

Structure, technology and demand in the Aberdeen granite quarrying industry, 1880-1914

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Although Scotland is rich in granite resources, most of these are located deep in distant highland glens, far from supplies of capital and labour, and, more importantly, from either immediate sources of demand or from transport to more distant markets. This explains why only the Aberdeenshire deposits of granite have been developed over a long period on a significant scale. The viability of a quarry was often determined not so much by its fertility as by its location, transport costs being the crucial variable in the industry's cost structure. For these reasons all the early nineteenth century workings such as Ferryhill, Rubislaw, Dancing Cairns and Scattie were clustered within eight miles of Aberdeen, while to the north of the county the quarries at Blackhill, Cairngall and Stirlinghill were all within easy reach of Peterhead harbour. The subsequent growth of demand, coupled with the exhaustion of some of the older workings, led to the frontier line of quarrying being pushed westwards from the city in search of new deposits. This would not have been possible economically had it not been firstly for the opening of the Inverurie canal in 1805 and secondly for expansion of the Great North of Scotland Railway into the Alford valley in the mid-nineteenth century, opening up Corennie and Tillyfourie. This however was as far as quarrying was to spread from the city. Taking a wider perspective, the Aberdeen granite quarries were after all only a small part of the British building industry as a whole. Nevertheless until the 1880s they produced a stream of natural stone which was used in all types of building work, including houses, public buildings, bridges, docks and harbours and road and street construction. Demand came from two main sources. The first was

the local north-east Scottish market where there were no other competitive building materials, and the second was England (especially London), which until the 1870s absorbed at least fifty per cent of the total annual output of marketable stone.

The last decades of the nineteenth century saw considerable change in the building industry as a whole. Apart from the growth of concentration, this sector of the economy became increasingly subject to cyclical fluctuations and experienced change and innovation in both construction materials and methods. From these Aberdeen granite was not immune. The building cycle was heavily influenced by the relationship between home and foreign investment, population growth, and migration, as well as changing levels of real income, all of which exercised a considerable impact on local demand. As a result by the middle 'nineties sixty-five per cent of stone output was being consumed in and around Aberdeen itself, thereby reversing the relationship between the Northern and Southern markets. In England, apart from cyclical influences, granite exports came under pressure both from alternative sources of supply and from innovations in construction methods involving iron, steel and concrete which reduced the demand for natural stone, lowering its use in many cases to a mere decorative frontage or cladding on public buildings. Bound up with this were changes in fashion among English architects who demanded polished rather than dressed slabs of stone for building fronts in a wider variety of colours than could be supplied by the Aberdeen quarrymasters. Most of this trade then fell into the hands of the city's granite manufacturers who began to specialise in this line of work using stone im-

ported from Northern Europe².

To meet the pressures of demand and of competitive change in the South, the quarrymasters responded by raising their levels of capitalisation, investing in new plant and equipment and increasing the number of operatives employed, especially in the late 1890s when the workings were deepening rapidly³. This article will concentrate on these structural and technical changes that occurred in the industry towards the close of the nineteenth century, and will also explore the various factors influencing the changing patterns of demand, as well as sources of capital and entrepreneurship.

The Aberdeen granite quarries

Precisely how many quarries were worked before 1895 (when the first official statistics appeared) is difficult to ascertain. William Diack, the industry's first historian, claimed that probably 150 quarries had been worked at various times between 1750 and 1939⁴, but it seems likely that between 1750 and 1914 no more than fifty sites were quarried intensively⁵. After the Report of the Royal Commission on Quarrying in 1893-94, the Department of Mines and Quarries published annual figures of the number of quarries worked in the county between 1895 and 1914; Table 1 distinguishes between those in private ownership and those controlled by the eight County Boards of Aberdeenshire. The total number of quarries worked rose to a peak in 1906 and declined thereafter, but it should be stressed that the downwards trend of those in private ownership began in 1900, while the number of County Board quarries trebled between 1895 and 1914. During the early 'nineties the County Boards (which were responsible for the maintenance of the roads and highways of Aberdeenshire) opened up small quarries at various places in the area where small quantities of poor quality granite were extracted for roadstone, thereby reducing demand for the private sector.

As the quarries of the North-East produced granites which varied in colour through from white to grey to pink and red, and which also differed significantly in quality and geological

content, a degree of market specialisation appears to have developed during the latter decades of the century. Three distinct groups emerged and yet all looked to the same staple outlets for setts, housebuilding stone, kerbstone and roadstone. The first group comprised the larger workings of Rubislaw, Kemnay, Dancing Cairns, Dyce, Scattie, Cairngall, Tillyfourie and Tom's Forest, the granites of which were also ideally suited for polishing and constructional engineering projects. The second group included quarries such as Clinterty, Hill O'Fare, Tyrebagger, Craignelow, Cairncry, Blackburn and Upper and Lower Persley which produced granites sufficiently inferior to those produced in the first to make them unsuitable for polishing, but well fitted for setts and common housebuilding stone. The third was the County Board Roadstone quarries⁶.

