmyle (1706-77) held an interest in Govan, which passed to his eldest son James Dunlop of Garnkirk (1741-1816) on his majority. James Dunlop's shares in turn passed to Colin Dunlop, the younger, on his majority. Colin Dunlop, the elder, was a merchant and tobacco importer. His principal mineral interests were with Alexander Houston. Other partnerships were: Dunlop, Houston & Co., 1750; Glasgow Ropework Co., 1764; Dunlop, Gross & Co., 1771; Little Govan Colliery, 1764; Dunlop,

Houston, Gray & M'Nair, 1768 t/a coal merchants; Colin Dunlop & Co., 1743-74; Colin Dunlop, Gross & Co., 1774.

Source: Dell.

DUNLOP, James

James Dunlop of Garnkirk, merchant and coal master (1741-1816), held Fullerton coalfield. There are several men of this name, leading to confusion over partnerships.

Source: Dell.

DUNMORE, Thomas

Dunmore had mineral interests both at Bankhead and Kirklee of Partick. His other partneries included: Shoe Manufacturing Co., 1738; Shuttlefield Factory Co., 1743; Cochrane, Murdoch & Co., 1750, 1761; Thomas Dunmore & Co., 1751-55; James Hall's Universal Warehouse Co., 1759-1763. His son Robert expanded on the mining interests.

Source: Dell.

DUNMORE, Robert

Son of Thomas Dunmore and partner in the following: Baldernock Coal & Limestone; Bankier Coal & Limestone; Blairskaith Coal & Limestone; Virginia merchant; Cotton Spinner, Ballindalloch; Robert Dunmore & Co., 1773.

Source: Dell; OSA.

FRENCH, William

William French of Baillieston (1734-1802) was a general merchant and tobacco importer. He began his business life as a clerk to Cunningham of Lainshaw, a prominent tobacco trader in the Cochrane, Murdoch, Buchanan groups. French was also a partner in: French, Crawford & Co., tobacco merchants with William Crawford. Spiers, French & Co., 1775; William Cunningham & Co. Forth & Clyde Canal (8 shares). Easter Barrachnie Coal Company.

Source: Dell.

HOUSTON, Alexander

Owner of Jordanhill and minerals proprietor and coal master of influence. Jordanhill was purchased from the Crawford Family during the 1750s probably as a mineral investment as much as a country estate. The purchase was financed from a range of partnerships which included: Port Glasgow Ropework Co., 1741; Dunlop, Houston & Co., 1750; Little Govan Colliery, 1764; Dunlop, Houston, Gray & M'Nair, 1768. These were mainly mineral partneries and included several other mineral entreprenaurs and estate owners, such as William McDowall of Garthland and Robert Houston Rae.

Source: Dell; Devine; OCH.

M'NAIR, James

James M'Nair of Greenfield. Merchant and partner in firms such as the Easter Sugar House Company 1760-89; Dunlop, Houston, Gray and M'Nair, 1768. Coalmaster at Greenfield in partnership with Richard Cameron, c1773.

Source: Dell; Devine; OCH.

PATERSON, John

Coalmaster at Springhill Colliery, 1793. Senior partner in John Robertson & Co., vintners, Glasgow.

Source: Dell; Glasgow Courier 6 October 1792; Glasgow Courier 14 February 1793.

RITCHIE, James

Proprietor of Craigton who was a tobacco merchant and a founder of the Thistle Bank. Associated with John Ritchie, senior and junior, William Keir and William Gordon, merchants and tobacco importers. Partnerships were: Cochrane, Murdoch & Co., 1750; Maxwell, Ritchie & Co., 1761; Smithfield Co., 1780-82; James Ritchie & Co., 1773-74. Craigton Coal Work, 1760.

Source: Dell; Glasgow Journal 10-17 March 1760; OCH.

