pass beneath the Caversham sandstone, which is a tertiary marine formation, which is again overlaid by the volcanic rocks of the Dunedin basin, as shown in sections 2 and 3.

The lowest stratum of the coal measures, as seen on the west side of Saddle Hill, appears to be a thick conglomerate, on which the coal rests, and is worked by drives into the face of the hill at 400 feet above the sea level. There have been extensive landslips in the face of the hill, so that the exact sequence of the strata is not clear; but there are three distinct seams of 8, 4, and 3 feet thickness respectively, contained in clay shale, and covered by laminated sands with carbonaceous markings. The upper part of the hill, which is 1,560 feet altitude, is dolerite and basalt, the Caversham sandstone either being very thin, or not represented in the section on the west side. On the eastern slope, towards the sea, however, fossiliferous sandstone occurs over the coal.

From the north end of Saddle Hill the ridge of schist rock increases in altitude to form the Chain Hills, which are crossed by the main south road, and are to be tunnelled for the railway. Several collieries have been in operation since 1862 in this part of the field, close to the eastern boundary of the schist rocks, being the only place in New Zealand where coal mining has been carried on by deep shafts, as in England, all the other mines in the Colony being worked either by "free levels" or by "inclines." As at Saddle Hill, there are three principal seams, as shown in the following sections of two of the principal shafts:—

At Walton Park Colliery, where the shaft is 130 feet deep, the following strata were passed through:—

	Feet.
Sands, clays, and ferruginous gravels, of which no record was kept, and which belong to a recent tertiary formation	65
Bituminous shale and clay, with thin bands of coal	35
Upper Coal	7
Sandy clay and blind coal	12
Lower Coal	9
Bituminous shale...	1
Quartzose sand	2
Gray sandy clay	1½
Coal	2
Micaceous fire-clay	4
Sandy clay	15
At Doig's mine, which is situated more to the north, the section is as follows:—	
Surface clay, with boulders of volcanic rock, sand, gravel, and other recent formations	80
Resting unconformably on	
Coal	6
Mica shale	3
Coal	2
Grit	3
Coal	2
Mica shale	3
Coal	14

The Green Island coal varies a good deal in quality, but most of it is a lustrous brown coal when first extracted. From the depth of the mines, and the porous nature of the strata, it generally contains a much larger percentage of accidental water than the coal from the Clutha field, so that it cracks and breaks up into small fragments on exposure.

Following the line above indicated to the northward, the next outcrop known is in the Halfway Bush, but the coal there has the character of a bituminous shale, containing a large proportion of ash.

In the Water of Leith fragments of coal have been found which indicate that the seams in that direction has been altered by the igneous rocks. One specimen, stated to have been obtained in the Botanic Garden reserve, has the property of caking, which is quite exceptional even among the altered brown coals. (Laby. Rept., 1871, p. 14).

No seam has yet been found up the valley of the Water of Leith, so far as I am aware, but several have been recently reported at various points round the harbour. From information furnished me by Mr. Richard Evans, it appears that thin seams have been found, by explorations made under his direction, near Arden's Bay, and more recently coal has been found nearer to Port Chalmers.

The discovery of coal seams in this situation is extremely interesting, and might be of great economic importance, as, if they prove to have been altered by the overlying basaltic rocks in the same way that the brown coals have been altered under similar circumstances at the Malvern Hills in Canterbury, the coal might prove a valuable steam generator.

The average evaporative power of the Green Island and Saddle Hill coal is 5·02 lbs. of steam to each pound of coal, which agrees with the unaltered brown coals of the Malvern Hills; but the altered portion of the same seams at that place have an evaporative power as high as 8 to 9lbs, or equal to the best English coal.

In an early report on the brown coals, I pointed out that this improvement in the value of the coal by the expulsion of the water and the addition of a small percentage of bitumen, might be effected artificially.

If this process,—a modification of which has recently been brought into use for the supply of locomotives on the Italian railways,—were economically successful, it would render available, for the use of steamers and locomotives, the large deposits of brown coal which are found in nearly every part of New Zealand, and which, in the natural state, are only fit to generate steam for stationary engines.

I have, &c.,

The Under Secretary for Public Works, Wellington. James Hector.