

by the West Coast Road, and thence the line of fault follows along the valley of Coleridge Creek to the mountain pass leading into the Rakaia watershed. Between Coleridge Creek and the Broken River, along the western boundary of the low grounds and younger deposits of the Trelissick Basin, there is no very distinct indication of a fault-line, though such may be present; but from the Broken River to the Craigieburn Saddle there are distinct evidences of faulting on this, the north-western side of the basin. Between Blackball Creek and Craigieburn Saddle, this line is well marked on the mountain sides; and from the saddle along Coal Creek to Craigieburn Station, the coal-measures are seen to be deeply faulted and much crushed along the southern side of the fracture. In fact the small area here present could not have been preserved but for the measures being involved in the manner they have been by the action of faulting.

In the lower valley of the Broken River there is a second and smaller area of Cretaceo-tertiary coal-bearing rocks, which are separated from those of the Trelissick Basin by a narrow belt of old rocks connecting Mount Torlesse with Constitution Hill, on the northern side of the gorge of Broken River.

The older rocks underlying the younger series of the Trelissick Basin may be regarded as forming the axis of an anticlinal arrangement, the general dip in Mount Torlesse being to the south-east, and in the mountains on the north-west side of the basin in the opposite direction. Between the Cass and the Bealey the dip is generally to the eastward, while along the Bealey Valley the dip is again to the westward. The Upper Waimakariri, therefore, runs along a denuded anticlinal ridge, and the third great synclinal lies between this and the crest of the Southern Alps. As directed, I examined the western side of the second great syncline along the course of Bruce's Creek for fossils, in proof of the supposed age of the rocks there exposed, but only fragments of a fibrous shell and some very obscure plant remains were obtained. On Arthur's Pass the dip changes again to the eastward, and thence to the granite mountains flanking to the westward the lower slopes of the main chain, through a variety of rocks and different formations; the dip of the strata south of the Teremakau Valley is steadily to the eastward.

In the Malvern Hills, and on the north-eastern spur of Mount Torlesse, at the Cass, and again in the Upper Teremakau Valley, within three miles of the Hurunui Saddle, there are cherts, diorite sandstones, and diabase ash-beds, often highly calcareous and frequently associated with red jasperoid slates, which, in their different places, may be regarded as belonging to the same period of deposition, and as being unconformable and younger than the Maitai series, or Mount Torlesse formation, with which they are generally in contact. Red and green slates are also met with in the deposits belonging to the Maitai series, but the diabase ash-beds and more intensely ferruginous rocks are usually absent from this formation in the South Island. At the Cass these rocks are evidently unconformable to the bulk of those forming the Craigieburn Range, and the mountains between the Cass and the Bealey. And, in this relationship to the other rocks of the district, they appear to extend along the valley of the Hawdon and across Mount Whyte to the Upper Teremakau. When, in 1888, I had occasion to examine the Waiau-ua and the Hope Valleys, in connection with tracing the effects of the earthquake of September in that year, I was readily satisfied that the rocks along the Hope Valley to the junction of Kiwi Creek were of Triassic age, but there was great difficulty in determining the western boundary of that formation. The rocks of the Upper Hurunui, above Lake Sumner, have always been considered as of Palæozoic age, and not younger than the Maitai series; yet in the Upper Hope I passed considerably to the westward of Lake Sumner without convincing myself that I had reached on to Palæozoic formations. From the evidence collected during the present season, it would appear that in order to do so the main water-parting must be passed.

*Northern Part of Westland.*—The rocks of the higher part of the Southern Alps, from Arthur's Pass to the southern sources of the Hokitika River, are sandstones and slaty shales, scarcely differing from the rocks that, belonging to the older series, have already been described. On the top of Arthur's Pass grey or greenish gritty sandstones form a very compact rock, as the highest beds on the western side of the syncline, where this can be distinctly observed. Lower in the section are heavy beds of black mudstone or slaty shale, while farther down the Otira Gorge the same beds are repeated in thick or thinner alternations, the sandstones, however, usually predominating. Following the Otira north to its junction with the Teremakau, although continually passing from higher to lower rocks, the same alternations of sandstones and slaty shales continue to the junction with the Teremakau. But turning up Kelly's Creek, which runs more directly across the strike of the strata, dark splintery or flaggy slates are met with more abundantly than the interbedded sandstones, and it is evident that here a distinction can be made between two formations, or between the higher and lower parts of the same formation. So far as ascertained there is no stratigraphical unconformity; but a few obscure fossils collected by me in 1875, point to the conclusion that the Trias or Permian rocks of the upper part of the syncline have been passed, and that we have entered on a series that are the equivalents of the Mount Torlesse formation in Eastern Canterbury. These rocks continue into the Taipo Valley, and along Kelly's River and Taipo Range, till in their lower beds they begin to show evident signs of metamorphic influence. Their western boundary to the northward crosses the Teremakau River a little below the Otira Junction, and to the south-west it crosses the Taipo above the Seven-mile Creek, and the Arahura above the second gorge, and, passing along the western flanks of Mount Sale, is continued in the same general direction across the intervening mountains and the Hokitika Valley above the gorge, to the southern sources of that river.

Following the Teremakau Valley westward, the rocks of the Maitai series gradually pass into a series of sub-metamorphic strata, and these in turn into true mica-schists. The semi-metamorphic rocks may be considered as being of Upper Devonian age. They lithologically compare with the rocks of the Kurow Range in north-eastern Otago, and with the Walter and Cecil Peak series on the western side of Lake Wakatipu. A little before reaching Rocky Point, opposite the break in the mountains leading from the Teremakau Valley to Lake Brunner, the change to highly metamorphic rocks is complete; and thence to the valley of the Big Wainihinihini, draining the eastern slopes of Turiwhate and the western slopes of the Mica-schist Range, with the exception of a band of mag-nesian rocks of variable thickness, different varieties of schist alone are met with. The mica-schist