SMELLIE, Archibald

Proprietor and mineral entrepreneur, who worked the minerals of his own estate at Easterhill. Archibald Smellie was a partner in Niven, Kinningburgh & Co., linen and yarn merchants. He worked the Easterhill Coal Work in partnership with his son Richard Smellie. In 1783, the colliery failed partly through the increasing debts from Smellie's other concerns. James Hopkirk of Dalbeth acquired the mineral rights on Smellie's failure.

Source: Dell; OCH; Glasgow Journal.

SMELLIE, Richard

Partner with his father Archibald, in Easterhill. Merchant partnerships also included Bogle, Smellie, Murdoch & Co., till 1798.

Source: Glasgow Courier 12 May 1798.

Source abbreviations:

Dell = DELL, Richard Register of Glasgow Co-partneries, Joint Stock Companies and Ventures to 1775. 1971.

DEVINE = DEVINE, T.M. The Tobacco Lords. 1975.

OCH = Old Country Houses of the Old Glasgow Gentry. 1870.

OSA = First Statistical Account. 1795.

Appendix 2.

The Alum Industry.

The theme of this study has been predominantly the rise of the coal industry, but would be incomplete without telling that of alum.

Textile manufacture and printing in the Glasgow area was the principal reason for the growth of the local alum industry. In 1725 a white linen works was established, and linen printing was begun by 1738. The many looms of the Barony Parish produced linen goods, which were printed for handkerchiefs, gowns and curtain materials. The extraction and modification of natural dyestuffs for these materials was therefore an important local industry. Cudbear, a dyestuff made from the lichens Ochrolechia tartarea and Urceolaria calcarea,[1] that were also the source of litmus, gave a good permanent purple with alum. The alum was probably imported from England and the continent, thus pushing up its price. It made economic sense to trace local sources and this became possible with the utilisation of shale from abandoned mine workings.

Attempts to exploit alum shale began between 1766-69 using the white efflorescences of hair salt - two parts sulphate of iron to one part of aluminium - which were found in the old coal wastes at Hurlet. However, Messrs Nicholson & Lightbody's works was not successful as their source gave too light a yield to be profitable and was soon abandoned. Alum continued to be supplied from outwith Scotland, principally from Whitby. This cannot have suited dye manufacturers such as George Macintosh, who in 1777 established his

Cudbear Works in Glasgow. Macintosh's contribution to the alum industry began with his introduction of acetate of alumina to the dye trade. This popular mordant was well suited to the printing and dyeing of delicate fabrics and was more responsive than alum alone. It was prepared by a double decomposition of a solution of alum and acetate of lead, the soluble aluminium and potassium acetates thus formed being decanted from the heavy insoluble lead sulphate. Its success economically was hampered by its dependence on large quantities of alum. Macintosh turned his attention to Hurlet as a cheap source of local alum. He formed a partnership with John Wilson, who had gained considerable experience at the Whitby Alum Works, to exploit the Hurlet deposits. Production of alum commenced in 1797 under Macintosh, Knox & Company, who were joined in 1800 by another notable industrial chemist Charles Tennent of St. Rollox.[2]

Chemically the alum formed a group of double sulphates through set formulae, of which there were five and all essentially correct to create "alum" or potash alum. The general formula was $M^{I}\ M^{III}\ (SO_4)\ 2\ 12\ H_2O$, where M^{I} could be potassium, sodium or ammonium; M^{III} could be aluminium, chromium, iron and so on.[2.1] The thresholds of the formulas could therefore be very wide and the technology left much to natural processes; it was Macintosh's speeding up of the process by heating that contributed much to Hurlet's success.

Hurlet.

The decomposing salts which Macintosh exploited for alum lay between the Hurlet coal and limestone, varying in thickness from a few inches to feet. The occurrence was localised to about an eighth of a mile of former workings, these being exceptionally dry with a temperature range from 60-63° fahrenheit, which helped the breaking up process.