Overall trends in output show a close correlation with the changing pattern of demand. Between 1876 and 1895 production levels doubled before reaching their maximum in 1898, remained high in the following year and thus corresponded to the peak years in the local and national building cycles respectively. The subsequent drop in output is associated with the decline in housebuilding and also with falling exports of paving setts to Southern markets, and by 1914 the annual output of granite in the county was 48 per cent below the peak figure of 1898⁷. As one would anticipate output per quarry also rose during this period, but it is thought that this was concentrated primarily in the larger and better equipped workings. In 1865 Kemnay quarries were producing 25,000 to 28,000 of stone per annum, but by 1900 over 40,000 tons were being raised annually on Paradise Hill. The pattern at Rubislaw was similar. From 30,382 tons in 1873, output increased to 40,000 in 1890 and to 55,000 tons in 1896 and then to almost 60,000 annually at the end of the decade. Indeed, between them Rubislaw and Kemnay quarries accounted for nearly one third of total production during the boom years⁸. How much stone was produced elsewhere is not known, but as almost every establishment increased its labour force during the 'nineties

MAJOR GRANITE QUARRIES OF ABERDEENSHIRE

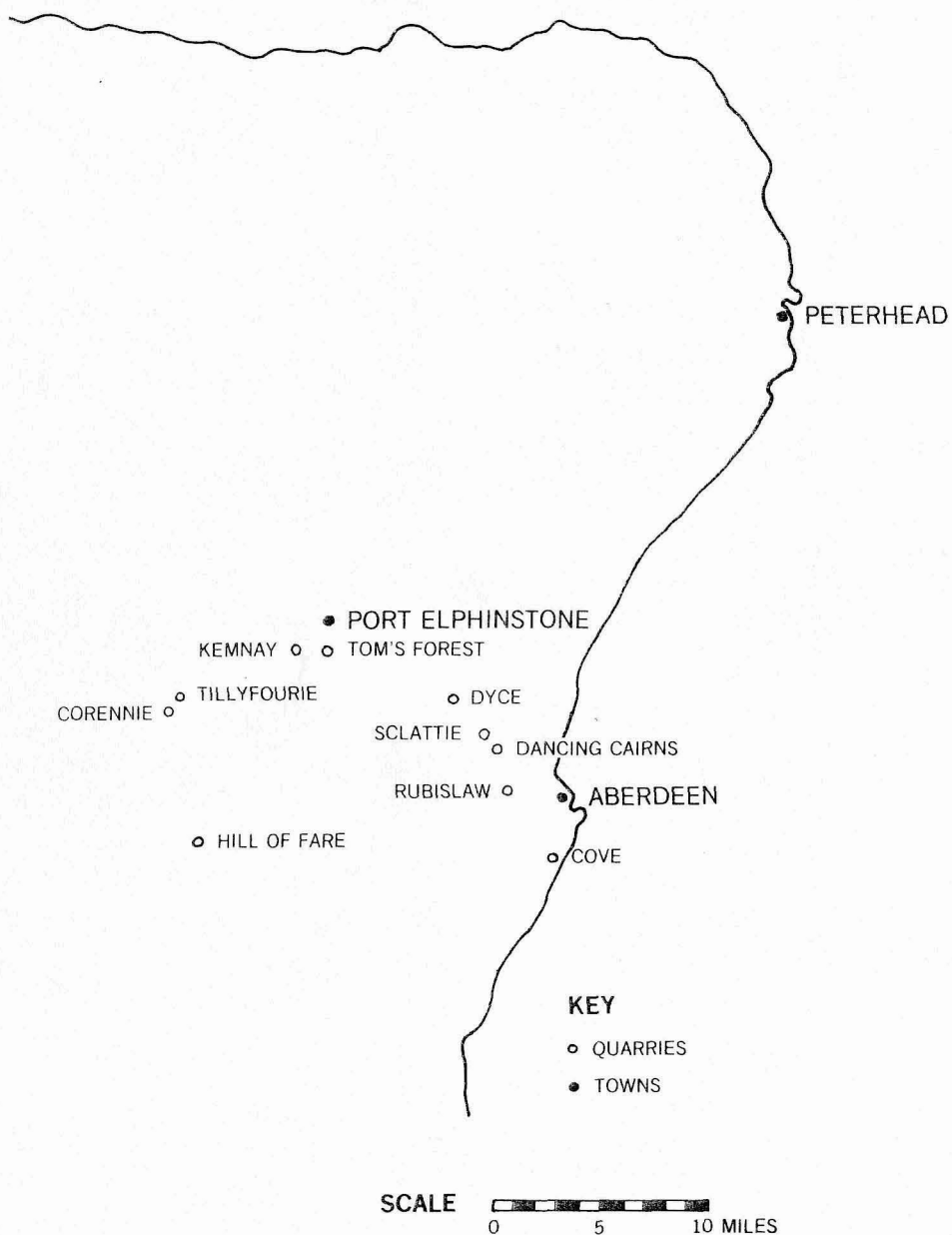


Table 1. The number of granite quarries worked in Aberdeenshire, 1895-1914

Year	Total number of quarries	County Board quarries	Privately owned quarries
1895	47	9	38
1896	47	9	38
1897	47	7	40
1898	45	7	38
1899	52	11	41
1900	55	11	44
1901	53	14	39
1902	53	12	41
1903	53	11	42
1904	52	17	35
1905	55	17	38
1906	60	18	42
1907	55	20	35
1908	54	21	33
1909	52	18	34
1910	50	18	32
1911	44	16	28
1912	51	21	30
1913	53	23	30

