

tufa, and gold, which latter curiously enough, is very little worn. The boulder formation on the top of the hills must have been formed when the land was still under water; but the alluvium in the gullies may have another and more recent origin. Next in age come the deposits of pumice sand that underlie the Town of Shortland. A shaft sunk just behind the town, after passing through a marine formation of sand with broken shells, about 10 ft. thick, traversed about 68 ft. of gravel composed of stones of tufa, dolerite, trachyte, quartz, and occasionally rhyolite and obsidian. It then got into pumice sand, after penetrating which for 10 ft. it was abandoned. These two last beds are evidently an old river-deposit, and must have been brought down the valley of the Thames when the land was at least 100 ft. higher than at present.

"The bed of sand with broken shells belongs to the third kind of alluvial deposits. Up the bed of the Kauaeranga it is seen to pass into two beds, the lower of which is a stiff blue clay full of shells of *Turbo* (recent species), *Venus intermedius*, *Tellina alba*, and a species of *Mactra*, which, although very abundant in this deposit, is now either extinct or very rare in the neighbouring seas. Upon this rests a bed, 3 ft. thick, of brown clay, only the lower part of which contains shells.

"The fourth kind of alluvium is formed by landslips from the adjacent hills, but between the Hape and Waiotahi it assumes much more important dimensions than landslips usually do. It consists of tufa more or less decomposed into yellow, white, or pale-blue clays, containing boulders of tufa, dolerite, and quartz, which latter are sometimes auriferous. Below the Royal Standard Claim, on the Karaka Hill, at a depth of 30 ft., kauri-gum, pieces of wood, and rotten raupo (*Typha*) have been found; and near Shortland, at about the same depth, an old Maori paddie was dug out in sinking a shaft. It would thus appear that when the alluvium full of boulders found on the tops of the hills was forming, the land was 1,600 ft. lower than at present; that it then gradually rose until it was at least 100 ft. higher than now; and at that time the Thames ran further north than Shortland. The land then sunk to about 10 ft. or 12 ft. lower than now, and subsequently has again risen to its present level."—(Second Report on Thames Goldfield, by Captain Hutton, pp. 3–11.)

In this second report by Captain Hutton, the slates at Tapu Creek and on the coast-line to the north (over and above those at Tararu or Rocky Point) are described, and the dykes of diorite cutting through the slates on the coast-line between the Mata and Waikowhau Rivers, and the presence of gold in lodes, traversing the slates at Tapu Creek, is noted. The trachytic tufa formation is more fully described than in the first report by the author, and as giving evidence of having been deposited in the sea and in places altered to a felspar porphyry more rarely to a hornblende porphyry, the lower altered parts of the tufa formation are not necessarily older or of a different age than the upper unaltered part that still shows as a trachytic tufa. Though the tufa formation is believed to be of sub-aqueous origin, the absence of fossils is noted, and its age can only be inferred from other considerations, the conclusion being that the tufa is of Upper Miocene age. The absence of scoriæ and other signs of the proximity of volcanic centres is noted. The many dykes in the tufa formations are divided into two groups: I., *Dolerites*; II., *Greenstones*; the latter being divided into (a) *Melaphyres* and (b) *Timazites*. Other hard rocks in the field are considered probably metamorphosed tufa, as in the immediate neighbourhood of the Thames.

"*Veins and Lodes*.—The tufa formation is traversed by a large number of quartz veins of all sizes, and running in all directions—one in the Portuguese Claim, on the Karaka Hill, being quite horizontal. Although there is no point of the compass to which veins may not be found running, still there is a most decided tendency to a more or less north-east and south-west direction. Out of nearly two hundred veins observed in different parts of the field, the bearings of 90 per cent. were in the quadrant between north and east, while only 10 per cent. were in the quadrant from east to south; north-east, north-north-east, and north being the most favoured directions, and south-east by south, south-east, and east by south the least favoured. The fact that the three least-favoured directions are almost at right-angles to the three most favoured ones is sufficiently remarkable. The direction of the veins does not appear to have any influence on the abundance or scarcity of the gold. They vary in thickness from a  $\frac{1}{4}$  in. to 14 ft., and, as a general rule, the smaller they are the more irregular is their bearing and dip. The thicker veins are not so rich as the thinner ones. The larger veins are often laminated or divided into different layers of quartz by thin bands of clay, or 'flucans.' The quartz is generally crystallized, the points of the crystals meeting in the centre, but it is also often compact, cavernous, or geodic. The veins often contain chert, red and green jasper, and (more particularly at Tapu) carnelian, chalcedony, and agate. Opal has not yet been found, but may be expected to occur. The jasper is sometimes highly charged with pyrites. Carbonate of lime, both as calcite and aragonite, and carbonate of iron are also found in some of the veins. In the Lady Bowen Claim at Tapu, a reef of pure white calcite, about 2 ft. thick, occurs. Gold is found in the clayey casing of this reef, but not in the reef itself. These carbonates have generally been introduced after the quartz.

"Gold is found in every description of quartz, from the most tough and flinty varieties to quite crystalline; and I have been informed that it has been found in red jasper, but I have not seen the specimen. It has not, I believe, been seen actually enclosed in a quartz crystal, as many other metals have been found.

"Besides the veins, lodes or reefs of three different characters are found in the district. The first occur only in the slates at Tapu, and consist of a mass of soft stiff blue clay generally from 1 ft. to 2 ft. thick, charged with small nodules of quartz. A good example may be seen in the Little Jessie Claim, at Tapu. The second kind is found in the tufa. These lodes consist of a tufaceous gangue, thoroughly infiltrated with silica, which also forms nodules and small veins and strings of quartz through it. The walls of these lodes are not easy to recognise, and the amount of quartz contained in them varies very much. Examples are found in the Golden Crown, Hunt's, and Middle Star reefs. The third kind also occurs in the tufa. These are fissures filled up with fragments of rock fallen into them, and cemented together by a siliceous matrix. Such are Dixon's No. 1, and the Dawn of Hope reefs.