The chemical works established above ground occupied 4-5 acres, with a profusion of buildings, chambers for acid preparation, two evaporation furnaces and lixivating vats. At nearby Nitshill, the alum works there had three furnaces and the working area provided space for great mounds of raw material.

The mineral shales and the decomposing salts once extracted were broken up and piled on a bed of fuel to about 4 feet high. Once calcination had begun more mineral was added to the pile, which could be as much as 200 square feet at the base. Apart from the mounds of raw material, the rest of the site was given over to burning. Combustion was rapid, but the mound had to be kept well sealed to stop air getting in and affecting the burning, this was done by sealing cracks, as they appeared, with watered down shale. It required about 130 tons of the decomposing shale to make a ton of alum. Once the calcination was complete, the

residue was run off to pits, from which it was pumped and added to fresh calcined ore. The process was repeated until the gravity was brought to 1.15. The saturated liquid was placed in pits to deposit contaminants and also boiled for the same purpose. The purified liquid was concentrated by boiling in leaden pans. It was passed on to settling tanks and muriate of potash or impure alkalis of the soap industry were then added to reduce the specific gravity from 1.4 or 1.5 to 1.35. The alkali potassium chloride was supplied from Tyneside, being sold at £12-£20 per ton by the Newcastle alkali manufacturers. The quantity necessary was measured by a Twaddel hydrometer, built by Twaddel to Macintosh's design. When the specific gravity exceeded 1.35 it did not crystallise, forming instead a greasy magma, which had to be further reduced if it was to crystallise at all. Urine was added for this purpose and crystallisation was accomplished by evaporation. The crystals which formed, often as octahedra and quite large, were purified by washing and boiling. The saturated solution was poured off into casks and allowed to solidify, an ancient practice known as "roaching" which was done in 7 by 3 feet casks at Hurlet. The casks were unhooped a fortnight or so later, the alum then forming a solid pillar of 32 cwt.[3]

The alum yield off the Hurlet shales was far higher than that at Yorkshire. But this was partly due to Macintosh's evaporating

furnaces, for the flame drawn by chimney draught across the surface of the alum solution served to concentrate it. It may also be mentioned that calcining the alum shortened the alum making process by many months. Hurlet alum could therefore be produced much more cheaply than that of Whitby which left much of the process to the actions of nature.[4]

Campsie.

The Hurlet works was extremely successful and soon tempted others to follow suit. But because of the limited reserves attention was turned elsewhere, principally to the Campsie District. Geologically the Campsie area was similar to Renfrewshire; the Campsie Main Coal and Limestone were equivalents of the Hurlet seams. The Main Coal was pyritic and the shale lying between it and the limestone more so, the shale proving useful for alum making. The extraction of iron and aluminium sulphates became an important local industry as a result. The local textile trade of Campsie was another reason for the alum makers to choose the area. It is interesting to note that there might have been two alum works in the Campsie district, had Walter Logan, a mercantile agent in Glasgow, managed to establish an alum making plant in partnership with a man named Laird, in the area. The scheme did not succeed,[5] probably on account of the shales being less productive than expected.[6]

Alum making began in the Campsie district c1805, possibly by chance

following Macintosh's arrival at Barraston to establish a tanning business, using the crystal clear waters of the area. The works was close to the pit heads of the Barraston Colliery and these attracted Macintosh's interest as a speculative investment, additional to his own trade. Certainly once he was experienced at Hurlet, he took a lease of the local Barraston minerals and worked them for some time. In the process he found the alum shale and exploited the iron sulphates in a copperas works which was established at latest by 1805. It is difficult to say how long this working lasted for the benefit of the lease was on offer by 1808.[7] There are references to a Loftus, Hurlet & Campsie Alum Works in 1809,[8] but its exact location is uncertain. What became the Campsie Alum Company does not seem to have been established then, it in turn growing up around Macintosh, Knox & Company's large coal and limeworks at Lennoxtown,[9] a year or so later. This seems the most likely base for the partners were the same as those at Hurlet, the two areas then being worked by a partnership of Macintosh, Major Finlay, R.E., John Wilson of Hurlet, and James Knox. Charles Stirling afterwards became a partner, and remained in the firms till c1829.[10] Finlay was a brother of Kirkman Finlay of Toward Castle and had some experience of the extractive industries in quarrying at Toward.

