

1893.
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WESTERN AUSTRALIA.

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REPORT

ON THE

MURCHISON GOLDFIELD,

BY

HARRY PAGE WOODWARD,

F.G.S., F.R.G.S.,

GOVERNMENT GEOLOGIST.

Presented to both Houses of Parliament by His Excellency's Command.

PERTH:

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No. 13.— $\frac{92}{2}$

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Report on the Murchison Goldfield, by the Government Geologist.

From the Honorable the Commissioner of Crown Lands to the Government Geologist.

1. Your letter of the 12th instant received. I approve of your intended departure for the Murchison Goldfields on the 28th instant, and also of the route indicated by you as that which you propose to take, viz.: *viâ* Berkshire Valley, Wongan, Mount Kenneth, and thence to the field.

2. I note that you expect this trip will occupy almost three (3) months.

3. With regard to instructions, I do not deem it advisable or necessary to hamper you with *set* instructions, and prefer to rely upon your discrimination and good judgment to guide you as to your course of action *once* you start upon your journey.

4. Of course you will closely observe and report upon the geological character and formation of the country intervening between the various points of your route, and indicate the prospects for gold, metal, or minerals; present condition of feed and water, and prospect of a permanent source of supply of the latter; and all other matters likely to prove of service.

5. Upon arrival at the Murchison Goldfield you will meet the Warden (Mr. Walter), and will, after consultation with him, be better able to arrange your programme of operations and inspection of the various localities either applied for, being worked, or likely to be worth inspection.

6. Your area of observation and examination should be as wide as possible, and, as the country will doubtless be in a good condition for travelling, both as regards feed and water, you will extend your inspection as far East-South-East and North as possible.

7. Having approached the field from the South or South-East, I suppose you would return by the Geraldton route or nearly in that line of country. If so, you will be afforded an opportunity of reporting on the large area lying between the existing finds and Geraldton, and indicating the extent in that direction of country likely to prove auriferous, and pointing out the most promising locations for prospecting.

8. While the above few remarks will convey to you my wishes as regards the general character of your report, I may say that I should like your report upon the Murchison Goldfield *itself* to embrace the following points, viz.:—

1. The extent and area of probable auriferous country in and about the Murchison Goldfield, and its bearings (approximate).
2. A General Report upon the Goldfield itself, and more especially with a view of giving an opinion as to the permanency of the Field, in the following respects:—
 - a. As an alluvial Field, and its prospects in this direction of sustaining a large population of diggers.
 - b. Is there a probability of deep leads of alluvial being found, in what localities, probable depth, &c.
 - c. Whether abundance of water exists for alluvial purposes (workings), and whether such water is *surface*, or is easily obtained by sinking, and at what depths.
 - d. As a reefing field, your opinion as to the reefs now being worked, their character and richness, and more especially the prospect of their going down in depth, and probable permanence; your opinion upon the reefs discovered not yet being worked, and upon other likely reefs you may yourself come across.
 - e. Water supply at reefs, and also supply of fuel for machinery purposes.
 - f. After you have reported upon the individual mines, claims, &c., which you will do separately, I would like you to express your opinion upon the Murchison Goldfield as a *reefing country*, and as to its future prospects of development and permanency.
 - g. As you will see much of the Warden, and the mining population will doubtless air their grievances and the wants of the field to you, I would thank you to note any and all matters that, in your opinion, would assist in expediting the development of the goldfield, and assure the miners that it is my wish, and that of the Government generally, to help them as far as possible. I would like you to make any recommendations you think would prove advantageous.

3. You might write me as you get opportunities, and shortly describe your work as it progresses. This would give me some indication of your opinion, to be made public only if I consider it advisable.
4. As usual I will write to the Warden, Murchison, and also have police at fields instructed to assist you as much as possible.

In conclusion, I have only now to wish you a safe journey, and hope your trip will result with credit to yourself and advantage and profit to the Government and Colony, increasing the knowledge of our great auriferous and mineral resources, and enabling us to give reliable information to an ever anxious and inquiring public.

W. E. MARMION,

Commissioner of Crown Lands.

21st May, 1892.

*From the Government Geologist, Murchison Goldfield, to the Honorable the
Commissioner of Crown Lands, Perth.*

SIR,—

I have the honor to report that I have arrived at the Nannine, after examining the country between Berkshire Valley and Mount Kenneth, to the Eastward of the Warne Flat and Mount Kenneth, as far as possible, without an exploration party. Here I experienced great trouble owing to the dense thickets and scarcity of water.

