

rocks form a triple series, the lower of which is composed mainly of a dark wavy or contorted mica-schist, abounding in garnets. The facility with which this rock breaks up, and its easy transport along the water-channels of the district, or its yielding character when subjected to the grinding action of glacier-ice, has resulted in the production of a low valley between the mica schists generally and the next formation, of a gneissic and granitic character, to the westward.

The remarkable erosion of the lower schists from Bell Hill to Lake Kanieri is one of the most striking physical features of the northern part of Westland. The mica-schist rocks, forming a belt of rugged mountain country between the gneissic schists and granites to the west and the sandstone country to the east, extend throughout the length of the district. Separated from the other rocks of the district in the manner above described, the gneissic and granitic rocks form a line of isolated blocks of mountains along the western border of the mountain region, being cut through and thus isolated by the valleys of the greater rivers of the district. Firstly, in the north, between Lake Brunner and Bell Hill, by an ancient course of the Teremakau River; secondly, by the present course and valley of the Teremakau River, between the Greenstone Mountains and Turiwhate; thirdly, by the Kawhaka Saddle and a former course of the Arahura River between Turiwhate and Island Hill; and, fourthly, by the present valley of the Arahura, between Island Hill and the granite mountains surrounding Kanieri Lake. South-west of the Hokitika River the schists have not been cut down in the manner described, so as to form a transverse valley leading from the Hokitika Valley into that of the Upper Mikonui.

If not in the Upper Teremakau Valley, near the saddle leading into the Hurunui watershed, there are no rocks of Old Secondary age within the Westland District; on Arthur's Pass and along the crest of the Southern Alps the younger rocks being referred to the Permian period; while the mountains south of the Grey River opposite Brunnerton, and in the southern part of the district, forming Constitution Hill and Mount Greenland, are of Carboniferous date and belong to the Maitai series of the Geological Survey classification.

The young Secondary, Cretaceo-tertiary, or coal-bearing series, are chiefly developed in the northern part of the district immediately south of the Grey River. Small areas of the same rocks exist further south: near Lake Kanieri, at Camel-back Hill on the southern side of the Kokatahi Plain, and on the south side of the Hokitika Valley, and thence extend through the mountains into or almost into the Totara watershed. At Lake Kanieri these rocks are deeply involved; along the western boundary of the granite area, and in the Hokitika Valley, they form the tops of the ranges, the middle and lower parts of which are of granite.

Tertiary deposits, of Miocene date, form over the greater part of the low grounds of Westland the substrata over which have been accumulated the different auriferous drifts. In the northern part of the district they rest towards the west on the coal-bearing series, while towards the east they abut against the abrupt termination of the granite rocks. Along the course of the Kanieri and its tributaries they again rest on Cretaceo-tertiary rocks, or on rocks supposed to represent the Maitai series. On the western slopes of Constitution Hill, and thence to the south boundary of the district, the Miocene rocks rest on those of the Maitai series, forming Mount Greenland.

Although these Tertiary deposits are thus widely distributed as rocks, appearing at the surface, their area is comparatively limited, glacier morainic material covers them for the most part on the inland side of their development, while marine terrace gravels of younger Pliocene and recent date obscures them north of the Hokitika River along the coast-line. The strictly marine part of the formation, known on the coast as "blue bottom," is exposed chiefly in the cliffs and banks of the deeply excavated river-channels, while the higher part of what is probably the same sequence though perhaps of Pliocene date, known as "terrace" or "Old Man bottom," forms ridges of hills and low ranges in different parts of the district, and in the southern part attains to a considerable elevation above the sea.

Glacier morainic deposits in their original condition, or re-assorted by the action of rivers, covers a large part of the total area of the low grounds, more especially between the lower Hokitika and Totara Rivers. More towards the coast-line marine terraces with leads of auriferous black-sand cover a moderate area between the Lower Hokitika Valley and the mouth of the Teremakau River, and a narrow strip of country along the coast north of the Teremakau. Lastly, at yet lower levels, there are the black-sand beaches of the present coast-line, and the alluvial flats and lower terraces along the valleys of the larger rivers.

*Physical Characteristics of the Northern part of Westland.*—The northern boundary of Westland is the Grey River, from the sea to the junction of the Arnold, draining from Lake Brunner; and from the outlet of Lake Brunner a direct line to the Hurunui Pass at the source of the Teremakau.

The eastern boundary is the crest of the Southern Alps, and the southern boundary of the part under description is the Mikonui River, and the southern side of the Hokitika watershed in its upper part. The sea limits the district to the west.

The mountain region occupies from one-half to two-thirds of the distance from the crest of the main range to the sea; and within this the only flat lands, excepting the narrow valleys of the present rivers, is Bruce's Paddock, between the Teremakau River and Lake Brunner, and the valley of the south branch of Crooked River, which is connected with the larger area east of Lake Brunner, and the Old Lake Basin between Turiwhate and Island Hill to the north-west, and the Mount Tuhua Range, on the south side of the Arahura Valley.

The out-running spur-ranges from the main chain of mountains have no very definite order of arrangement, but generally have a nearly north direction. The mica-schist ranges, on the other hand, trend nearly parallel with the summit ridge of the main chain. This is due to the direction of the strike and the varying hardness of the different bands of rock in the mica-schist series. The general trend of the gneissic and granitic rock, and the physical features which they form, is conformable to those of the mica-schist country.

*Grey River System, Valley of the Arnold River.*—From the mouth of the Grey to the junction of the Arnold there are no important streams draining from the southern or Westland side of the watershed, Omotumotu Creek and the Waimea or Stillwater being streams of small volume,