On arriving in Perth I reported myself to His Excellency the Governor, and received instructions to proceed to Yilgarn to report upon the gold discoveries of Messrs. Anstey and Von Bibra. Immediately on my return I was instructed to go back again, in order to examine the find of Mr. Colreavy, at Golden Valley. I had met him on the road, and, had he then communicated his discovery, I should have been saved this second journey.

My next trip was to the Wongan Hills, to see the gold reef found by Mr. Paine, at Little Wongan. After this I proceeded North to Roebourne, to examine the Mallina and Peeawah reefs, and on my return journey received instructions by telegraph to look into some new mineral discoveries in the neighborhood of Geraldton, which I imagined to refer to the Mulga Mulga or Berin Fields, and so proceeded there, but on returning to Geraldton found that they referred to some new copper lodes in the Northampton District, so I visited them and also the Geraldine District, and returned to Perth overland so as to be able to see the coal seams on the Irwin River.

I then proposed that a certain amount of work should be done each year in a systematic manner, which suggestion meeting with approval, I proceeded to Gingin, Bindoon, and Berkshire Valley. I then took an Easterly direction to see if the line of gold reef found at Yilgarn and Mulga Mulga was continuous, and found this to be the case, by striking it at Mount Kenneth. I then returned by Peterwangy, the Irwin Coal Field, Yandenooka, Dongara, and Geraldton, where I took boat to Perth in the beginning of December. The remainder of the year I employed in arranging my office, and compiling a map from the Survey Records, in which I received much assistance from the Officers of the Crown Lands Department, and from Mr. Ridley, and I take this opportunity of publicly thanking them.

During this year, 1888, I travelled about 8,100 miles on service, and roughly mapped 67,500 square miles of country.

The following are the Reports which I furnished to His Excellency the Governor after each trip, and which have mostly appeared in the newspapers.

FIRST REPORT.

Issued in February, 1888.

Country passed over and inspected from Fremantle to Newcastle, and Eastward to Yilgarn.

There are large drifting sand-dunes along the coast, near Fremantle, which are a great source of trouble to the town, for whenever strong winds blow from certain quarters, for any length of time, roads are rendered impassable, and gardens, walls, and even houses are occasionally buried.

Below these occurs a series of false bedded calcareous sandstone of Tertiary age, which further inland rises into a low coast range. The upper beds of this formation contain in places fossil shells of forms that are nearly all still existent, while those of the lower beds and nearer to Perth are mostly of Eocene age. This formation varies in composition from coralline and shelly beds to sand-rock. No complete collection of these fossils has as yet been made.

The Swan valley is bounded by high cliffs or hills of sandstone, almost as far as Perth, when it spreads out into a wide undulating plain extending up to the Darling Range. The clay beds which here crop out are probably of much greater age, though at present we have no certain information, as no deep wells have been sunk and no natural sections are visible. There are extensive estuarine deposits under Perth itself, which indicate either that the Swan, in former times, was much wider and deeper here than at present, or that its course has changed, and that it discharged itself into the sea to the North of its present mouth.

On approaching the foot of the hills one meets with large deposits of clay, sand, and clay ironstone, but these entirely disappear on ascending the steep slope of the range, where granitic and gneissic rocks, intersected by numerous dykes of diorite, make their appearance.

This face of the hills was probably the old coast line, and if the deposits of clays and sand were removed we should most likely find the old cliffs against which the Tertiary sea used to wash. Continuing Eastward the ground rises rapidly; the rocks are almost entirely covered by large deposits of red clay and nodular ferruginous clay-stones (locally called gravel), and these, where deep wells have been sunk, have been shown to overlie beds of pipe-clay, evidently derived from the decomposition of the feldspar of the granite. In constructing the railway a very thick deposit of pipe-clay was encountered in a gorge which drains a tract of country to the East, and caused a great deal of trouble, for the water kept it in so boggy a condition that it swallowed up ballast as fast as it could be put on, and sheet-piling had to be adopted to effect a crossing. It is difficult to account for these nodular clay-stone deposits, but in all probability they owe their origin to the bush fires which are common in this upland forest country. These fires burn the clay, whilst the upturning effect of the roots of the trees and the drip from them in rainy weather cause the rounded appearance. When large quantities of iron occur they frequently form a sort of conglomerate cake on the surface, but in most cases they form thin beds at the surface intermixed with more or less clay or sand, which, on the lands being cleared and cultivated, rapidly decompose, forming clays. Similar country, *i.e.*, granitoid and gneissic rocks with superimposed clays and clay-stone, extends as far as Clackline, after which it varies a good deal in character, the rocks becoming more schistose, though in places large masses of gneiss still occur, while diorite dykes are more numerous; there are also veins of diorite containing actinolite and plenty of quartz reefs, which, up to this point, are of rare occurrence, and those of a very barren and crystalline character. When the highest ridges, consisting of hard gneissic rock, are passed, the valley of the Swan, or, as it is here called, the Avon, is re-entered, and almost for the first time mica schists are seen. These are comparatively soft. The country here assumes a more decidedly mineral character.