Source: Department of Mines and Quarries, *List of Quarries*, 1894-1914

Table 2. Output of Granite in Aberdeenshire, 1876-1914

Year	Output (Tons)	Year	Output (Tons)
1876	117,308	1904	301,205
1895	242,108	1905	248,620
1896	248,887	1906	230,311
1897	306,272	1907	177,248
1898	332,140	1908	148,1877
1899	328,789	1909	156,872
1900	295,949	1910	142,059
1901	287,407	1911	137,943
1902	298,356	1912	138,943
1903	301,205	1913	151,267
1904	293,956	1914	166,963

Source: Department of Mines and Quarries, Annual Reports of Inspectors of Mines and Quarries, 1895-1915

it is likely that this was reflected in rising output. However, with the subsequent contraction in demand after 1900 output per quarry was cut back considerably as men were laid off.

the 'nineties the average number of men per quarry was never above 40 and that only ten workings employed more than 60 operatives and of these, only five had a workforce more than a hundred strong. By 1914 only four

Table 3. Numbers employed in the Aberdeen granite quarries, 1881-1914

Year	Total number employed	Number employed in County Board Quarries	Number employed in private quarries
1881	988	—	—
1895	1,775	17	1,758
1896	1,883	47	1,836
1897	1,840	70	1,770
1898	1,959	31	1,928
1899	1,986	52	1,934
1900	2,181	41	2,140
1901	2,099	50	2,049
1902	2,067	72	1,995
1903	1,965	53	1,912
1904	2,058	65	1,993
1905	1,793	80	1,713
1906	1,641	92	1,549
1907	1,543	87	1,456
1908	1,349	91	1,258
1909	1,232	100	1,132
1911	1,286	76	1,210
1912	1,031	138	893
1913	895	102	793
1914	980	90	890

Source: Department of Mines and Quarries, *List of Quarries*, 1895-1914.

Production trends corresponded with fluctuations in the numbers employed in the industry. Again not until 1895 are accurate data available, and because of the seasonal nature of the industry any figures extracted from the decennial census can be taken only as a very rough indication of the strength of the workforce. Nevertheless the number of operatives rose markedly between 1881 and 1900 before falling thereafter, with the increases and subsequent lay-offs concentrated in the private sector. The distribution of the workforce as a whole was uneven. Crude averages show that during the boom years of

employed more than 60 men⁹. Trends in employment can be illustrated more clearly by examining the movements in the number of operatives employed in the larger workings. In 1873 William Gibb employed 71 men at Rubislaw, while John Fyfe had a workforce nearly 200 strong at Kemnay¹⁰. As demand for granite increased it was essential to attract more labour into the quarries, because although increased capital investment could raise crude output, all the working and dressing of stone at the quarry surface still had to be done by hand. Without such an increase there would have been a severe bottleneck in

the final production stages. Table 4, which covers four of the largest units in the industry shows that the peak years for employment occurred between 1899 and 1903 and that beginning with Rubislaw in 1899 the quarrymasters ran down their workforces in the face of contracting demand. Of the operatives the most vulnerable to unemployment were the surface workers, especially the masons and the sett makers, and it was among these two groups that most redundancies occurred before 1914¹¹.

increased to over two hundred and fifty feet. Similarly, the depth of Kemnay quarry increased from over two hundred to over three hundred feet; while at Rubislaw the pit deepened from approximately one hundred and fifty to well over two hundred feet between 1886 and the outbreak of the First World War¹².

Throughout our period the boring of the blast holes was done by a combination of hand, steam-powered and pneumatic drills. Steam-boring had been introduced in 1867 and

Table 4. Numbers employed in selected quarries, 1896-1914

Year	Rubislaw	Kemnay	Sclattie	Corrennie
1896	213	336	111	52
1897	227	360	103	64
1898	251	379	114	68
1899	246	386	119	80
1900	214	404	108	109
1901	193	389	104	140
1902	182	372	94	126
1903	182	356	119	127
1904	171	356	104	124
1905	156	337	105	61
1906	138	306	92	53
1907	105	260	84	39
1908	106	256	63	34
1909	98	206	56	32
1910	106	256	69	34
1911	104	230	67	46
1912	95	194	48	44
1913	91	197	62	41
1914	87	198	70	37

Source: Department of Mines and Quarries, *List of Quarries*, 1895-1914

Technology and investment

Though the basic techniques of quarrying changed little between 1880 and 1914, the increasing depth of the workings and demand pressure necessitated the introduction of more powerful drills and lifting devices. As previously, new parts of quarries were opened up to expose new joints and working faces, causing the workings to narrow as they deepened. As early as 1886 Sc lattie quarry was over 186ft deep, but by 1906 its depth had

represented a significant improvement on the slow, cumbersome hand drilling process, but in the middle-'nineties pneumatic drills were introduced into the larger concerns to boost output. According to Diack this 'marked an important stage in the history of reducing costs in the industry':

The power drill in the hands of a skilled operator could do the work of a drill squad of three men in one tenth of the

time ... To drill a hole 21 ft deep with a diameter of 3 ½ inches required only one full working day of ten hours with a pneumatic drill, whereas manually this would have constituted four days work¹³.

