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Chapter 13

Stone Quarrying

THE STONE industries include the quarrying, and to some extent also the dressing or milling, of all except precious and semi-precious stones. The principal kinds of stone produced in quantity are marble, granite, limestone, sandstone, basalt (or trap rock) and slate; some other varieties of less importance are reported by the Bureau of Mines under the heading "miscellaneous." The output of each of these varieties comes partly as dimension stone (i.e. shaped for building, paving or monumental work); and partly as crushed or nondimension stone. Quarries can mostly be classified either as dimension or as nondimension, according to the nature of their product. However, dimension basalt is practically a byproduct of crushed basalt, and we have therefore included it in the indexes for crushed stone; similarly, crushed marble and crushed slate (granules) are byproducts of the respective dimension stones, and have been included with the latter. The segregation of enterprises according to whether they produce dimension or crushed stone is admittedly far from perfect. A certain amount of crushed granite, limestone and sandstone comes from dimension quarries as well as from those we have classed as nondimension enterprises.

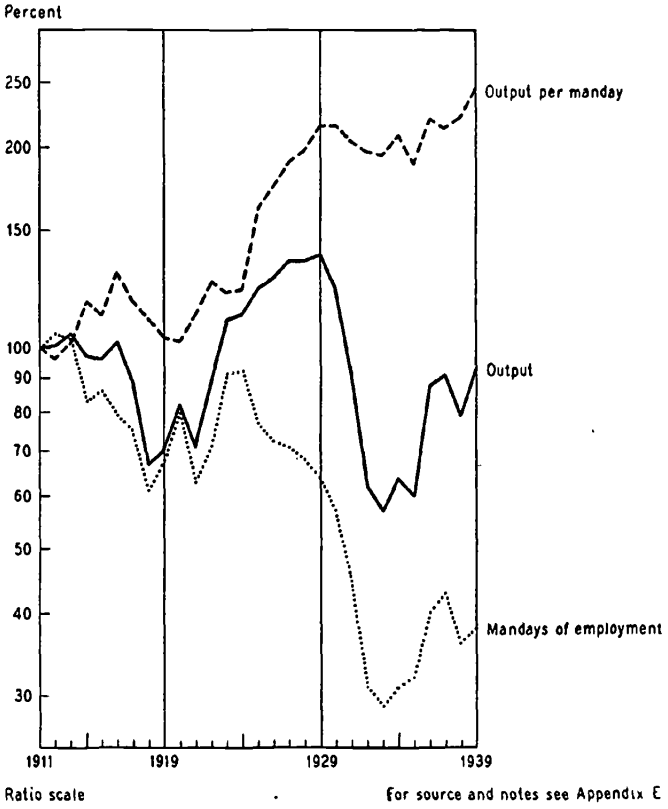
Much of the employment reported for the stone industries relates to dressing or milling, operations frequently carried on by the enterprises which perform the quarrying. Stone dressing, however, is an activity covered in some degree by the Census of Manufactures, and is therefore properly considered as manufacturing —a topic treated in other volumes published by the National Bureau.[1] Yet to isolate quarrying, and to exclude all manufacturing operations from our data, would be impracticable. For reasons given in Appendix C, where this question is discussed, we regard the milling of crushed stone as part of mining activity, but exclude dressing or other finishing operations applied to dimen-

[1] Solomon Fabricant, *The Output of Manufacturing Industries, 1899–1937* (1940) and *Employment in Manufacturing, 1899–1939: An Analysis of Its Relation to the Volume of Production* (1942).

sion stone. This practice has accordingly been followed. Further, the output of noncommercial crushed stone has been excluded from our indexes in this chapter, owing to the absence of data for employment in the enterprises which produce it.

Output data for dimension and crushed stone are available for all years since 1906; these were discussed in Chapter 2. We have figures for employment in the stone industries as a whole for the period since 1911; we can construct indexes of productivity only for years since that date. A segregation of employment between dimension and crushed stone enterprises can be made only for 1922 and later years. The material on output, employment and productivity is summarized in Charts 47, 48 and 49.

Chart 47
STONE QUARRYING
Output, Employment and Productivity, 1911–39
(1911 · 100)



For the stone industries as a whole, if the years 1911 and 1939 are compared, output fell from 100 to 93, and employment from 100 to 38; during this period output per manday rose from 100 to 245. If dimension stone and crushed stone are considered sep-

Chart 48
DIMENSION STONE QUARRIES
Output, Employment and Productivity, 1922 – 39
(1922 : 100)

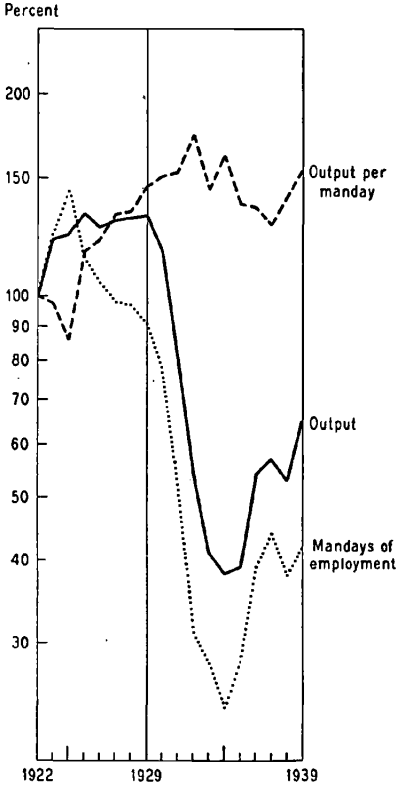
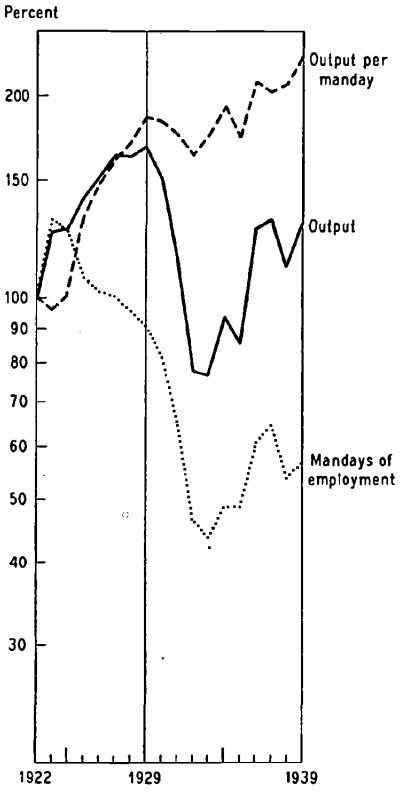


