

mentary rocks from Auckland to Riverhead were laid down. That they are unconformable to the coal-bearing series and the limestones of Wade and Mahurangi is proved by the presence in the upper beds of material derived from those lower. The exact age of these overlying trachyte or rhyolite sands may, however, be matter for doubt, as there has evidently been two periods in late Tertiary times at which such rocks appeared, but it is to the elder of these that the Riverhead rocks must be referred. There are no vents or volcanic cones in the immediate neighbourhood, and the nearest that are, in the direction of Auckland, show only rocks of a basic character. Though largely formed of volcanic material, the beds themselves are purely sedimentary, and their source must have been at a considerable distance from where they now lie, but whether the material was brought to its present position by way of the lower Waikato, or forms part of the deposits filling the Thames Valley and at one time was continuous along the inner part of the Hauraki Gulf to Auckland, and, as a consequence, to Riverhead, matters little, since the source in either case was probably the same.

ALEX. MCKAY.

The Under-Secretary, Mines Department.

REPORT ON LITHOGRAPHIC LIMESTONE, MANGONUI COUNTY, AUCKLAND.

By ALEXANDER MCKAY, F.G.S., Government Geologist.

THE mineral resources of the Northern District of Auckland were well represented at the Auckland Industrial and Mining Exhibition, held at Auckland, 1898-99; but there was manifest oversight in that there was no exhibit of samples of the cretaceous limestone so strongly developed within Mangonui County, north of the Mangataniwha Range. This was pointed out to a number of settlers and business men interested in the district, who usually remarked that they were unaware of the existence of such stone in their district. Among these Mr. J. H. Mackie particularly interested himself as representing an association that specially aims at the development of the resources of this part of Auckland. For further information on the geology of the district, he was referred to the Mines Department, and, accordingly so applied; but it was found that the general reports did not afford in a consecutive manner the information needed or even what was available. To supply the need thus arising the following account has been compiled, in the hope that it may lead to a thorough prospecting of the district to ascertain the value of the limestone at different places, more especially within Mangonui County.

Limestones of a cretaceous or non-crystalline character are abundant along the west coast of Auckland, from Kawhia, in the south, to Ahipara, Mangonui County, in the north, and reach to the east coast of peninsular Auckland at Wade, Mahurangi, Whangarei, and Kawakawa. South of Whangarei and the Upper Wairoa watershed these rocks usually assume the character of broken, much-jointed, indurated, fine-grained limestones of a light colour, or, as at Mahurangi, of a friable marly limestone, which is there worked as hydraulic limestone by Wilson and Co., of Mahurangi and Auckland. In Limestone Island, Whangarei Harbour, and along the shores of different arms of the Kaipara Harbour, it is often of a more flaggy character, and might in places be found suitable for lithographic purposes; but the proportion of spoil and rejected rock in all known localities south of Hokianga would probably be so great that it is hardly likely a quarry would be found which could pay to work. Even on the south side of the Hokianga River the limestones of this age and character are thin-bedded, highly tilted, broken, and contorted, and are hydraulic rather than lithographic limestones.

It is only within the limits of Mangonui County, stretching along the northern slope of the Mangataniwha Range, and thence spreading over the lower grounds to the north on both sides of the Kaitaia Valley, that the limestone occurs under conditions such as enables it to be worked and used as a lithographic limestone. Here it is thick-bedded and free from joints so far as to enable the raising of it in blocks of any size likely to be used in lithography. In the hilly country, on the south side of the Middle Kaitaia Valley, there appears to be an abundance of such rock.

During my survey of that district, carried on in 1892, I found this limestone being quarried for road-metal, and on examining the quarry I pointed out to the men engaged the true nature of the rock, and took a small slab of the same for the purpose of having its quality tested on my return to Wellington. This I faced and polished and set in a bed of cement, and Mr. Pierard, draughtsman to the department, placed thereon some shaded drawings, which, on being printed off, proved the stone free from blemishes and defects, and in every way suitable for ordinary lithographic work. The member for the district was then applied to, and in due course a larger block was sent to the Survey Department. This was so unskilfully taken from the quarry, being blasted out with some explosive, that so quarried it showed rents in various directions which did not originally exist in the rock, and therefore made it unsuitable for the purposes of a lithographic stone. However, it was faced, but no attempt was made to square or size it as regards thickness. A map was traced upon it, and some copies struck off. It was reported as being unsuitable for the purpose for which it was sent, owing to the numerous rents in the stone, the larger of which showed on the prints. How these originated I have explained. Since then no interest has been shown in the matter of lithographic stone within the limits of Mangonui County until the present application for information by Mr. J. H. Mackie.

The road-quarry whence the samples experimented upon were obtained lies about thirteen to sixteen miles from Mangonui Township and Port; and in the hills on the south side of the valley stone of good quality might be got at a lesser distance from the shipping-place.

Various qualities of stone, from hard to soft, are likely to be found in the hilly country on both sides of the Kaitaia Valley, but for some reason or another great indifference has been displayed respecting the further prospecting for or development of this stone at known localities. The limestone is perfectly non-crystalline and free from iron impurities or minute shells, which