

decomposes it into a stiff clay. The lower part of the formation has generally been metamorphosed to a variable height above the sea into a hard, green, pink, or purple felspar porphyry, or more rarely into hornblende porphyry; and this action is also distinctly traceable in the neighbourhood of the various igneous dykes which traverse it. The tufa, whether in its normal or metamorphosed condition, never contains mica in this district.

"I can see no reason for supposing that the lower part, or porphyry, is distinct in age from the upper part, or decidedly trachytic tufa. When decomposed they are both alike. There is no appearance of any line of separation between the two rocks, but the one passes gradually into the other; and there are no signs of any suspension of the volcanic energy for so long a time as to divide it into two geological periods. No doubt the fact of the tufa often containing angular blocks of the hardened tufa itself (not necessarily metamorphosed into porphyry), as well as the great thickness of the formation, prove that the volcanic action lasted so long that the lower part of the tufa was consolidated, broken through, and ejected by volcanoes while the upper part was forming. Although evidently of sub-aqueous origin, no fossils have as yet been discovered in it, and its age can only be inferred from other considerations. No scorïæ or other signs of the proximity of volcanic centres of eruption are seen at the Thames; but on the Great Barrier Island a trachytic tufa, similar in most respects to that at Shortland, is largely charged with scorïæ, and is seen to be connected with subaërial volcanic cones, whose craters can still be distinctly traced. The same trachytic formation extends across the Hauraki Gulf to Manaia, at Whangarei, where it rests upon Tertiary sandstones and limestones; and at the North Head of the Manakau a formation, essentially the same, but differing in the composition of the dykes which cut through it, forms the upper part of the Waitemata series, which is known to be of late Tertiary, probably of Upper Miocene date. On the whole, then, it is probable that this trachytic tufa, breccia, and felspar-porphry is of Upper Miocene age, but more information must be obtained before the question can be considered as settled.

"Gold is found both in the porphyry and in the softer blue tufa, but more abundantly in the latter. This may, perhaps, be owing to the greater hardness of the porphyry, and to the more perfect crystallization of the pyrites contained in it, which prevent the water percolating freely through the rock and decomposing the pyrites, and so liberating the gold contained in it.

"The tufa formation is traversed by many dykes of igneous rocks, generally more or less magnetic, some of which seem not to have reached the surface. These dykes may be divided into two classes—viz., I., *Dolerites*; and II., *Greenstones*. The first class are composed of dark-gray dolerites, showing crystals of augite in a compact dark felspathic base. One is seen in the Star of Karaka Claim, on the left bank of the Karaka Creek, a little above the Hokiang machine. Another runs along the top of the ridge between the Karaka and the Waiotahi, and traverses the Galway, Fair Maid of Perth, and the upper part of the Monster (Karaka Gold-mining Company) claims. In the Waiotahi Creek, on the Lovers' Walk Road, in the upper part of the Freeman's Bay Claim, another dolerite dyke appears, probably the same as the one in Star of the Karaka. This throws off a branch which runs through the Duchess of Kent Claim. Another dolerite dyke occurs in the Cosmopolitan Claim, at the junction of Madman's Gully with the Moanataiari; and this is again seen lower down, on the right hand side of the creek, in the Pheasant Claim, about 200 yards below the Launceston (Carter's) battery.

"The second class of dykes is much more numerous, and can be again divided into two groups, which are, however, connected by many intermediate varieties. These groups are: (a.) *Metaphires*: Dark bluish-green, weathering red, generally fine-grained, with only occasional distinct crystals of hornblende or augite. Examples: Fiery Cross Claim, on Ponga Flat; Tararu Creek; Waiohanga Creek; Tinker's Gully; Moanataiari Creek, below the Point Russell Claim; and also near the junctions of the Lucky Hit and Alabama Creeks with the Karaka. (b.) *Timazites*: Paler green, weathering red, with well-developed crystals of hornblende. These rocks appear to be the same as G. Rose's *dioritic-trachyte*, or the *greenstone trachyte* of Van Richthofen; but Breithaupt's name of *Timazite* is the more euphonious. Examples: Pukihinau Creek; Heart and Hand Claim, in Wiseman's Gully; and in the Ballymore Claim, Waiotahi.

"Besides these dykes, there are several masses of what appear to be highly metamorphosed tufa traversing the field. One of these extends from the Waiotahi, a little above the Waiotahi Gold-mining Company's machine, to the Otago Claim, in the Moanataiari, and strikes the Shellback above Bleazard's machine. These masses are just similar to the tufa when in proximity to a dyke, and I therefore suppose that they are the tops, or caps, of dykes that have not penetrated as far as the present surface of the land. As there is no evidence of the tufa ever having been covered up by younger formations, it is evident that we might expect that few if any of the dykes had reached the surface, for if they had done so they would probably have formed volcanoes, and traces of them would have been left by pieces of vesicular scorïæ becoming embedded in the tufa. It is highly probable that these dykes influence considerably the direction of the quartz veins; but it would be premature at present to form an opinion as to what effect, if any, they may have on the distribution of the gold, as neither the position of all the dykes, nor the richest parts of the field, are as yet perfectly known.

"Besides the *gold*, which is always combined with more or less *silver*, the following metals have been found in the tufa, but not in sufficient quantity to be worked. [*Mercury, zinc, lead, antimony, copper, arsenic, and iron.*]

"*Alluvial Deposits.*—These are of four kinds. The oldest is a loose, red, and more or less sandy clay, containing rounded boulders of dolerite. It occurs in many places on the top of the spurs that divide the creeks from one another. On the ridge between Karaka and Waiotahi, above the Hauraki Gold-mining Company's Claim, it reaches an elevation of 1,550 ft. above the sea-level. It also, at Tapu, fills up some of the gullies on the flanks of the spurs, as seen in the Hit-or-Miss and Marquis of Hastings claims. It here contains many rolled agates and carnelians from the