The Campsie alum works is described in the Agriculture of

Stirlingshire (1812) as follows:

"In the immediate vicinity of Campsie, there are considerable chemical works carried on, where alum, copperas, soda, Prussian Blue &c., are manufactured on an extensive scale: and in which a very large capital appears to be embarked. The Company produced the alum and copperas from a decomposed aluminous schistus found in considerable quantity in the adjoining coal wastes. This schistus forms originally the covering or roof of the coal strata of the district, and is composed of silex, alumine, or clay, iron and sulphur; the two latter probably in a state of chemical union. Soon after the coal is wrought, this schistus, of various thickness, separates from a limestone stratum immediately above; thus falling down into the waste. In process of time, indeed, generally after the lapse of many years, owing to a constant circulation of air through these wastes, which being level free, are always dry (an indispensable requisite to this operation of nature) the sulphur becomes oxygenated; and is converted into vitriolic or sulphuric acid; this, uniting with the iron, forms copperas, and with clay, sulphate of alumine, from which crystallised alum is afterwards made.

The decomposed schistus, as taken out of the waste, is lixivated, and the lixivia evaporated. Upon cooling, pure

sulphate of iron, or copperas, separates. The mother waters are then boiled with a solution of potash, by which (the triple salt) crystallised alum is formed; this separates in its turn by cooling, and is purified by subsequent crystallisations."[11]

The Campsie alum works was by 1812 producing 1,000 tons per annum, using 3,000 tons of coal and 300 tons of potassic materials. The abundance of local coal was of considerable benefit to the Alum Company, explaining why the Alum Company became such a dominant minerals owner in the area. The potassic materials had to be bought in from other works, most commonly as soapers' salt. Tennent's works at St. Rollox may also have been a source of potassics in part payment for the raw alum materials which were sent there from Campsie. By 1835 alum production had increased to 2,000 tons per annum and the price had fallen to £12 per ton,[12] and by 1846 it was still further reduced to £9 10s. per ton.[13]

The alum shales were pursued with considerable vigour across the Campsie District mining area. Old coal workings were frequently reopened to work the shales in their wastes, a pattern of operation illustrated by the Black Road Pit, an old colliery close to the Baldernock Road, a short distance west of the boundary between the Lennox property and the Eleven Plough

Lands of Balgrochan. The pit had been wrought c1823, and c1838, under lease from Lennox, but had been dormant from at least 1840 to 1852, when it was reopened to extract alum shale. The shales were separated from the coal by a thin wedge of ironstone and not surprisingly it was often found useless having been brought down in working the coal. Between August 1852 and February 1853, 616 tons 12 cwt. of alum shale was taken from the pit.[14] More might well have been expected and it was often the case that the Alum Company took draconian measures to conserve the shales for their own use. This naturally brought dispute with those who worked the mines for coal, and the history of alum making in Glasgow was often one of litigation. It was also a case that the Campsie Alum Company willingly enforced their monopoly of the trade, and the technicalities of who owned what and where presented a more significant problem to alum mining than its actual extraction.

Alum Miners versus other miners.