Country of the same kind prevails for some distance to the Eastward of Newcastle, rising gradually till an elevation of 1,000 feet is attained, when the sand plains begin. A few small patches are crossed before reaching Goomalling, but to the Westward of that place, for about sixty miles, they cover almost the whole country, with the exception of an outcrop here and there of granite, and an occasional patch of light loamy land. These sand plains evidently belong to the great desert sandstone formation so largely developed in central Australia. The sand is seldom loose, except where cut up by the traffic, and might almost be called a sandstone, the grains being held together sometimes by clay, often in considerable proportion, at other times by iron, or by both together.

The granite bosses occurring in this line of country appear to be mostly intrusive, for in rare instances do they show any signs of former stratification. They are very frequently traversed by dykes of granite having an entirely different character to that of the main mass.

The country changes entirely at Mugakine, where porphyritic and gneissic rocks, containing many quartz reefs, make their appearance. This was the first place in the Eastern District in which gold was reported to have been found, but although it has been well prospected since, none unfortunately has been obtained. Shortly beyond this the first alluvial flat is crossed; it is that which drains the Cowcowing Lakes, but is of no great extent, being confined at this point between two low ranges of hills. At Yarraging and on to Mangowine, quartzite and schistose rocks out-crop, in which many quartz reefs occur. From one of these, a few miles South of this place, a quantity of stone was sent away to be crushed, but only yielding a pennyweight or two to the ton, will not pay to work.

The country between this and Yilgarn is mostly open, with large alluvial sandy plains, though here and there huge masses of intrusive granite stand out in great bold hills, but no other rock breaks the plains.

YILGARN HILLS.—The Yilgarn Hills are a low range of hills about 250 miles East of Perth, on the Western side of a series of salt lakes, of which Lake Deborah is the Southernmost.

They are from two to three miles in width from East to West, whilst the general direction of the range is North and South. The Western face is somewhat steeper than the Eastern, which gradually descends towards the lakes, from which it is separated by a plain, from four to six miles in width, of red clay strewn with ironstone and quartz.

The rocks are mica schist, mica slate, and flaggy quartzites, with many diorite and quartz veins: their general strike is North and South, with an Easterly dip. They have been tilted up from the West by a large mass of intrusive granite, which forms a rough Western face to the hills in the Northern part, while in the Southern it is only seen appearing above the surface of the plain in large rounded masses. The quartz reefs follow the strike of the rocks, but vary greatly in character, those of the white quartz being, as a rule, not in such large masses nor so well defined as the more ferruginous ones.

ANSTEY'S REEF.—On this claim there is a series of small veins of variable thickness, which pinch out or become so small that one vein cannot be traced far in any direction at the surface; whilst underground, as seen in the shaft, the vein dips first East, getting very small, then turning over suddenly to the West it makes a large body of stone, but without any defined walls, and in character more of a quartzite than a true quartz; it is of a reddish color at the surface from the decomposition of the iron pyrites, and in one place is so friable that it can be crushed up to sand between the fingers. This reef then takes another sudden turn to the surface where it makes its appearance about 10 or 15 feet to the W. of the shaft, and was in all probability connected by another bend above the present surface, which has since been washed away, with another reef a little further to the West.

The rocks between these veins are kaolinized mica slates, which in some parts have been so highly altered as to form nearly pure kaolin.

It is stated that gold specimens were taken from the surface where the shaft now is, and all along the cap for a distance of about 20ft. South of it, but as no gold has been obtained since the shaft had been sunk, the claim has been abandoned. This, like many veins in broken country, where the gold is patchy, has proved to be very unsatisfactory to work, for when one rich patch is worked out there is no telling how far one may have to go before finding another.

BIBRA'S LINE OF REEF.—This is a large reef, a little to the East of Anstey's, of ferruginous and jaspery quartz, with bands of hematite; it forms a series of hills or blows, and is easily traced for about ten miles in a Northerly direction.

But this, although supposed at first to be very rich, unfortunately did not prove so on crushing, and has therefore been given up for the present.

Bush's Line of Reef.—This is two or three miles South of Anstey's, and is a white quartz vein with dark bands of iron and masses of gossany hematite, evidently resulting from the decomposition of iron pyrites. It is not bad looking stone, but I was unable to obtain any gold from the specimens I crushed.

About 18 miles North of Anstey's the country changes a little in character, the Western side of the range being granite, whilst the Eastern is slate and shales of a more calcareous nature, intersected by many diorite dykes. In the granite the veins are white quartz containing some pyrites, but not well defined; there are also large yellow jaspery reefs, and large blue and red banded quartz veins, with some hematite, though not of a very promising appearance; while in the slate country to the East they are rather lenticular masses of white quartz with ironstone, some of which can be traced for a good distance, but most for only a few feet; these veins have a far more promising appearance than those in the granite.