A major advantage of the pneumatic drill was that, unlike the water-cooled hand and steam drills, it was air-cooled and could be kept at a steady temperature and so there was no need to cease boring operations when the machine became too hot. The pneumatic though was heavy on drill bits which had to be changed in decreasing diameter sizes after each foot had been drilled¹⁴. Once brought down the granite was then split into smaller blocks so that it could be raised to the surface, but all improvements in production and productivity on the quarry floors would have been rendered totally ineffective had it not been for parallel development in raising stone to the loading banks. The problem of raising stone from increasing depths was not new, but by the late 'eighties it was becoming more acute in the larger workings¹⁵. To overcome this problem new and more powerful cranes and 'Blondins' were introduced. The latter, nicknamed after the famous tightrope walker, Charles Blondin, was basically a suspension cableway with a travelling carriage or skip and had been invented in 1872 by John Fyfe who erected one at his Kemnay quarries. The Blondin's prime advantage over cranes lay in its speed of operation. It could reach any part of a quarry from a fixed position and reduced the time taken for raising large blocks of stone from the deepest quarries to the loading banks from more than an hour to a matter of minutes¹⁶.

Despite the changes in technology that took place there were wide variations in investment patterns. For instance, there were marked differences between the Aberdeen-Alford valley quarries and those in the Peterhead area, and even within the former the experiences of the larger and smaller workings differed sharply. Evidence suggests that between 1880 and the turn of the century the bulk of investment took place in the Aberdeen-Alford workings, especially those

owned by John Fyfe, A. & F. Manuelle and William Gibb's Rubislaw Granite Company which between them accounted for just over sixty per cent of total output. In the early 'eighties, for example, Kemnay quarries had only two small Blondins, two small Scotch Steam Derricks and one floor crane, but by 1900 the small Blondins had been replaced with two larger ones with a lifting capacity of ten and 15 tons respectively. Two more Scotch Derricks and two new floor cranes had also been added and hand drilling had given way entirely to pneumatic drilling¹⁷. Likewise, Tillyfourie quarries were equipped by Fyfe in the early 'eighties with steam-borers and cranes, and Blondins and pneumatic drills were introduced in the following decade; and at Dancing Cairns and Sclettie quarries, both owned by the Manuelles, new cranes and Blondins were installed in the 'nineties and preparations were made to convert the quarry to electricity¹⁸. The Rubislaw Granite Company spent some £5,000 on new cranes, Blondins and drills between 1896 and 1899, making Rubislaw one of the best equipped workings in the industry¹⁹.

The incentives towards new investment in this first group of quarries were a mixture of physical necessity and the attraction of higher profits from greater efficiency. The increasing depth of the workings required new investment if they were to remain viable, but of more importance was the expansion of markets and the possibility of increased profits. Although there are no reliable figures for profitability in the industry as a whole, the annual profits of the Rubislaw Granite Company rose from £3,000 in 1890 to over £8,000 in 1899 before falling off again continuously to 1914, when they stood at a mere £1,710. Such meagre quantitative evidence is reinforced by the annual trade reports in the *Aberdeen Journal* and the *Daily Free Press* during the 'nineties when both publications emphasised that the profits made in the industry were significantly higher than those of the previous decades²⁰.

By contrast investment in the smaller quarries took place on a lesser scale. Quarries such as Persley, Cairncry, Sylavethie,

Birsemore, Blackburn, Clinterty and Kintore were not more than a hundred feet deep and could function adequately with small steam-derricks rather than Blondins, and it is significant that hand-drilling continued in many of these down to the First World War. They were usually owned by small building firms which had integrated backwards to secure supplies of building stone, and which rarely had sufficient spare funds to indulge in heavy investment. Furthermore, often these quarries were not worked on a continuous basis, but only when new supplies of stone were required. Thus the incentives for investment were much weaker in these than in the larger concerns²¹.

In Peterhead and its surrounding district there was little new investment in quarrying even during the halcyon days of the 'nineties and this can be explained by geological and market conditions. The jointing in the red granite areas were even more irregular than that of Aberdeen or Alford valley and so there was always the danger that what appeared to be attractive deposits would give out within a short space of time, making heavy investment in fixed capital highly speculative. This partially explains why the workings in the north of the county were much smaller than those of South Aberdeenshire. For example, both the Blackhill and Stirlinghill deposits were pitted with traces of small workings which quickly exhausted themselves and so from the 'eighties onwards no more than four quarries were worked intensively in the Buchan area.

The red granites were unsuitable for either roadstone or paving setts and consequently a great deal of unsaleable stone had to be quarried to extract the high quality building and polishing stone, thereby resulting in high costs of production; and despite its high quality the red stone never gained the popularity of the whites and greys in the market for polished stone. Lastly, although there was an increase in housebuilding in Peterhead at the close of the century, associated with the expansion of the fishing industry in the port, this was probably not of sufficient momentum to warrant heavy investment by the quar-

rymasters, since there was no competitive building material in the immediate vicinity²².

