sills of igneous rock separating the members of a series of lava-flows, as is now believed to be the case at Tonopah. This explanation had previously occurred to me, but since very little evidence in its favour was available, and its validity was thus more than doubtful, publication seemed unnecessary. Though at present in the position of an unsupported hypothesis, it is, however, well worthy of consideration by those interested in mining at Waihi. In concluding this paragraph I may add that the earlier accounts of Waihi geology—those of McKay and Park in 1897* and of myself in 1902†—appear to be substantially correct in their main details, and more especially in their direct or implied statement that the auriferous rocks of the Waihi Goldfield consist of a succession of lava-flows. McKay, however, appears to ascribe too great importance to the tuff and breccia beds present.

The importance of establishing the sheet-like character of the Waihi Goldfield rocks (whether they are wholly flows or partly flows and partly sills) cannot be overestimated, for it follows that the country favourable for gold probably has a lateral extension far beyond the boundaries assigned in Bulletin No. 15. In consequence vigorous prospecting in the areas adjoining the Waihi and Grand Junction mines is justified.

In many parts of Nos. 10 and 11 levels the quartzose lode material of the Waihi Mine is associated with oxides of iron and manganese. Veinlets and small pockets or patches of sulphide ore, in some places carrying ruby-silver or pyrargyrite, occur even in the poorer parts of the lodes. Inclusions of country, large and small, are numerous in the more important veins, and as a rule are surrounded by good ore. This is quite in accord with the old mining rule that "a horse pays for itself." Replacement of country by lode material is well shown by hand-specimens of the inclusions. In the Royal and other lodes patches of soft chloritic material generally carry gold and silver in such amount as to render the whole lode profitable where they are numerous. On the whole, calcite and quartz pseudomorphous after calcite are much less prominent than in some of the upper levels. Near the larger lodes, such as the Martha, oxidation extends into the joints and crevices of the country, as is shown by the presence of iron and manganese oxides.

The abundance of oxides of iron and manganese, the open vuggy character of the larger lodes, the presence of thin sulphide veins containing ruby-silver, and the scarcity of calcite all seem to point to secondary enrichment at a lower level. That ore-shoots equal in extent and value to those of the upper levels in the Waihi Mine will again be encountered does not seem likely, but the outlook for the future is by no means unhopeful.

Grand Junction Mine.

The ore-bodies in the No. 7 level of the Grand Junction Mine are similar in most respects to those of the Waihi Mine. The lodes branch and reunite both on a large and a small scale, thus forming horses of varying size. Some of the faces and backs (roofs) of levels driven on the lode courses exhibit a series of branching veinlets enclosing lenses of country, the appearance being therefore that of small stockworks. As in the Waihi Mine, soft chloritic ore is of good grade. In places rhodochrosite (carbonate of manganese) is associated with the better grades of vein stone.

In various places, especially in the eastern part of the workings, the branches of the Empire and other lodes widen and contract at intervals. Another feature is that the lodes not uncommonly make a sudden bend where ore pinches, and resume their original direction ten to twenty feet to one side, the appearance being that of a fault; but the true explanation seems rather to be that the country having been jointed, fissured, and shattered prior to lode-formation on two sets of nearly vertical planes, ore-deposition in various cases took place for some distance on one joint or fissure, and then migrated to another parallel plane a few feet away. Probably the same phenomenon happens on the dip as well as the strike of the lodes—that is to say, the lodes, or some of them, suddenly shift on a nearly horizontal plane to one side or the other.

Water.

In September, 1915, the water pumped by the Waihi Gold-mining Company was estimated at 500 gallons per minute, whilst the Waihi Grand Junction Company was pumping about 630 gallons per minute. The water entering at the bottom of the shaft was stated to have a temperature of 98° to 100° F.

In 1902 the Waihi Gold-mining Company pumped water at the rate of 835·6 gallons per minute, and in 1903 at the rate of 683·2 gallons per minute.‡ In the latter year the Waihi Grand Junction Company also pumped a considerable amount of water, but the permanent flow at the Waihi No. 6 level (555 ft. below the collar of No. 1 shaft) was then estimated at not much more than 600 gallons per minute for the whole of the Waihi mines.‡ It is evident that the deepening of the mine-workings by approximately 750 ft., together with the increased area of ground drained, has caused a large increase in the amount of water pumped. Again, since 1903 the temperature of the water pumped has increased by at least 20° F.

* McKay, Alexander: "Report on the Geology of the Cape Colville Peninsula, Auckland." C.-9, 1897. (See pp. 59–60.) Park, James: "The Geology and Veins of the Hauraki Goldfield." Trans. N.Z. Inst. Min. Eng., vol. i, 1897. (See pp. 86–95.)

† Morgan, P.G.: "Notes on the Geology, Quartz Reefs, and Minerals of the Waihi Goldfield." Trans. Aust. Inst. Min. Eng., vol. viii, Part II, 1902, pp. 164–187.

‡ Morgan, P. G.: "Water in the Hauraki Goldfield, New Zealand." Eng. and Min. Journ. (New York), vol. lxxviii, 1904 (15 Sept.), p. 429.