

*Newer or Fresh-water Series of Quartz Drifts.*—These are found throughout the areas regarded as forming the old lake-basins of central Otago, but the deposits to be described have not been deposited in lake-basins the outlines of which can now be traced. During Pliocene times extensive lakes did exist, filling the valleys of the Upper Taieri, Ida Burn, and Manuherikia, and from the junction of the Manuherikia extending down the Molyneux Valley probably as far as the vicinity of Bald Hill Flat. At the same time, above the Dunstan Gorge a very extensive lake, the waters of which stood at a height of 1,600ft. above the present level of Lake Wanaka, occupied the low grounds of the watershed, and extended up the Lindis and Cardrona Valleys, and further mountain-valleys, as far as then excavated. The deposits in and around the margins of these lake-basins are still in a horizontal position, and the old shore-lines can be traced with tolerable accuracy. It is, however, different with the lake-basins of Miocene times. The boundaries of these can no longer be traced, and their marginal deposits are now to be found at all elevations from 400ft. to 4,000ft. above sea-level.

The quartz-drift deposits in the Wether Burn, and thence extending north into the Ida Burn watershed, form the southern end of a long line of deposits that dip to the east, and are suddenly brought to a close along the foot of Mount Ida and the Hawkdun Mountains. This line of drift has not yet been proved to be payable, except it may be in Gorge Creek, where a party are now at work; but at several places the beds are of interest as illustrating movements that have affected the formation, and also as to the character of the strata.

On the north side of Marion Burn heavy beds of quartz cement stone, such as have been described as being fine quartz sand or grit, cemented into a hard flinty rock, cover the top and south-east side of a low hill; clays and loose quartz drifts underlying. A portion of this sheet of cement stone is still undisturbed, and this is therefore the most easterly example of the occurrence of this rock *in situ*. See Fig. 16: A, Hawkdun Home Hills; B, Marion Burn; C, western slope of the Hawkdun Range; 2, Devonian or Carboniferous rocks; 5, older quartz drift; 5a, white clays and beds of hardened quartz sand forming cement stone.

Some prospecting has been done in beds 5 on both sides of Marion Burn, and a little gold obtained, but not sufficient to warrant the further working of the quartz drifts at this place. At Macdonald's Hut, four miles further north, the beds are standing nearly vertical, and at one place where a little gold was found some work has been done, but this also did not give encouraging results. Close to Macdonald's Hut, on the northern side of the creek, an opening has been made in the lignite-seam, showing that here the beds are standing vertical.

Further along the line of the Mount Ida Water-race the dip of the beds is at lower angles, sometimes nearly horizontal, but the general tendency of the younger strata is to dip towards the high range, and suddenly to terminate at or close to the foot of the range.

At Hill's Creek, and the Woolshed, Blackstone Hill, the quartz drifts are greatly disturbed, and dip at high angles towards the range. Near the road-line, on the saddle leading to the Manuherikia, the grits are partially pushed under the older rocks, and as vertical beds appear, striking at right-angles to the line of fracture, and the west boundary of the old rock.

The beds at German Hill and at Black's No. 3 have been sufficiently described by Mr. Park. Sectionally the quartz drifts at the two places would appear to be connected, and underlie the superficial deposits of this part of Pool-Burn Valley; but this is a matter of no practical importance at the present time.

At St. Bathans the section across the southern end of the basin shows the quartz drifts as having but a narrow exposure, as shown in section. See Fig. 17: A, St. Bathans; B, Dunstan Creek; 1, schist rock; 2, Devonian or Carboniferous; 5, quartz drift; 10, "Maori bottom."

Fig. 18 shows the section across the middle part of St. Bathans's Basin, in which line, 2 represents the Devonian rocks of St. Bathans's Spur, 5 the older quartz drifts below the leaf-bed. It is from this horizon that the greater amount of gold won has been obtained; 5a represents the leaf-bed and numerous alternations of grit-bands and beds of white clay; 10, "Maori bottom."

Fig. 19 represents the section across the north-western outlet of St. Bathans's Basin: A, sludge-channel leading to Dunstan Creek; 2, Devonian rocks belonging to the Te Anau series; 5, the older quartz drifts; 5a, white or greenish marly clays; 10, "Maori bottom," consisting of sandstone gravels; 12, Recent. There are no indications of the presence of a fault in the St. Bathans's Basin, but the beds dip at different angles and in different directions in the opposite ends of the area occupied by the quartz drifts.

At Vinegar Hill the beds are unquestionably the same as those exposed in the St. Bathans's Basin, but the sandstone gravels forming the western rim of the basin are absent, and a thick deposit of clearly stratified greenish marly clay forms the highest beds in the sequence of the auriferous quartz drifts.

Fig. 20 illustrates the section from the higher part of Vinegar Hill in a line north-west to the lower slope of the Dunstan Mountains: A, Vinegar Hill; B, slopes of the Dunstan Mountains; 1, schist rock; 5, older quartz drift; 5a, greenish marly clay; 12, Recent.

More to the eastward the section, along a parallel line, Fig. 21, shows an increased thickness of auriferous quartz drifts: A, Vinegar Hill; B, Dunstan Mountains; 1, schist rock; 5, older quartz drifts; 5a, greenish marly clays; 12, Recent.

The beds at Vinegar Hill extend south-west along the base of the Dunstan Mountains, but have not been worked beyond the watershed of Cambrian's. As already explained, more to the south-west, younger terrace gravels reach back to the foot of the range, and so hide the quartz drifts from observation.

In the Molyneux Valley quartz drifts of this age occur at Coal Creek, where the north-west part of section, see Fig. 22, is clearly exposed: A, Molyneux River; 1, schist rock; 5, older quartz drifts; 5a, clays overlying lignite.

There are no gold-workings in the quartz drifts at Coal Creek, or where they appear on the