When the boom came to an end in the opening years of the present century the diffusion of technology in the industry was extremely uneven. For the most part, the larger quarries were better equipped than their smaller counterparts, but even in substantial workings such as Sclettie and Corrennie, which were among the most advanced, hand drills were still in use as late as 1914. The general impression is that new investment took place in a somewhat haphazard fashion, occurring only when absolutely essential for the continued viability of the workings and when profit levels permitted²³. The decline in output, markets and the numbers employed after 1900 was accompanied by a fall in investment, and not until the inter-war period was there any evidence of a reversal of the downwards trend. In 1907 the Rubislaw Granite Co. cancelled its plans to have the quarry converted to electric power, as well as its order for three new cranes, and at Sclettie seven years later a near similar decision was reached²⁴.

The investment that took place in the 'eighties and 'nineties led to a rise in efficiency levels in the industry, but it must be stressed that the yardsticks used to measure efficiency in quarrying are by no means precise. Given the paucity of available data all that can be offered is a discussion of the important role played by geological conditions and weather in determining the industry's efficiency, and an attempt to calculate crude productivity levels in terms of output per man per annum between 1895 and 1914. Because of the highly irregular jointing in the Aberdeenshire granite fields, geological conditions played a vital role in determining not only the viability of a quarry as a whole but of different parts of the same workings. For instance, at Rubislaw quarries the quality of the stone generally improved with depth, whereas in parts of Kemnay quarries, the quality deteriorated sharply with depth. This is well illustrated in a speech made by John Fyfe at a conference of sett-makers in 1902:

You all know that no ordinary quarry such as we have can pour out a continuous stream of stone as you can open a cock and pour out so much water, and you cannot say that you are going to turn out so much every day. That is impossible owing to the nature of our rock²⁵.

In addition to geological difficulties quarrying was also subservient to the vagaries of the weather. It was impossible to quarry systematically in heavy rain, snow and ice because of the obvious dangers to the operatives and therefore quarrying was often handicapped during the winter months. This gave the industry a seasonal nature. In spring extra casual labour was frequently taken on to boost production and perhaps offset the effects of a bad winter.

Despite such problems, Table 5 indicates that output per man rose significantly between 1895 and 1898 (the peak year for production in the industry) and then fell back almost steadily until 1912, when it increased again until 1914. Why there should have been such a marked recovery in the years immediately preceding the outbreak of war remains unclear; perhaps the closure of many of the smaller private workings and the growing concentration of production in the larger establishments after 1906 goes some way to explaining this, albeit inconclusively²⁶.

Demand: north and south

From the start the quarrymasters had been dependent upon two major sources of demand: the north east of Scotland, and England. As late as 1867 local commentators claimed that England, especially London, absorbed at least 50 per cent of the total output of granite. This high figure is at best a 'guestimate', and a reversal of this trend appears to have set in during the 'seventies; at any rate by 1895 the proportion of output exported south had fallen to around 16 per cent, leaving the local market the more dominant of the two²⁷.

After the near-total collapse of its textile industries in the late 1840s, Aberdeen's

Table 5: Annual per capita output in the Aberdeenshire granite quarries, 1895-1914

Year output (Tons)	Output per capita (Tons)
1895	136
1896	132
1897	166
1898	169
1899	166
1900	136
1901	137
1902	144
1903	153
1904	142
1905	139
1906	140
1907	114
1908	110
1909	127
1910	109
1911	107
1912	134
1913	169
1914	170

Source: Based upon Department of Mines and Quarries, *Annual Reports of the Inspectors of Mines and Quarries*, 1895-1915 and *List of Quarries*, 1895-1914

economy appears to have languished over the next two decades and it is not until 1880 that the pace of economic growth and development quickened. This is usually associated with the expansion of the White Fish industry in the port. Additionally, the numbers employed in agriculture both in Aberdeenshire and Kincardineshire were declining with a consequent drift of population to the city. As a result of these two factors and natural increase Aberdeen's population expanded markedly between 1871 and 1901, before slowing down in the decade 1901-1911. The relationship between building cycles and home and foreign investment, population growth, migration and income levels has been debated by Saul, Cairncross and Brinley

Table 6: Population of the City of Aberdeen, 1861-1911

Year	Total population	Intercensal increase	Natural increase	Net migration
1861	74,378	—	—	—
1871	88,884	14,506	9,297	5,209 +
1881	106,306	17,442	12,820	4,602 +
1891	124,943	18,637	14,989	3,648 +
1901	153,503	28,560	18,358	10,202 +
1911	163,891	10,338	19,728	9,486 —

Source: Decennial census, 1861-1911

Thomas and, although their respective views differ, the experience of Aberdeen corresponds roughly with national UK patterns of building activity²⁸. The rise in population appears to have put pressure on Aberdeen's housing stock as early as the 1880s when a very considerable demand for housing was reported. Local builders responded by constructing large blocks of tenement flats and a commercial shopping centre for the working class at the east end and centre of the city and also at Torry on the south bank of the Dee to meet the needs of the thriving fishing community. Attractive detached and semi-detached houses and up-market tenements were built for the growing middle class which was drifting westwards towards the more salubrious suburbs²⁹. Table 7 demonstrates that, apart from the early 'nineties the general trend in housebuilding between 1884 and 1899 was upwards, in line with national patterns. Immediately afterwards a decline ensued and by 1908 the building industry in the city was described as being 'very depressed'. Many houses in the city were lying empty; rents had fallen to a very low level and builders were having great difficulty in selling new houses³⁰.