The Alum Company often imposed its interests on others and this is well illustrated considering John McGilchrist's working of Bankier from c1850. He found a quantity of the pyritic alum shale in the mine and took a sample to Glasgow, where he showed it to Messrs Miller the chemical manufacturers. They were immediately interested, realising that by this means they could overcome the high price charged by the monopolistic Alum Company. McGilchrist arranged to supply what was in the mine at 9/6d. per ton and

brought the weight of the Campsie Alum Works Company down on his shoulders:

> "I don't recollect whether I was sent for or not, but shortly after this I recollect of calling again on Mr King in his office in Glasgow. Mr King proposed that I should put out the rest of the pyrites out of the pit and lay it down at Hungryside - and he would boat it and sell it himself - (I think) it was 6/6d. per ton I bargained for to bring it out of the pit and lay it down at Hungryside."[15]

John King was quite unwilling that the Alum Company's local monopoly should be breached. John King had had a long relationship with alum , having worked at Hurlet as a young man, and risen to a managerial position at Campsie, then to ownership on the deaths of Charles Macintosh (1843) and George Macintosh junior and Charles Stirling, so it was in his personal interest to strengthen the will of the Campsie Alum Company.[16]

The definition of mines and minerals created further litigations, most especially where two minerals were wrought in the same mine by different parties; the rights of each had to be clearly defined; and the strong willed John King naturally pursued his. This is shown clearly in case of John King &c., trading as the Hurlet Alum Company v the Earl of Glasgow, in 1850.[17]

John King and others had had successive leases of alum shale found in connection with the coal strata at Hurlet from 1753. The Hurlet Alum Company had powers of access to the coal wastes but no right to work any other minerals.

In 1800, the alum shale was let for 63 years, reserving the coal, limestone and ironstone, with the exclusive use of 5 pits for working these minerals to the lessor. The Alum Company had no right in these pits, except in the event of working of the limestone, when they were to be told so that they could get the alum shale resting between the coal and the limestone.

In 1818, the Earl of Glasgow leased his mines to John Wilson, inclusive of the alum shale for £2,000 per annum; obliging Wilson to honour the Alum Company's access rights. An agreement to continue for 9 years was reached, with powers to break at 4 so that the Alum Company was excused rent to 1823. Messrs Wilson were expected to keep the pit in order and to avoid falls of roof by leaving in sufficient roof supports. They were given the liberty to charge the Alum Company 1/6d. per ton for the ore comprised in their former tack.

In 1823, the Alum Company complained that the colliery water was rising and covering the alum ore which had been collected, a claim for damages resulted. In 1824 and 1829, Wilson's lease was

renewed, with full powers of working but to avoid any damage to the alum shale. From 1837 to 1843 the Alum Company regularly complained that the alum shale was being damaged by rising water. In claiming damages they stated that Wilson's workings were in breach of the covenant protecting their rights, for he had allowed subsidences across 30 to 40 acres of the workings, where the alum shale was lost.

In 1846, the Earl of Glasgow's law agents stated:

"That the alum ore lying above the old pillars was not let to anyone; therefore the coal tenant ought to have it. In the general letting of the alum ore, it was not contemplated that the pillars were to be removed; hence, any found, on their removal, was no encroachment on the field of the Alum Company, but the allowance for Mr. Wilson to take out the pillars was an after arrangement, and, therefore, that part of the alum ore was at the landlord's disposal."

Messrs King replied:

"That the whole ore in the Earl's coals pits and coal wastes at Hurlet is conveyed to us."

The lease had at no time stated otherwise and had specified very clearly the rights of the Alum Company. In 1847, Wilson commenced

his workings, and the Alum Company pulling out stood upon their rights of damages.

The merits of the case hinged on whether the alum shale resting upon old pillars of the wastes was or was not included in the letting to the Alum Company, whilst the coal and limestone was let to Wilson and whether Wilson in working the coal, did not unlawfully damage the rights of the Alum Company as defined by the Earl of Glasgow. The trial by jury lasted several days, the outcome being that the alum shale was indeed under lease to the Alum Company; that Wilson in his working away the pillars and claiming the alum shale, had damaged the plaintiff; and, therefore, a verdict was given for several thousand pounds, a large proportion of which cost was borne by the Earl of Glasgow, whose law agents had advised the workings by Wilson.[18]

The very real problems of working Hurlet, led to the abandonment of the Renfrewshire alum shales, at a comparatively early date as no longer profitable, this in turn increased the importance of the works at Campsie.

