Between the 14th and the 24th December, work was confined to the low grounds, in the hope that after the new year the weather in the mountain region would improve. January and February are usually regarded as fine months for the purpose I had on hand; therefore, early in January a start was again made for the Upper or second Gorge of the Arahura River, but the weather proved no better than during the earlier part of the season, and much time was lost on this account. Up till 6th February, out of thirty-four days spent amongst the mountains, only four could be said to be other than wet days. The magnesian rocks and mineral belt which crosses the Arahura Valley about the middle of the second gorge is better explored on the north than on the south side of the river; as on the north side, if the river was at all high, there would be no escape by way of the mountains; and thus only once, and then at considerable risk, was this part examined. The chief explorations were on the south side of the valley as far as the Styx Saddle, leading from the Upper Arahura into the valley of the Browning River, along the western base of Mount Sale.

Subsequent to the 8th February I made examinations of the country north of the lower part of the Arahura Valley, including the valley of the Waimea River, and in the opposite direction the middle part of the Three-mile Creek; and from Kanieri Township, the Kanieri Valley to Kanieri Lake. The Kokatahi Plain, Hokitika Gorge, Rimu, Back Creek, and Ross were also visited. Also during the latter part of the season, examinations, mainly in connection with the classification of the various auriferous drifts, were made in the vicinity of Kumara, in the Greenstone Valley, and along the southern shore of Lake Brunner, and more to the north as far as New River and Marsden. I was thus occupied till the 12th March. In the meantime, my guide and assistant, Richard A. Harcourt, made another attempt to reach the mineral belt on the north side of the second gorge of the Arahura, and this time by crossing the mountains forming the Mica-schist Range east of Turiwhate and Island Hill. In this work he was accompanied by John Olderog, who also was with me during the early part of the season. The attempt failed, owing to the exceedingly rough and precipitous character of the mountains that had to be passed before reaching the line of the mineral belt. Finally, they were driven back by bad weather, but not before it was evidently impossible to reach the mineral belt by this route.

It was now quite evident that the season throughout was likely to prove unfavourable for prospecting the higher mountains towards the main water divide, and I determined to make no further attempt in that direction. It was necessary, however, that I should have some knowledge of the upper valley of the Teremakau, and between the 16th and 20th March this work was accomplished. On the 22nd I left the Kumara District, and, sailing from Greymouth on the 23rd, arrived at Wellington on the 25th March.

Physical Aspect and General Geological Structure of the District Examined.

District East of the Main Range.—The Provincial District of Canterbury, not including Westland, consists of the eastern slopes of the Southern Alps, and the lower grounds of the Canterbury Plain. Between the Rakaia and Waimakariri Valleys, rocks of Cretaceous age form the lower slopes of the Malvern Hills, and to the eastward disappear below the gravels of the alluvial plain. The lesser mountains of the Malvern Hills are formed of strata of Middle and Older Secondary date, while the Big Ben and Mount Torlesse Ranges, forming the outer portion of the truly mountainous district, are at least of Palæozoic age. The Mount Torlesse Range rises abruptly from the low grounds of the Waimakariri Valley to a height of 6,000ft. above sea-level. On its western side lies the Trelissic Basin, an oblong depression amongst the mountains, about nine miles in length, north and south, and about four miles in width, in an east and west direction. This has an average elevation of about 2,300ft. above the sea, and is filled with Tertiary and Young Secondary or Cretaceo-tertiary deposits and gravel accumulations of Post-tertiary date. It is drained by the Broken River, a tributary of the Waimakariri, and is surrounded on all sides by mountains, the higher parts of which are snow-clad during the greater part of the year. Between the Trelissick Basin and the Bealey Township, on the right bank of the Waimakariri, the road follows the lower grounds along the southern side of the valley; but in the direct line between Castle Hill and the Bealey high ranges intervene, drained by the Cass River and Bruce's Creek, tributaries of the Waimakariri. Very little is known of the geology of this particular part of the district. In the mountains north-west of the Trelissick Basin, and in the Craigieburn Range, the rocks are mostly grey sandstones and dark-coloured slaty shales, which, towards the east dip to the west, and west of the Cass River dip to the eastward. Green and red rocks, similar to those of the Selwyn Gorge and Flag-pole Hill, in the Malvern Hills, are met with at the Cass Crossing, and it is probable that both Mesozoic and Palæozoic strata are present in the mountains surrounding the sources of the Cass River. Along the Bealey River, by the valley of which Arthur's Pass is approached, the strata again dips to the westward, and are probably of the Old Secondary or Permian ages. From Springfield to the top of Arthur's Pass there are thus three great synclines, and two corresponding anticlines, the first and most easterly syncline being shown in the structural arrangement of the Mount Torlesse Range. On Porter's Pass the rocks are much crushed and disturbed, probably owing to the presence of the great Clarence Fault, which crosses the pass at the very saddle, and thence is continued to the southern end of Lake Lyndon. The evidences by displacement of the surface along the line of fault is so very clear that it cannot be but that the peculiar features formed by this action must have been noticed by the different geologists who previously examined the district; yet there is no reference in previous writings to these or their cause. In tracing the probable continuation of the great Clarence Fault in the line southward beyond the Marlborough District, the evidences of faulting on Porter's Pass were not known to me, and the connecting links more to the south-west indicated the theoretical line as passing along the north-western base of Mount Torlesse. As a matter of fact, a line of fault does run along the north-west base of Mount Torlesse, and roughly forms the boundary between the older rocks of Mount Torlesse and the younger Cretaceo-tertiary deposits of the Trelissick Basin; but this has not the general direction of the great Clarence Fault. From the lower valley of the Broken River it is traceable along the foot of the mountain range to the Porter River, where that is crossed