Chart 49
CRUSHED STONE QUARRIES
Output, Employment and Productivity, 1922 – 39
(1922 : 100)



For source and notes see Appendix E

arately for the period 1922 to 1939, the results are naturally less striking. When 1922 is regarded as the base year, figures for 1939 are as follows (1922:100):

	Output	*Employment*	*Output per Manday*
Dimension	65	42	154
Crushed	130	57	229
Total	105	54	195

Evidently the two branches of the stone industry exhibit very different tendencies. For reasons analyzed in Chapter 2, dimension stone output has declined, and crushed stone output has risen. It is not surprising, therefore, that since 1922 employment in dimension stone has fallen in relation to employment in crushed stone. Productivity rose rapidly, however, and an absolute decline in employment occurred in both branches of the industry. Neither in dimension nor in crushed stone was quarrying hindered appreciably by depletion of resources, but rates of technological change were quite dissimilar. As often happens, the form of enterprise whose output was expanding improved its techniques more rapidly than did the one whose output was contracting. The greater increase in productivity in crushed, as compared with dimension, stone is not difficult to explain.

As already noted in Chapter 6, numerous technological changes have occurred in the dimension stone industry. But the scale, and to a large extent the methods, upon which the industry is conducted, are determined by the peculiar character of the product. Building stone is relatively valuable in proportion to its weight, and much depends upon the quality of the output: color, size, grain and uniformity are all important. Excessive use of explosives in breaking the rock or carelessness in handling may easily damage the product. Moreover, orders are frequently filled on a custom basis. All these factors combine to limit the scale of operations and the degree of mechanization possible in the dimension stone industry. In crushed stone production, on the other hand, explosives may be used freely, and the scale of operations may be expanded with every increase in the capacity of loading and transportation equipment. Here, too, uniformity of product is important, but it can be secured conveniently and expeditiously through the use of suitable milling and screening equipment, even though large scale methods of quarrying have been adopted. Unlike dimension stone, the crushed stone industry has been able to take full advantage of the developments in the technique of open pit mining discussed at numerous points in this report.

The six industries to which we have devoted these chapters in Part Three do not exhaust the field of mining activity. But in

selecting them for discussion, we have been able to chart movements and observe tendencies with greater care than would have been possible had we attempted to give equal treatment to every industry listed in the Census of Mining. Instead, we have considered successively the coal industries, the petroleum industry, two important metal mining industries—iron and copper—and, finally, stone quarrying. This plan has enabled us on the one hand to notice many characteristics which are common in greater or less degree to all forms of mining, and on the other to isolate certain striking differences between different branches of extraction. First among the characteristics common to more than one type of mining enterprise may be listed the enormous superiority of open cut to underground methods of exploitation, wherever it has been found possible to introduce them. Another noteworthy feature is the growth in the scale of mineral enterprise, and its progressively greater mechanization. These changes have led to increasing specialization of function, both of workers and of equipment. Sometimes this specialization has occurred chiefly within the mine—as with the mechanized cutting, loading and transportation of soft coal. In other cases functions previously performed by miners have been transferred to surface preparation plants—as with the cleaning of coal and the concentration of metallic ores.

But the six industries to which we have given detailed consideration also exhibit significant differences, not least in regard to the role played by depletion of resources. Although all minerals are exhaustible, the degree to which depletion has added to the burdens of extraction, and so tended to depress the level of productivity, varies greatly from one industry to another. In relation to known reserves, rates of extraction are higher in the petroleum and natural gas industry than in any of the other five. Yet, owing to the peculiar resource conditions of this industry, depletion has so far had little if any effect in making oil and gas less accessible. In the other industries considered, the additional burdens which depletion has placed upon mining enterprise have corresponded in a rough way with the inroads so far made upon resources. We have seen that the mining of bituminous coal and of iron ore, and the quarrying of stone, have not—within the period considered—been seriously beset by greater difficulties of extraction. The production of anthracite coal and of copper ores, by contrast, has suffered from the effects of depletion, in the first case through greater in-

accessibility of deposits and in the second through declining grade of ore. Where, as in anthracite mining, the difficulty could not readily be overcome by changes in technology, productivity has risen but slowly; where, as in copper mining, the deterioration of resources was accompanied by a technological revolution, striking advances in productivity occurred.

In Chapter 14, which constitutes Part Four, it will be our task to tie some of these results together, and to place them in a somewhat wider setting. What evidence is there of the advent of diminishing returns in the American mineral industry? How are our results related to such problems of public policy as conservation and the tariff? What does the future hold for productivity levels, and for the volume of employment? It is with questions of this order that we shall occupy ourselves in the next and final chapter.