Unfortunately the number of houses built is a poor indicator of the quantities of granite absorbed locally. Moreover, the word 'house' can be misleading in that it simply indicates one unit and can mean anything from a simple cottage to a large block of tenement flats. Nonetheless, since by far the greater propor-

tion of 'houses' built fell into the latter category the quantities of stone used must have been considerable. Indeed in the late 'nineties the local press claimed that the immediate market for housebuilding stone was consuming nearly 65 per cent of total quarry output and also noted with considerable satisfaction that Aberdeen itself had replaced the English market as the major source of demand³¹. This, however, was both short-lived and economically dangerous as it left the quarries too dependent upon local economic conditions. When the bottom fell out of the local housebuilding market, a sharp drop in demand for stone resulted and this was probably the most important cause of the depression in the industry between 1904 and 1914.

Aberdeen's urban and commercial expansion necessitated the opening of new streets and roads to keep pace with the spread of housebuilding and this led to the advent of electric tramway systems connecting the city centre with the outer suburbs, all of which increased demand for granite setts and kerbstones. In 1904, for example, the *Tramway and Railway World* commented on the opening of seven miles of new tramway in the city as follows:

The tramway tracks and margins of eighteen inches outside the rails were paved with granite setts, 6 inches by 4 inches and 6 inches by 3½ inches, procured from any of the local quarries, Kemnay, Dancing Cairns, Corrennie,

Table 7: Number of houses built in Aberdeen, 1887-1914

Year	Number of houses	Year	Number of houses
1884	178	1900	334
1885	157	1901	331
1886	187	1902	331
1887	208	1903	320
1888	243	1904	363
1889	245	1905	360
1890	250	1906	261
1891	170	1907	178
1892	143	1908	60
1893	189	1909	60
1894	238	1910	47
1895	254	1911	45
1896	409	1912	13
1897	407	1913	25
1898	429	1914	22
1899	450		

Source: Derived from *Annual Reports on Building in Aberdeen, Daily Free Press, and Aberdeen Journal, 1884-1914*

Cove and Rubislaw being the class most in use³².

But as with housebuilding stone, there is no way of knowing the quantities of stone involved. With the falling away of the housebuilding programme, demand for setts and kerbstone declined and by 1910 it had dwindled to insignificant proportions.

Top quality polishing stone never accounted for more than 10 per cent of total granite output. It was sold to the city's granite manufacturers who fashioned it into tombstones, plinths, statues and polished building fronts. Until the late 'seventies the quarrymasters were able to satisfy the demand made upon them in this end of the market, but with the rapid growth in manufacturing in the next decade it was soon evident that supply could not keep pace with demand. Indeed, as early as 1884 the *Daily Free Press* noted with concern that orders for polishing stone were often six months late in delivery. This was due less to any failure of entrepreneurship than to the gradual exhaustion of deposits of high quality, near-flawless stone. The difficulties fac-

ed by the quarrymasters can be illustrated by the experience of Heslop, Wilson and Co. In 1899 the firm was working a quarry at Longhaven in the Buchan area and was achieving moderate results in obtaining polished stone. Within a few months however the working had to be abandoned when they ran into a heavy band of flint running diagonally across the face of the stone, rendering it unsaleable. Operations were then moved to Aikey Brae and Hill O'Knock but both sites had to be abandoned quickly once the surface deposits gave out. Similarly, in a quarry in the Den O'Crichie the rock was exhausted unexpectedly when layers of sand were encountered. Finally, the company tried to quarry at Rora where a fine, close-grained bluish stone, eminently suitable for polishing was obtained, but after a short time this too proved disappointing because of an intrusion of quartz which made the granite economically useless except as a roadstone³³. The overall failure of local supply left the manufacturers with little alternative but to import from Northern Europe (mainly from

