Gold is distributed thinly through the quartz drifts, but the Kildare lead, which is a gravel typically from 3 ft. to 8 ft. thick, traceable for 900 ft., or more, is very rich, and gives prospects equal to an ounce of gold or more per cubic yard. In places the gold content is probably several ounces per cubic yard. For 150 ft. or more (180 ft.) below the original surface the Kildare lead and the adjoining quartz drifts have been worked by hydraulic sluicing and elevating, and an enormous hollow, "glory hole," or "gorge," has thus been formed.

Lately the St. Bathans Gold-mining Company has been formed in order to work the Kildare lead at deeper levels by ordinary mining methods. To this end the company has sunk a main shaft west of the "glory hole" to a depth of about 120 ft., but here quicksand caused difficulty, and work on the shaft was suspended. An adit driven from the bottom of the "glory hole" towards the line of the shaft encountered quicksand also. A small shaft was sunk to a depth of 52 ft. or 53 ft. at a point near the bottom of the "glory hole" and north of the Kildare lead. From it at 50 ft. down a level was driven south-eastward, and from this crosscuts towards the Kildare lead were driven. Running sand was encountered close to the lead, but this was ultimately tapped and gave a rich prospect, said to be equal to 2 oz. per cubic yard.

Several of the sandy layers in the St. Bathans quartz drifts have thus been found to have the properties of quicksands, and therefore the exploitation of the Kildare lead becomes a problem of great difficulty. These sands, if dry, stand up well, but if wet have undesirable physical properties. On examination they are found to consist of small angular particles of quartz, mixed with a large proportion of very fine particles. When dry, a sample of these sands, owing to the so-called force of adhesion between its particles, is comparatively firm and solid, but on being wetted it becomes a slippery, greasy, and mudlike wet sand. To some extent the coarser beds in the quartz drifts, owing to their containing much fine sand, when wet behave similarly, but they are not likely to cause much trouble to the miner.

The successful working of the Kildare lead below drainage level, and probably of similar deposits elsewhere in Otago, depends upon the successful draining of the auriferous leads in advance of actual mining. The problem thus presented will have to be solved by special methods of working.

The Kildare lead consists of a gravel with many well-rounded quartz pebbles larger than those ordinarily found in the quartz drifts: there is also much sand, formed almost wholly of angular and subangular quartz particles. Numerous small grains of dull-coloured pyrite or marcasite are present. Examination of the sand under the microscope shows that tourmaline and monazite occur, but only in very small amount. Zircon seems to be absent. Tourmaline was found also in the sand layer that occurs at the mouth of the adit driven from the "glory hole" towards the main shaft. The gold in the Kildare lead is mainly in somewhat large, heavy "colours," and forms what is termed a "good sample." The St. Bathans gold is nearly free from impurities, and accordingly is worth more than the gold from most other Otago localities.

## 8. MURCHISON DISTRICT, NELSON.

(By P. G. Morgan.)

In accordance with instructions I visited Murchison on the 19th and 20th May, 1926, in order to make a general examination of the district with a view to obtaining some idea of its oil possibilities. Mr. J. F. Downey, Inspector of Mines at Reefton, kindly accompanied me, and took me to many points of interest in his motor-car. Thus I was able to see more of the country than would generally be possible in such a short time.

At the outset I ought to explain that the detailed examination of the whole of the Murchison district would occupy a geologist for several months, and therefore this report must necessarily be of a highly incomplete nature. Although several geological reports dealing more or less with the Murchison district have been made, its geology, and more especially its structure, are still poorly known.

Reports bearing on the geology of the Murchison district are as follow:—

1861. Julius von Haast: *Report of a Topographical and Geological Exploration of the Western Districts of the Nelson Province, New Zealand.* (See pp. 10–21, 95–99, 122, 125–127, 130.)

1884. S. H. Cox: On the District between the Maruia and Buller Rivers. *Rep. Geol. Explor. during 1883–84*, No. 16, pp. 1–10.

1888. James Park: On the Geology of the Owen and Wangapeka Goldfields. *Rep. Geol. Explor. during 1887–88*, No. 19, pp. 74–78.

1895. Alexander McKay: Geology of the South-west Part of Nelson and the Northern Part of the Westland District. C.–13, in *Mines Reports*, 1895. (See pp. 3, 4–6, 16–17, 19, 25 *et seq.*, and map.) Republished in pamphlet form, 1897.

1896. H. A. Gordon and Alex. McKay: Mining Reserves, Westland and Nelson. C.–9, in *Mines Reports*, 1896. (See p. 3, 12–13, and map.) Mostly republished in pamphlet form, 1897.

1915. J. Henderson: Notes on the Geology of the Warwick Valley. *Ninth Ann. Rep. N.Z. Geol. Surv.*, C.–2, pp. 102–103.

1917. J. Henderson: Notes on the Geology of the Murchison District (Summary of Report). *Eleventh Ann. Rep. N.Z. Geol. Surv.*, C.–2B, p. 7, with map at end.

1918. J. Henderson: Notes on the Geology of the Murchison District. *N.Z. Jour. Sci. & Tech.*, vol. 1, No. 2, pp. 108–112.

Early in 1922 Dr. L. A. Cotton, now Professor of Geology at Sydney University, visited the Murchison district on behalf of Mr. James Burns, of Sydney, and reported to him on the oil prospects near Warwick Saddle, and at the Mangles River a short distance above the Blackwater Stream junction.

No two of the reports mentioned above exactly agree as to the sequence of the Tertiary rocks in the Murchison district, and the management of the Murchison Oil Company has still another view. Nor did what I saw during my visit enable me to agree fully with any previous observer. It is