

banks of the river at the junction of the creek; nor are the quartz drifts seen on the opposite south-east bank of the river; but they can scarcely fail to be present as shown in the section. In this connection it is somewhat remarkable that the banks of the river have been worked to a considerable extent at and below the point where the quartz drift is supposed to cross to the left bank, while higher up, to the foot of the gorge, there have been scarcely any workings—at least, in the higher banks of the river.

At Bald Hill Flat the sections of the quartz drifts show no peculiar feature, and at Butcher's Gully, where they are deeply involved, they are so in the manner that appears along the south side of Conroy's Gully. The position of the drifts at the latter place is represented in Fig. 23: A, Conroy's Gully; 1, schists; 5, older quartz drifts.

At Bannockburn the general section from Quartzville east to the slopes of Cairnmuir Range is as shown in Fig. 24: A, Cairnmuir Range; B, Bannock Burn; C, Lower Flat, Bannockburn; D, Upper Flat; E, Carrick Range; 1, schist rock; 5, older quartz drifts; 5a, clays, lignite, and quartz drifts overlying 5; 10, "Maori bottom"; 12, Recent.

From the Bannockburn the line of highly-tilted strata runs north-east along the base of the Mount Pisa Range, but, being for the most part covered by gravels of more recent date, no important exposures of the quartz drifts are seen north-east of the Kawarau Gorge.

The section from Mount Pisa through Mount Criffel to the lower part of the Cardrona Valley shows the quartz drifts on both sides of Luggate Creek somewhat as rendered in Fig. 25: 1, schist rocks; 5, older quartz drifts; 9, newer quartz drifts and breccia conglomerate; 10, "Maori bottom" (sandstone gravels), with clays and thin seams of lignite at the base; 12, Recent.

These sketches will serve to show the manner of occurrence of the marine and fresh-water quartz drifts throughout the district examined, and will make it abundantly clear that, whether old sea-beach or lake-margin be sought for, these are difficult of recognition, and, when found, in nothing do they indicate the limits of the sea or the extent and outlines of the ancient lake-basins in which the beds were laid down.

*Newer Breccias and Newer Quartz Drifts.*—The deposit of the breccia conglomerates, marine and fresh-water quartz drifts, may have been in progress contemporaneously. Even the overlap of the fresh-water beds from the Manuherikia and Ida Burn Valleys into the Maniototo Basin does not imply more than a slight elevation of the land and the formation of low-lying lakes, where once the sea had been; but it is evident that prior to the production of the newer breccias and quartz drifts considerable elevation of the land had taken place. The deposits under this head must be considered as of Upper Miocene age, since they are intimately connected with the sandstone conglomerates that close the Miocene or form the earlier deposits of the Pliocene period in this part of New Zealand. At Tinker's and Drybread it is not everywhere quite clear which of the two—the newer breccias and quartz drifts, or the sandstones of the "Maori bottom"—are the older. On Criffel Face there is no doubt that the "Maori bottom" conglomerate is the superior rock; and this must be taken to be the general relation of the beds. The beds are found only at Drybread, Tinker's, and along Criffel Face, from Mount Barker to the Cardrona Township; but with these have been included the quartz drifts of the Upper Waipori, not that there is any certainty that these latter are of the age of the beds at the other localities mentioned, but mainly as a matter of convenience.

Fig. 26 shows the arrangement of the beds at Drybread, in the Manuherikia Valley: A, Pipe-line spur, Dunstan Mountains; B, Drybread Flat; 9, strong bands of quartz drift and breccia conglomerates; 9a, bands of clay alternating with 9; 10, "Maori bottom"; 12, Recent.

The beds 9 contain washed and well-rounded boulders, derived from the cement bands in the older quartz drifts present *in situ* at St. Bathans, German Hill, Marion Burn, and elsewhere. The beds have a good deal of subangular or partly-rounded schistose material mixed with the quartz gravel. The lower beds of quartz drift, close to the fault-line F, are composed mainly of pure quartz.

There is no doubt that the beds are present along the foot of the range as far as Tinker's; but recent gravels at Thompson's Creek break their continuity as a surface exposure. They however reappear in the Sugar-pot, the Wild Duck, and in Ewing's and in McConochie's claim at Tinker's, and continue in the same line as far as the Devonshire Diggings. See Fig. 27: Section across the gold-workings in Ewing's and McConochie's claim, Tinker's, Manuherikia Valley: A, Dunstan Mountains; B, terrace between Tinker's Township and the claims; 1, schist; 9, breccia conglomerates and newer quartz drifts; 10, "Maori bottom" (sandstone conglomerate); 12, Recent; 13, slip-deposit or wreckage of the spur, due to working of the claim.

At the Devonshire Diggings, where also the slaty breccias are seen to underlie the surface-shingle, no clear section or contact with the older rock is exposed.

Whether any of the rocks of the Nevis Valley belong to the series under consideration is uncertain; but the bulk of the quartz drifts, &c., there belong to the older series.

In the Cardrona Valley the whole line of the involved rocks on Criffel Face belong to this division. At the south-west end of Criffel Face, where three or four claims are being prospected, the beds appear in section, as in Fig. 28: A, slopes of Criffel Face; B, Cardrona Valley; C, slopes of Mount Cardrona; 1, schist rock; 9, newer breccia conglomerate and quartz drift; 10, "Maori bottom" (sandstone conglomerate); 12, Recent. Throughout the sections illustrating this report, F indicates faults, and inversions of younger beds in contact with the older rocks.

*"Maori Bottom" (Sandstone Gravels).*—These, as has been shown in the preceding sections, are, at places, involved with the younger breccias and quartz drifts, and therefore have to be considered in connection with deep alluvial mining in Otago. They are worked for gold at the Upper Kyeburn, and have been at Tinker's, though the workings there are now abandoned. They have also been worked in the west side of the Cardrona Valley, below the township, and largely at Switzer's, the greater part of the gold obtained from the higher levels at Switzer's having come from the sandstone gravels of the "Maori bottom." The beds *f*, old lake-margins, and *g*, recent alluviums, also *h*, sea-beach deposits, require no special description in this section.