1.—Possibility of the Occurrence of Artesian Water in the Northampton and Geraldine Districts.

(*With a Map.*)

The consideration of the question as to whether the pastoral lands lying "beyond Geraldton, North of Northampton" are capable of yielding artesian water is very much a matter of geological investigation and mapping.

It is not clear to what special portion of the Murchison District the motion brought forward in Parliament, on the 6th of December last, refers. This motion reads :—

> Whether in view of the fact that the carrying capacity of the great wool-producing centre beyond Geraldine, north of Northampton, would be very much increased if there was an ample and certain water supply, the Government would be prepared at an early date to bore in that district for the purpose of testing whether artesian water existed there or not.

In the year 1897 a traverse was made of the country between Northampton and Peak Hill (*a*), and an examination, in more or less detail, was made of the valley of the Murchison River as far as the big bend at Bompas Hill. Later on, in the year 1900, I traversed the country between Cue and Carnarvon, in connection with the question of artesian water (*b*), and in the early part of 1901 returned from Carnarvon to Northampton along the telegraph line.

These traverses, coupled with the information contained in the different official reports by my predecessors, together with the records of the bores put down during the last few years, afford ample data for dealing with the broader aspects of the question without a special visit to the district being necessary.

Since the date of my report of December 17th, 1896 (*c*), some boring has been carried out in the Champion Bay District, having the search for artesian water for its object. Two of these bores, viz., Dongara (*d*) and Yardarino (*e*), have been successful in obtaining overflowing supplies; the Geraldton Racecourse Bore (*f*), a sub-artesian supply, whilst the Geraldton Station Yard Bore (*g*), having reached bedrock at 420ft., obtained no water.

(*a*) Annual Progress Report of the Geological Survey for the year, 1897. Perth: By Authority, 1898, pp. 14-19.
(*b*) Annual Progress Report of the Geological Survey for the year 1900. Perth: By Authority, 1901, pp. 26-28.
(*c*) Annual Progress Report of the Geological Survey for the year 1896. *Vide* Annual Report Department of Mines for the year 1896. Perth: By Authority, 1897, p. 28.
(*d*) The Mineral Wealth of Western Australia. Geological Survey Bulletin No. 4. Perth: By Authority, 1900, pp. 105-106.
(*e*) Annual Progress Report of the Geological Survey for the year 1901. Perth: By Authority, 1902, pp. 13-14.
(*f*) The Mineral Wealth of Western Australia. Geological Survey Bulletin No. 4. Perth: By Authority, 1900, pp. 140-141.
(*g*) Loc. Cit. p. 139.

The bore at Pelican Hill (*a*), Carnarvon, which had been carried down to a depth of 3,011ft., obtained an overflowing supply of water at the rate of 520,000 gallons per diem. The record of this bore shows in descending order :—About 150ft. of newer or post-tertiary strata; about 1,211ft. of mesozoic (and possibly cretaceous) rocks ; and about 1,650ft. of carboniferous rocks ; the base of the latter formation, however, was not reached.

The important point in this bore is the fact that the main artesian supply is drawn from the bed of sandstone, 448ft. in thickness, which forms the lowest bed of the carboniferous series penetrated.

These strata cross the Gascoyne River and extend without any interruption southwards to the valley of the Wooramel somewhere between Innouendy and Bilung Pools (*b*). At the former place granitic rocks prevail, whilst in the vicinity of the latter, sandstones, shales, and conglomerates, dipping south-west at a low angle, occupy the country. The pebbles in the conglomerate are of rocks identical with those which form the Coor-de-Wandy, Yalbra, and similar hills.

Near the mouth of the Wooramel River there are, in addition to the coastal limestone, fossiliferous tertiary rocks, and the mesozoic beds, from beneath which the carboniferous strata, described in the last paragraph, emerge and occupy the surface of the upper portion of its course.

Little or no geological mapping has been carried out between Coor-de-Wandy on the Upper Wooramel and Mount Narryer on the Upper Murchison, but between the latter hill and Tilly Gully (*b*), the older crystalline rocks give place to the almost horizontal sedimentary beds, which make such a prominent feature in the Woodrarrung Range (*c*), and which, there are very strong geological reasons for believing, represent the southward extension of the carboniferous rocks of the Wooramel.

In the valley of the Murchison River, somewhere below Bompas Hill, is a fairly large development of sedimentary beds. In the vicinity of the 14-mile crossing, some distance above the Geraldine Mine, and 80ft. by aneroid above it, is an exposure of what appears to be an older series of strata than that comprising the Woodrarrung Range. The lowest bed in the section is conglomerate and breccia, composed of angular fragments of quasi-vitreous quartzite, dipping to the east ; the base of the conglomerate is not visible. A peculiar feature of some of the pebbles is that they are covered with slicken-sides, which, however, have no prevailing direction. A few yards lower down the river is a bed of quasi-vitreous sandstone overlaid by beds of cross-bedded sandstone and fine conglomer-

(*a*) Annual Progress Report of the Geological Survey for the year 1902. Perth: By Authority, 1903, pp. 23-24: also Annual Progress Report of the Geological Survey for the year 1903. Perth: By Authority, 1904, p. 34.
(*b*) Lands Department Lithograph, 2m.
(*c*) Lands Department Lithograph 6m.

ate, trending north and south, and dipping east at an angle of 20 degrees. One of the sandstone beds has evidently been much faulted, for one of the beds is slickensided to such a degree as to produce surfaces as smooth and polished as plate glass.

Lower down the Murchison the sedimentary beds referred to in the last paragraph give place to the older crystalline rocks (gneiss, etc., with greenstone dykes), which occupy the country to a point on the river in the vicinity of the peg W. 1., on the boundary of Location 66/1135 (*a*).

Near this point, which is about twenty miles east of the sea coast, the Murchison River enters a narrow gorge, flanked by vertical walls of sandstone and grit. The junction between these sandstones and the older gneissic rocks, as can be seen by a section on the north bank of the river, is a fault dipping to the west. This sedimentary formation occupies the whole of the Murchison Valley as far as its mouth in Gantheaume Bay.

A traverse from Carnarvon to Northampton, *via* Gladstone, Hamelin Pool, and the Murchison River, near Mount Curious, in 1901 showed the staple formation to consist of sandstones, grits, etc., together with their decomposition products, indicating the continuity of the same geological formations seen outcropping on the high ground along the upper portions of the valleys of the Gascoyne, the Wooramel, and the Murchison Rivers.

No observations as to the actual discharge of the Wooramel and the Murchison Rivers would appear to have been made, so that no estimate of the amount of water absorbed by the sedimentary beds can be arrived at. From the available records, it seems that the rainfall of the district is fair, and that, after due allowance has been made for evaporation and run-off, a good deal of the rainfall must disappear underground, and be capable of being reached by wells or bore holes.

Having due regard to all the prevailing geological conditions of the country to which previous reference has been made, it may be said that, on the whole, the area occupied by the carboniferous and newer strata is favourable as regards the possibility of the occurrence of artesian water, whilst so far as can be judged by the present evidence, the chances of obtaining overflowing supplies is greatest on the lower-lying ground near the coast.

To the eastward of the boundary between the carboniferous and newer strata, no hope of obtaining a supply of artesian water exists.

A Geological Sketch Map, Plate I., accompanies this report.

A. GIBB MAITLAND.

(*a*) Lands Department Lithograph, C. 71.