

Quartz Ranges; and, with respect to the gravels on the lesser streams—Appo's Creek, Lightband's Creek, Golden Gully, Sailor's and Blue Creeks—being enriched from the main slide in the middle and lower parts of their courses, the answer is that none of these streams reach to the south-east of the line of fracture or the occurrence of the quartz-gravels. And so, though in part they may have derived gold immediately from the Silurian rocks through which they have cut their way, either the gold from the main slide has not travelled far beyond where the quartz-drifts ceased to occur or a mixed sample of gold must be the result below where auriferous reefs strike across the water-channels. This argument will also apply to the auriferous gravels of the Slate River, north-east of the point where the line of fracture crosses the valley of that stream.

Thus Slate River gold is said to be distinguishable from gold from other sources in the terraces for some distance below the junction with the Aorere. But, apart from all this, as a general rule alluvial gold tends to become purer the longer it has been freed from its matrix; and this ought to be a sufficient explanation of the difference between that in the gravels of the main slide and that which for a much shorter period has been liberated from the original matrix. The gold in both cases may have been derived from the same rocks. Nor is it easy to see how the one variety of gold could have been derived from a distance without being in part mingled with that derived from the rocks of the locality where now the quartz-drifts lie.

In almost all parts of the South (Middle) Island the lower beds of the coal-bearing formation are characterized as being composed of coarse breccia conglomerates or of well-rolled gravels. Usually the older and very lowest beds are breccia conglomerates, and these, disregarding the coal-measures, are followed by quartz-drifts which, though younger, have not always the breccia conglomerates under them. These vast accumulations of breccia and gravels were the result of a long-continued denudation of the land-surface that, antedating the marine beds overlying the coal-measures, had continued from Jurassic times till the submergence of the land, locally and generally, during the middle and latter parts of the Cretaceous period; and it is as part of such breccia-conglomerate or quartz-drift formation that we have to regard the greater portion of the material involved in the main slide or fracture that has already been described. These gravels vary in thickness in different parts of the Aorere Valley, and that within short distances; and on the north-western side of the valley the thickness of the gravels and breccia under the limestone is very considerably greater than on the south-east side.*

On the south-east side of the valley, after a very considerable denudation of the overlying limestone and marly clays of younger date, the various strata successively exposed were covered over by heavy beds of gravel of younger Pliocene date; and, more especially along the north-east part of the line of fracture, these younger were involved with the older beds of Cretaceous-tertiary date. This will account for the great number of large boulders that occur involved with finer quartz-drifts in Glengyle Creek and the upper part of Appo's Creek; and they may in part be accounted for as belonging to the original breccia conglomerate and quartz-drift deposit.

The quartz-drifts on Appo's Flat, along Lightband's Creek, and at Golden Gully completely disprove the theory that the auriferous gravels on this side of the valley are due to the action of the Aorere in former times, or to that of some river the whence, the whither, or the period of which cannot now be traced. I have in a former report† shown that quartz-drifts such as are now being considered are not the product of any New Zealand river of the present time; also, that it is highly improbable that such gravels could be produced by the action of any river that at the same time could carry along the much coarser detritus with which the quartz-drifts are sometimes mixed. Nor could a rapid stream, having many tributaries from the mountains on each side of the watershed, owing to the continued influx of fresh material, produce gravels of one kind of rock only—and much less a purely quartz-gravel—in a country where there is a considerable variety of rocks.

But these difficulties to a great extent disappear if we suppose the sea to be the agent concerned in the production of the quartz-drifts of the Aorere Valley, and assume the existence of a gradually-sinking land, giving opportunity for the pounding and reduction of the softer rocks, and the conversion of the harder material of these into water-worn material, mainly quartz-gravel, such as occur in the particular district here dealt with, where are numerous quartz reefs, and where, in addition, large bodies of quartz-rock are associated with the more argillaceous rocks, mica-schist and carbon slates. Thus could be easily accounted for the local character of gravels on the Quartz Ranges and on Blue Creek Plateau, at both of which localities there is a mixture of coarse locally-derived material and quartz-drift, which latter is in all probability derived from the rocks of the vicinity.

More to the north-east I have pointed out that Pliocene gravels may have been engulfed along the line of fracture, and here, therefore, foreign material may be expected to occur. I therefore regard the gravels of the main slide as being, on the whole, local, there being no great river during the time of their deposition which carried *débris* from the distant interior to the part of the coast that then was, but now forms the south-east side of Aorere Valley.

VII.—DEVONIAN.

Rocks of this age are described by Mr. Park as found within the watershed of the Aorere Valley, around the sources of the Slate and Snow's Rivers. These, however, do not come under consideration, as they were not examined by me during my recent trip to the Collingwood district.

* Report on Collingwood County by James Park, "Geological Reports," 1888-89, p. 238.

† Report on the

Older Auriferous Drifts of Otago.—C.—4, 1894.