be difficult and expensive, and should not be undertaken except by a company prepared to stand the loss. Yet the indications of petroleum are so favourable that a trial is warranted. The preliminary geological examination of an oil-area may be reduced to the answering of three questions: (1) Is there any oil-formation in the district? (2) What is the horizon of the oil-formation? (3) What is the structure of the strata? The fact that oil has been struck in wells in moving fault-pug where no one would expect to find it even in a proved oilfield seems to indicate that oil occurs in quantity. But it is questionable whether the oil has had an opportunity of accumulating in a sandstone or other pervious rock capable of acting as an oil-reservoir. The rocks to be tested are with one exception fine-grained and argillaceous, and would suit well for the impervious cap-rock, but could not serve as the reservoir. The single exception is the chalky limestone of Cretaceous age, which is itself a close-grained dense rock, but is broken and fissured. It is possible that this may afford storage for oil. The conglomerates are compacted and cemented with clay, and possess little or no pore space. No bore has yet reached the horizon of the limestone, where alone the occurrence of oil in quantity seems probable.

With bores beginning in the Turanganui Series, as in the case with most of those already sunk, and as must also be the case with the majority of future bores in the Gisborne and Whatatutu subdivisions, two unconformable junctions have to be passed. It is therefore impossible to say anything about the structure or the depth of the limestone. When additional work has been done in areas farther north and west more will be known about this stratum, which at present seems to be the only possible oil-reservoir. Where the blocks are tilted the fault-zone will serve as one impervious limb of the anticlinal, and the best hope of striking oil seems to be in boring in the solid country some distance from the faults in such a manner as to strike the limestone at a reasonable depth.

Macadamizing-material.

Really good macadamizing-material is not procurable in the district. The limestone of the Tawhiti Series is quarried in several places for roadmaking purposes. Beach and river gravels in some localities also afford material of fair quality. A quarry is being opened in Motuhora, a hill of greywacke and argillite in Motu Survey District, fifty miles north-west of Gisborne. The greywacke of this locality seems to be the best stone for road-making procurable in or near the Gisborne district.

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3. WAIHI.

(By P. G. Morgan.)

In October, 1914, and again in September, 1915, I made short visits to Waihi, and inspected portions of the underground workings of the Waihi and Grand Junction mines. The following notes embody various features of interest observed in these two mines:—

Waihi Mine.

In 1914, during the driving of the Bath crosscut north-north-west from the Dreadnought to the Martha lode, three carbonaceous seams interbedded with tuff and fine breccia were intersected at 100 ft. to 127 ft. from the Dreadnought lode. The following description, with slight verbal alterations, is quoted from the report of Mr. J. L. Gilmour, mine-manager, published in the Waihi Gold-mining Company's annual report for 1914, pages 24–25: "From 71 ft. to 100 ft. (north-north-west of the Dreadnought lode) brecciated grey dacite is seen. At 100 ft. a black carbonaceous seam about 1 ft. wide was met. It is dipping south-east at 28° from the horizontal. From 101 ft. to 109 ft. is made up of thin layers, which are probably volcanic ash. From 109 ft. to 109½ ft. is a black carbonaceous seam parallel to the black seam at 100 ft. From 109½ ft. to 127 ft. is mostly made up of thin layers, probably volcanic ash. At 127 ft. there is a thin carbonaceous seam about 1 in. wide, dipping south-east at 35° from the horizontal. From 127 ft. to 130 ft. is made up of thin layers, probably volcanic ash, parallel to the black seam at 127 ft." Analyses of the carbonaceous bands show the presence of 1·5 and 1·57 per cent. of free carbon.

The locality where these surface-formed layers occur is towards the centre of the area mapped by Dr. J. M. Bell and Mr. C. Fraser as "intrusive dacite."* This they regard as by far the most favourable class of country for the presence of profitable ore-shoots. The discovery of bedded material in the heart of the supposed intrusive rock makes it certain that Bell and Fraser's diagnosis of the geological structure of the Waihi Mine was to some extent erroneous. Recently Mr. Arthur Jarman, of the Waihi Grand Junction Company, has written a paper entitled "The Geology of the Waihi Grand Junction Mine,"† in which he marshals a considerable amount of evidence in favour of the thesis that the supposed intrusive dacite has the characters of a succession of lava-flows. In reviewing this paper the editor of the *Mining Magazine*‡ again draws attention to the close resemblance between the geology of Waihi and that of Tonopah, Nevada (a resemblance first noted by myself§), and suggests that at Waihi there are intrusive masses or

* N.Z.G.S. Bull. No. 15, 1915, p. 125.

† Published about October, 1915, by the Institution of Mining and Metallurgy as a paper to be discussed at the meeting on the 21st October. See also the discussion on this paper, published some time later.

‡ The *Mining Magazine* vol. xiii, November, 1915, pp. 251–252. (See also p. 281.)

§ Morgan, P. G.: "The Hauraki Goldfields, New Zealand," *Engineering and Mining Journal*, vol. lxxix, May 4, 1905, pp. 861–862. (See also Spurr, J. E.: "The Geology of the Tonopah Mining District, Nevada," U.S. Geol. Sur. Prof. Paper No. 42, 1905, pp. 284, 285.)