Golden Valley.—Golden Valley is situated about 12 miles South of Anstey's reef, in a continuation of what is really the same range of hills, although a break occurs where the lake passes to the East through the range. The rocks and general character of the country are almost identical; granite rocks protruding through the plain to the West; then low undulating country of decomposed mica schists, with diorite dykes and quartz reefs; while further East are mica slates, quartzites, and hornblendic rocks, with large ferruginous reefs and ironstone lodes.

In the valley itself there are, as far as I can make out, two fairly defined reefs; one, on Mr. Colreavy's claim on the Eastern side of the valley, has been opened in several places, but as the holes have either been filled in again or the reef has been torn up and broken into small pieces by the numerous prospectors who have visited this claim, it is quite impossible to say what body of stone there is, in what direction it dips, or what is the general formation of the reef. As all the surface stone had been well looked over, it took some time before I could see even a color, and indeed it was not till Mr. Colreavy opened a small place on the reef that I could find anything worth calling a specimen. The gold is very fine but nuggety, and is generally found in the iron-stained portions of the reef or in little cavities with oxide of iron, resulting from the decomposition of the mundic.

The reef is decidedly worth opening up, but how it will behave in depth it is quite impossible to say till more work has been done, but I think there are good grounds for hope from the fine character of the gold, scattered as it is throughout the stone.

On the Western side of the valley are two claims, the "Edith" and the "Marion," probably both on the same line of reef, but this is not at all certain, as no work has been done on them yet. I was able to obtain pretty good specimens from each, at the places where the prospectors had been grubbing.

The stone is rather different in character from Mr. Colreavy's, being less iron-stained, but the gold seems, as in the former, to have been associated with pyrites. These claims are also worth testing, and should there prove to be one reef passing through both, there will be a great probability of finding gold between them.

I believe gold is reported to have been found by Messrs. Barratt & Saunders four miles to the North, and by Mr. Crossland about two miles South of the Golden Valley, but as a quarter of a mile square was rather a large area to look over for a few specks of gold in the limited time at my disposal, I was not successful in finding any. Colors are reported to have been found, on crushing, in many other places, but I do not think that anything rich has been discovered up to the present. Taken as a whole, the country is decidedly auriferous, but there will have to be a good deal of hard work and money expended on it before any idea can be formed as to whether it will pay. Water at present is the great obstacle in the

way of prospecting, but the boring machine will soon test the country, and I have great hopes of their finding fresh water in the flat a little to the South-East of Golden Valley, which is divided from the salt flats by some hard ridges of rock.

Prospectors who intend to test their claims would also do well to construct dams before the rains; but these will have to be puddled when the first shower falls, as the sandy loam of the gullies will not hold water unless it be puddled, when it becomes quite impervious.

The country to the East and South, as far as I can judge from a distance, appears to be similar in character, and I hope as soon as the rain sets in to be able to take a long trip in the direction of the Hampton Plains.

As a whole this country is very promising, and I hope that it will be thoroughly prospected as soon as there is rain. Rich alluvial deposits will probably be found both in the Golden Valley itself and in the South.

I returned by the York road, which passes through very similar country, but as it follows for the most part the low drainage line, it is, from a geological point of view, very uninteresting; moreover, the scrub and thickets are so dense that it is a very rare thing to get a glimpse of the surrounding country, and, with the exception of Mt. Stirling, very few hills of any size are seen. There is, however, one point on the road of some interest, where some nice looking quartz reefs cross the schistose rocks near Nulligan.

All the rocks crossed on this line have a N. and S. strike, but a variable dip sometimes E. and sometimes W., for as they are always inclined at a very high angle, little change is required to turn the dip from one direction to the other.

SECOND REPORT.

Issued in May, 1888.

York to Northam, Newcastle, New Norcia, and the Wongan Hills.

To the North of York the road follows for some distance the valley of the Avon, passing over hard crystalline rocks, *e.g.*, hornblende schist, gneiss, and granite, with numerous dykes and quartz veins; some of the latter are iron-stained and of a granular character, much resembling the auriferous stone of some parts of the Colony.

On leaving the river the road crosses a small rise, capped with clay and clay ironstone, then descends into the valley of the Mortlock, where rocks similar to those nearer York are met.

Between Northam and Newcastle the river flows North-West through a rocky gorge, which in all probability follows a fault occurring across the strike of the series of schistose and gnessic rocks.

The road to the North from Newcastle, for some way follows the Toodyay Brook, then turning North-West crosses a series of very rough schistose hills, after which it passes over high ground covered with sand and clay ironstone for about 30 miles, when, near the junction of the Perth road, the country begins to fall toward the East Moore River, and the crystalline rocks re-appear, with a series of quartz reefs of a very promising character. Similar country extends for about fifteen miles. The road then follows the Victoria Plain, the alluvial deposit of the East Moore River, which has high hills of crystalline rocks on each side. Continuing Eastward, towards the Wongan hills, for a few miles there are ranges