Table 8: Quantities of Granite Stone Shipped from Aberdeen Harbour, 1884-1913

Year	Setts (Tons)	Kerb, paving and building stone (Tons)	Roadstone (Tons)	Total (Tons)
1880	50,175	8,752	8,505	67,432
1881	30,013	7,925	14,132	52,070
1882	38,814	8,006	18,653	65,473
1883	39,693	11,686	17,579	69,958
1884	38,124	15,016	23,032	76,172
1885	24,926	12,120	21,190	58,236
1886	22,840	16,666	19,221	58,727
1887	27,757	17,364	17,765	62,868
1888	17,751	10,237	23,481	51,469
1889	23,809	5,427	15,787	44,993
1890	21,948	5,686	17,184	44,818
1891	25,029	5,898	13,575	44,502
1892	22,507	3,812	19,441	45,760
1893	17,436	3,840	27,723	48,999
1894	22,116	5,819	11,258	39,193
1895	22,052	3,992	12,976	39,020
1896	22,024	4,573	16,935	43,532
1897	31,043	4,236	11,217	46,496
1898	35,248	4,479	14,616	54,346
1899	39,948	4,633	11,180	54,761
1900	38,346	4,725	8,112	51,183
1901	35,214	8,226	11,594	55,034
1902	37,000	8,546	9,250	54,796
1903	41,401	5,915	6,312	53,638
1904	29,979	3,920	3,832	37,731
1905	31,367	6,501	9,453	47,321
1906	41,128	4,376	4,888	50,392
1907	25,698	4,715	4,264	34,677
1908	18,717	5,127	1,693	25,537
1909	38,781	5,705	570	44,056
1910	19,093	3,581	1,556	24,230
1911	19,607	4,322	5,336	29,265
1912	17,319	1,987	452	19,758
1913	19,404	1,297	738	21,439

Source: Aberdeen Harbour Board, *Abstract of Accounts, 1880-1914*

Sweden, Norway and Russia), and by 1910 more than 50 per cent of all the granite cut in the manufacturing yards was of foreign origin³⁴.

In contrast to the experience of the home market, exports to England followed a downwards trend throughout the entire period

and amounted to no more than 12 per cent of total output by 1914. This was the result both of the growth of alternative sources of supply in England, notably in Cornwall and Leicestershire, and of technical change and innovation in building technology. The most serious impact of the former was felt in the

sett trade, which was also affected by the building cycle. There is no explanation in the Aberdeen trade reports as to why exports of setts dropped so sharply in the 1880s and early 1890s. Professor Parry Lewis has pointed out that, at both of those particular times, the London building trades were extremely dull, especially during the depressions of 1884-87 and 1893, with no lasting upswing until the middle and later 'nineties. Since the greater proportion of setts exported went to London, it is likely that the fluctuations in shipments were a reflection of the level of cyclical activity in London. Similarly, when this fell after 1900 exports from Aberdeen moved sympathetically. A second factor influencing recovery in the sett trade and also slowing down the pace of decline after 1900 was the advent of electric tramway systems, which often involved the lifting of old setts and the laying of new ones. Certainly, the *Daily Free Press* believed that this source of demand had helped to maintain the overall level of sett exports between 1902 and 1906. After the latter date, however, this source of demand also diminished as towns completed their tramway building programmes³⁵.

Unlike the sett trade there was no cyclical pattern in exports of kerby, paving and building stone. Apart from a brief flurry of an inexplicable contra-cyclical nature in the mid-eighties the whole period was one of decline. Sales of building stone fell for several reasons. First, the traditional granite building stone exported south was of a high quality near-flawless type, but by the early eighties it was becoming increasingly difficult to obtain as the quarries deepened. Consequently, supplies became more and more erratic, and as unit costs were driven up so too were prices, making granite increasingly uncompetitive as a building material. Second, changes in building technology involving new techniques of using iron, steel and concrete had the long-term effect of cutting demand for natural stone as a load-bearing agent, reducing it in many cases to a mere decorative exterior cladding consisting of narrow strips or slabs of stone. Third, from the late 1880s onwards English architects

began to favour polished fronts in a much wider variety of colours than could be supplied by the Aberdeen quarrymaster. Consequently a significant proportion of this trade fell into the hands of the granite manufacturers who, taking advantage of the different varieties of stone from Northern Europe, built up specialist lines in this sector of the market, which was never regained by the quarrymasters. Likewise, the increased use of concrete and cement as alternatives for kerb and pavement-making destroyed the export trade in kerbs and paving slabs, while roadstone exports declined simply because former markets either developed their own source of supply or switched to using gravel. By 1914 almost all of Aberdeen's southern markets had been lost³⁶.

Entrepreneurship and capital

As in previous decades the main source of entrepreneurship and capital was north-east Scotland, and the industry continued to be dominated by the same three major concerns which had guided its fortunes since the middle of the nineteenth century, John Fyfe's, A. & F. Manuelle's and the Gibb's of Rubislaw. Beneath these came a motley collection of small building firms and the occasional granite manufacturer.

The Gibb family had quarried at Rubislaw since 1824 when John Gibb, the then resident engineer at Aberdeen Harbour, extended his quarrying operations from Dyce to the Rubislaw estate and by 1830 he exercised sole rights over all the workings there. After Gibb's death in 1850 the firm was run by his son Alexander until 1867, when his son William assumed control. Educated at the universities of Aberdeen and Berlin, William followed the policy of his predecessors in expanding and developing the workings so that by the close of the 'eighties the workforce was nearly 200 strong and output hovered at 40,000 tons per annum. By 1890 William's health was failing and he wanted to retire from active participation in quarrying, but not to relinquish his interest in the business. To achieve this end as well as raise further injections of capital for new investment he approached a

group of Aberdeen businessmen, Robert Wilson, an architect, Roderick McKay, a building contractor and Forbes Manson and Charles Christie, merchants, with a view to forming a limited company, the first in the industry. The new concern, known as the Rubislaw Granite Co. Ltd., had a share capital of £38,000, consisting of £20,000 in 10,000 seven per cent redeemable preference shares at £2 and of 9,000 ordinary shares also at £2 each. A further £22,000 was issued in debenture stock at £100, but redeemable at £105 at the discretion of the company. Gibb himself received by way of payment £3,494 in cash, £5,600 in debenture stock, £9,906 in preference shares and all the ordinary stock. The Gibb family connection was reinforced by William's two brothers Easton and Stegmann both of whom subscribed on a large scale to the company³⁷.

