unworked owing to the friability of the coal." (Morgan, "Coal Resources of New Zealand," 1913, p. 19.) Much of the coal has been subjected to irregular folding and exhibits frequent faults.

(iv.) Amount of Coal Resources.

The amount of coal available for mining in the Dominion has been estimated by different authorities at various times. Professor Park estimates the total quantity of available coal at about 1,100,000,000 tons, after making the necessary deductions for losses due to faults, disturbances, and mining. This total is made up of—Bituminous, 254,500,000 tons; pitch-coal, 306,700,000 tons; brown coal, 520,889,000 tons.

Mr. P. G. Morgan, reviewing the available data (Coal Resources, p. 5), estimates the total of coal proved to exist at 1,001,000,000 tons, and the probable coal at 2,385,000,000 tons.

Table 2.—Estimate of Coal in New Zealand (Morgan).

Class of Coal.	Proved (Million Tons).	Probable (Million Tons).	Possible.
Anthracite	Very little	Very little	Small.
Bituminous	374*	477*	Moderate.
Semi-bituminous	114	341	Moderate.
Brown coal	234½	728	Large.
Lignites	278½	839	Large.

* "These quantities rest to some extent on over-optimistic assumptions, and ought to be reduced rather than increased, especially in view of the fact that much of the coal is unmineable." (Bulletin, No. 17, p. 43.)

No allowance has been made for loss in mining. "It is quite safe to say that not one-fourth of the coal in the ground is being mined under present methods. Even in the bituminous fields probably two-thirds of the coal in the areas actually being worked is not extracted, to say nothing of areas left unworked, owing to the coal being too friable to command an adequate market price" (p. 9). Within the seams actually mined in an area it is possible to win as much as 85 or 90 per cent. of the coal, as at Westport and Point Elizabeth, but that percentage does not represent the proportion mined over the whole lease, and in some cases even this percentage may be a very low figure, as low as 15 per cent.

Careful estimates of the amount of coal in the two most valuable fields—viz., the Grey field and the Westport field—have been made by the Geological Survey under the direction of Mr. P. G. Morgan. "The Grey Coalfield is estimated to contain 636,000,000 tons of coal, of which about 6,000,000 tons have already been mined, and a further 10,000,000 tons at least left as irrecoverable in worked areas. Of the remaining 620,000,000 tons, about one-fourth, or 150,000,000 tons, may be mined, provided that conditions as favourable as can reasonably be expected prevail in future. Under almost ideal future conditions possibly one-half, or 300,000,000 tons, may be recovered. These estimates assume that crushed coal will be profitably utilized in the future. The low possible percentage of profitable extraction is due mainly to faulting and irregular folding. The estimate of the quantity of coal in the ground, and of the amount that can be profitably extracted, is based on an interpretation of the field evidence as optimistic as is justifiable." (Bulletin No. 13, New Series, Geological Survey Branch, p. 127.)

(v.) Probable Duration of the Coal Resources.

The Director of the Geological Survey considers that the proved supplies of coal, more especially bituminous coal, are decidedly limited, and will approach exhaustion within one hundred years, or at most one hundred and fifty years from the present time. (Bulletin No. 17, p. 43.)

Writing of the bituminous coal to be found in the Westport district, he says, "The total amount of proved coal originally in the ground is estimated at 123,000,000 tons, of which about one-half, or 60,000,000 tons, may be considered extractable under present conditions, but of this 13,000,000 tons has already been mined, leaving only 47,000,000 tons as mineable. To the proved coal may be added a considerable amount of probable coal that may possibly be proved by boring to exist under the Westport flats and elsewhere. The whole situation, however, calls for the serious consideration of all interested in seeing that the far from inexhaustible coal resources of New Zealand are properly husbanded and utilized to the best advantage. In addition to bituminous coal, there are considerable quantities of brown and lignitic coal (in the district). The full extent of the areas containing these fields is not known at the present time." (Bulletin No. 17, New Series, p. 190.) The same authority calculates that if the present yearly production (1913) increases at the rate of 5 per cent. per annum until half the coal is exhausted, and then decreases in the same ratio until the coal is worked, half the proved bituminous coal "will be mined in a little over fifty-two years, and all in less than one hundred and five years. If probable coal is included, almost half will be mined in seventy-five years, and all within one hundred and fifty-one years." ("Coal Resources of New Zealand," p. 8.) He expresses the opinion in regard to the Westport supply that "if the leases are taken as a whole, then, unless present conditions alter very greatly, not more than one-half, or possibly little more than one-third, of the coal in the mining leases will be extracted before the mines reach the stage of commercial exhaustion. An immense amount of coal will then be irrecoverably locked up in the forms of roof and floor coal not mined from thick portions of the seams, of pillar-stumps, of friable coal not mined because there would be a loss in so doing, of small isolated blocks which could not be economically reached by the transport roads, of thin portions of the seams (which would, however, be considered as of workable thickness in Europe and in most parts of the United States), of somewhat dirty coal (which in various parts of the world would be gladly accepted as fuel), &c. In addition, a considerable amount of coal will have been consumed or ruined by underground fires" (p. 43). The brown and lignite coals constitute the chief fuel reserve, and "quite possibly will be mined in considerable quantity two hundred or even three hundred years hence."