

On the 21st February, after the disappointment attendant on not being able to cross into Canterbury by Stradbroke Pass, we left the Landsborough to return the way we had come by the McKerrow Glacier and Karangarua River. On the 23rd, after a trip in exceptionally bad weather, we reached Scott's Homestead safely. Next afternoon we left for the Hermitage, and, travelling by the route up the Copland River over Fitzgerald Pass into the valley of the Hooker Glacier, we arrived there on the evening of the 25th February.

The journey up the Copland is now easy, owing to the construction of a track up the valley and the bridging of Architect Creek, which once formed the most serious obstacle in the trip from Scott's to the Hermitage.

*General Geology.*—From a purely geological standpoint there is little of interest in the valleys of the Karangarua, Copland, Twain, and Landsborough. The solid rocks of the area are all metamorphic, and show a gradually decreasing metamorphism in passing from west to east. Thus, in the lower part of the Karangarua, the rocks show coarse mica-quartz schists—often garnetiferous—chlorite and biotite amphibole schists, and various other crystalline schists; while in the upper reaches of the river the rocks are phyllites and schistose grauwackes, often containing lenses and ribs of quartz. The gradation from highly metamorphic strata to less metamorphosed is gradual and not abrupt. However, the highly crystalline schists may be said to have practically ceased at the mouth of the Troyte. A few miles below the Troyte, greenish serpentinous schists appear as huge erratics in the river-bed, and the solid rock is evidently exposed on the southern slopes of the lofty ridge between the Karangarua and the Twain. In the Karangarua the rocks strike in general about  $20^{\circ}$  west of north, but variations from  $41^{\circ}$  west of north to  $30^{\circ}$  east of north occur.

In the Twain-Douglas Valley the rocks, so far as seen in the limited investigation made, are practically identical with those in the Karangarua. Epidote schists and serpentinous schists, containing idiomorphic crystals of magnetite and of pyrite, are exposed on the northern side of the Douglas Glacier, just below the great ice-fall.

In the Copland Valley the solid rocks are also similar to those of the Karangarua. The remarkable hot springs, depositing brownish sinters, occurring in this valley were described in my last annual report.

Along the McKerrow Glacier and in the Upper Landsborough Valley, which are in the less metamorphosed portion of the area under consideration, phyllites and schistose grauwackes are mainly in evidence.

Heavy morainic débris, both relatively ancient and modern, is visible in all the valleys, being especially conspicuous in the Douglas-Twain Valley and in the McKerrow-Landsborough Valley.

From an economic standpoint the area under consideration presents few features of interest. In the Upper Karangarua, along the McKerrow Glacier, and near Fitzgerald Flat, small veins appear in the schistose grauwackes and phyllites. Most of them are composed of very hungry quartz, though some are slightly rusty owing to the oxidation of pyrite. Samples were taken from several of the most promising veins, but the assays showed merely traces of the precious metals or none at all. A sample from a vein in friable phyllites and schistose grauwackes, which strike at  $56^{\circ}$  and dip south-east, occurring at the prominent rock buttress on the north side of Fitzgerald Flat, was found to contain no gold, but 3 dwt. 3 gr. of silver per ton.

In the past alluvial gold has been mined in the lower part of the Landsborough River, but careful prospecting in the upper part of the stream failed to reveal any of that metal.

*Physiography.*—It is from a physiographic and scenic standpoint that the area between the Karangarua and the Landsborough rivers presents most interest. The main part of the Karangarua Valley may be considered as the portion occurring between the mouth and the great bend at the Cataracts, some sixteen miles up the stream. The Copland Valley, the Twain-Douglas Valley, and the Upper Karangarua Valley, which are nearly parallel, may be described as the principal branches of this main trunk. Of the three streams occupying these valleys the Copland is undoubtedly the largest, while the other two are of approximately equal volumes. Regina Creek, which enters the Karangarua just south of the Twain, is a fair-sized stream, and, as judged by the width of its U-shaped valley, it formerly contained a large glacier. Since, however, it was not visited in the present reconnaissance, it cannot be further described in this report.

The Copland River, which rises in the Marchant Glacier, near Fitzgerald Pass, was briefly described in the last annual report of the Geological Survey. It has a long straight valley, exhibiting strongly the influence of past glaciation.

The Twain-Douglas Valley contains not only the Twain River and the Douglas Glacier, but also Fitzgerald Glacier. The latter was formerly directly connected with the Douglas Glacier in one continuous ice-river, but now Fitzgerald Flat, through which meanders the small stream of the same name, separates the two features.

The Twain-Douglas Valley is remarkably straight. The prominent knob close to the Karangarua, known as Conical Hill, which sentinels the ridge between the Twain River and Regina Creek, can be clearly seen from a point on Fitzgerald Flat near the frontal face of the Fitzgerald Glacier. The valley is relatively broad and U-shaped, and shows very abruptly truncated spurs on either side. Precipices are pronounced and decided on both sides of the valley. Over these precipices small streams, generally rising in small ice-blocks, in places leap hundreds of feet into the valley beneath.

Fitzgerald Glacier is formed by the consolidation of the ice, which descends into a spacious cirque from many small glaciers perched at high altitudes on the main alpine divide. The glacier, which is about two miles long, is well shrouded in moraine, especially near its frontal face.