Of the other two mentioned firms, Fyfe's and Manuelle's, relatively little is known. The latter, a firm of London stone merchants, first came to Aberdeen in 1837, but their exact reasons for doing so remain unclear. It is possible that being stone merchants they may have been importing granite into the capital from Aberdeen and in order to control supplies, cut out middlemen and reduce costs, decided to integrate backwards and quarry on their own account. The venture obviously proved successful because besides working Dancing Cairns quarries they also worked at Dyce and Sclattie, becoming one of the largest employers in the industry. The firm flourished in Aberdeen for almost eighty years, but all attempts to find out more about it have failed³⁸. The only firm to rival the Gibbs was that of John Fyfe. Born in 1830 in Newhills, some eight miles from Aberdeen, Fyfe fell heir to his late father's small quarry at Tyrebagger when only sixteen years old, and, as noted earlier, also quarried at several other places in the county, earning for himself the title 'Granite King'. Taking all his workings together Fyfe was the largest employer in the industry with a workforce of over 500 at the close of the century. Of all the quarrymasters Fyfe was alone in integrating forward into granite manufacturing, but this

always remained ancillary to his quarrying activities. At the time of his death in 1907, when the firm was taken over by his sons Malcolm and John, Fyfe also held directorships in the Aberdeen Grit Co., the Aberdeen Lime Co. and the Town and County Bank, all of which enabled him to play a prominent part in local affairs in Aberdeen³⁹.

Builders and manufacturers entering quarrying were few in number, and in our period numbered no more than 18 at most. Pringle and Slessor, a firm of Aberdeen builders, worked the old quarries at Tyrebagger and Clinterty during the building boom of the 'nineties, while another city builder, George Hall, quarried on the Hill O' Fare and a third, James Leith, worked at Caircyr and Lower Persley. This integration was doubtless inspired by a desire to gain control over supplies of raw material and freedom from total dependence on the major quarrymasters in the area. Once the building boom ended, however, all the builders laid off workers and ran down their operation to a care and maintenance basis. Of the granite manufacturers only three integrated backwards, MacDonald Field and Co., Bower and Florence, and Charles McDonald and Co. The first of these, in addition to working a small quarry near Peterhead, quarried a part of Rubislaw between 1880 and 1890 at an annual rental of £300 with the proviso that all the building stone extracted was sold directly to Gibb, the polishing stone being retained for their own use. Similarly, for a short period in the 'nineties, Bower and Florence worked the small quarry of Sylavethie but then abandoned it. Finally, Charles McDonald's in a vain attempt to obtain fresh supplies of polishing stone opened a quarry at Scalloway in the Shetlands, but with McDonald's untimely death it was closed. Basically, backwards integration was unattractive to the great majority of manufacturers. Few of them had the necessary capital and preferred to use what funds they had to build up the fixed assets in their yards. Granites were subject to changes in fashion, especially those used for polished slabs in the building industry, and so commitment to any one quarry could have con-

stituted a considerable burden if and when its particular stone went out of fashion. Therefore manufacturers preferred to purchase their stone from a variety of sources, which gave them a wide choice of types and colours of granite. This choice was increased substantially by the introduction of foreign stone in the 'eighties'⁴⁰.

Conclusion

The last two decades of the nineteenth century saw the Aberdeen granite quarrying industry at its peak in terms of output and numbers employed, after which it embarked on the long decline that has characterised it since. The industry exhibited both the strengths and weaknesses of small extractive industries subject to derived demand and the vagaries of the building cycle. The resultant fluctuations in output and investment were intensified by the speculative nature of the quarries themselves, which were bedevilled by great unevenness in the quality of the rock even in the most prosperous workings. On the other hand, benefit was derived from the geographical proximity to Aberdeen and its expanding economy and also to the city's excellent coastal shipping services which provided access to more distant markets, even though these were of decreasing importance during this period. Despite the overall expansion between 1880 and 1900 there were no major technological advances in quarrying techniques other than the introduction of pneumatic drills, and generally the approach to capital investment was conservative and cautious, with investment occurring only when absolutely necessary for continued growth and output and when it could be financed from profits. This meant that new investment was confined mainly to the larger undertakings and that the quality and diffusion of innovation across the industry was very uneven. Even in moderate sized workings old and new equipment operated side by side. Socially the sources of entrepreneurship and capital were generated in north-east Scotland with very little finance coming from outside the environs of Aberdeen and its neighbouring county. Perhaps the best testa-

ment to the industry's success in the late nineteenth century lies in the magnificent late Victorian buildings that dominate Aberdeen itself, earning for it the unique title 'Granite City'.

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