The End of the Alum Industry.

The yield of the alum shales varied greatly, so much so that exploitation often proved uneconomic, as early as 1830 in the case of the Woodhead Mines, which were in the neighbourhood of the Campsie

Alum Works. In a letter to the estate factor of Woodhead, the Alum Company expressed its reservations:

> "In consequence of the deteriorated quality of the alum schist in the Woodhead Mines and of other causes more fully narrated in the letter of which the enclosed is a copy we hope to be exempted from payment of the rent stipulated in the alum ore lease until the ore is in a fit state for being applied to the purpose of alum making."[19]

Alum production did though continue, even to the late 19th. century, though expected yields were seldom met. Reserves of alum shale grew less and less, though many old workings were opened up again to work the shales for short periods. Then there came competition as the production of cheap sulphuric acid allowed alum to be made from aluminous clay and acid. Faced with failing reserves the shale alum producers faltered in the face of the new technology and suffered considerable losses.[20] Both Campsie and Hurlet turned their production lines to basic chemicals and alum shale technology became a thing of the past.

Alum and Society.

Artificial dyestuffs production took root in the expansion of the textile industries in the Glasgow area. The demand for mordants

and dyes created the need for alum which formed the basic raw material of the chief mordant copperas. This local need coincided with the growth of shale alum technology and the identification of local reserves in old coal wastes, a resource which Macintosh and his partners were well placed technically and demographically to exploit. They ensured an almost exclusive possession of the trade with Macintosh's techniques of roasting and heating which shortened the alum making process by many months.

Alum was useful for many purposes, and though the main centres of the alum industry were Campsie and Hurlet, where the raw salts occurred elsewhere, notably in the Kilpatrick District where there were geological similarities, every effort was made to exploit them. These salts were sold to the copperas makers at 15/- per ton,[21] but it was never the significant trade established elsewhere. Indeed the Macintosh enterprises took very definite steps to suppress any rivals.

Alum was useful for hardening tallow, also for degreasing printing equipment to help ink adher to the blocks. It also proved useful in the explosives trade, for wood and paper soaked in alum solution lost its flammability and could then be used to line gun powder containers. Alum could also be used in tanning and as an astringent in medecine. The contribution of alum to social technology was considerable.

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2.1 There was no standard formula for alum till 1935. The first steps towards a standard formula were taken in the mid 19th. century, with the formulation of Cannizzaro's system. Cannizzaro was Professor of Chemistry in Genoa from 1855 and in 1858 he published Sketch of a Course of Chemical Philosophy. This was a scheme for determining atomic and molecular weights, once the atomic weights of elements composing a compound and its molecular weight were known, its true formula, the number and kind of the atoms in its molecules, could be worked out. Cannizzaro's system was slowly adopted and standard formulae began to emerge. But in the case of alum no standard formula was immediately derived. In 1850, the potash alum formula was KO, SO^3 + Al^2 O^3 $3SO^3$ + 6Aq + 18 Aq. A new formula was derived as $Al_2 (SO_4)_3 + K_2SO_4 + 24H_2O$. Later the fact that the constituents were not simply mixed was recognised by writing the formula as $K_2SO_4Al_2(SO_4)_3.24\ H_2O$.

However some authors continued to use varied formulae and even up to the 1870s the formula could be seen as $K_2Al_2(SO_4)_4.24\ H_2O$ or as $KAl\ (SO_4)_2.12\ H_2O$. It was the case that no means of deciding could be found till the X-ray analysis of crystals developed. Thus with alum only in 1935 did Beaver and Lipton show that the two sulphates did not exist in the crystals as individuals and showed reasons, based on X-ray studies, for writing the formula as $KAl\ (SO_4)_2.12\ H_2O$.

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