I examined the country from this point North to East Mount Magnet, then North-West to Austin's Lake. From this point I proceeded to the West Mount Magnet gold discovery, where most of the diggers are working near Jones' Well, West of the mount, but very little is being done, owing to the wet state of the ground. There are one or two small reefs here, but very little has been done on them yet.

At the island in Austin's Lake a large number of men are at work, doing very well, and several small but extremely rich reefs are being profitably worked by hand. There is also another patch of workings on the North mainland, but this is quiet at present.

At the "Eight" and "Four Miles" and Dead Finish (Cuddingwarra) several very promising reefs are being opened, but very little alluvial work is now being carried on. At the Cue there are a large number of men, who are mostly employed in working over old tailings; but very little can be done, as the ground is so wet, and no fresh ground can be prospected till it dries. There are also several very rich small reefs here being worked at a profit by hand.

The Nannine seems to have quite settled down to steady reefing work, and the machinery is being erected on two or three claims, but as very little of it has arrived on the field yet, it will be some time before they can start crushing. I have not yet examined these reefs, so can say nothing about them at present.

On this trip I have seen a good deal of country which is worth prospecting.

There is plenty of water and feed all over the country, but the trouble seems to be that men cannot prospect when the ground is wet and cannot travel about when there is no water, so that in all probability it will be some considerable time before this country is thoroughly tested.

There is still a little fever hanging about, evidently due to diggers drinking surface water after the late rains.

I shall leave here in a week or ten days, and go on North to the Murchison River, when I purpose to end this trip, and hope to be in Perth about the middle of September, when I shall be in a position to report fully on the country examined and the prospects of the field.

As far as I can judge at present, there is a very extensive belt of auriferous country, and many of the reefs promise well.

The heavy rains have greatly hindered me, as the ground has been so boggy that it was impossible to travel across country at all, and in this country one has to carry everything, as nothing can be procured, and it is not safe to leave anything in camp without a guard, as the natives are very troublesome.

At present I have no authority to examine mines, and for many reasons the owners often would rather not have them examined. I shall therefore in future decline to inspect workings, whether gold mines or mineral mines, until the Government give me an authority to do so, as I have not met with the most cordial reception on some properties and diggings, and as the Warden's quarters are here at the North end of the field, I have had to do my work so far without his company.

In the position I hold I should have the fullest authority to examine, test, and report on, as it is most unfair to me to have to form a report for general circulation without being able to see the reef tested in such a manner as to satisfy myself.

As a rule I must say that I meet with the utmost courtesy, but there are exceptions.

Since I left Perth there has not been a week of fine weather, and sometimes the rain has been very heavy; these showers seem to have been very local, but I, unfortunately, always happened to catch them. The well at the Cue is failing, and driving operations are being started, which will probably increase the supply, but I would advise the Government to go on with the sinking of the other abandoned well, which is down 70 feet, as a "stand-by"; the water level will be found at about 120 feet.

I have, &c.,

HARRY P. WOODWARD,
Government Geologist.

15th August, 1892:

*From the Government Geologist to the Honorable the Commissioner
of Crown Lands.*

In accordance with instructions, I left Perth on the 1st June to examine the Murchison Goldfield.

I proceeded overland *via* Victoria Plains, Berkshire Valley, Ninghan (on this West side of the Range there is a belt of mineral country), the Warne River, to Mount Kenneth, examining the country to the Eastward as far as practicable, but owing to the density of the thickets and scarcity of water I was not able to do much in this direction.

Near Mount Kenneth there is a small patch of auriferous country, though up to the present gold has not been found in payable quantities on it.

North of this, near K 71 and Boodano, promising quartz reefs outcrop and extend in a Northerly direction beyond East Mount Magnet.

From this latter place I proceeded Westwards to West Mount Magnet, near which several nice patches of alluvial and a few reefs have been discovered.

Between this point and Austin's Lake there are a few small patches of mineral country, but the rocks are mostly intrusive granite.

Austin's Lake, as shown on the map, does not exist. The road runs North from K 20, crossing a narrow salt marsh about half a mile wide, then along the island keeping the same direction, when it crosses another half mile of marsh to the North shore.

The island is the highest hill mass of the neighborhood, and it was upon it that the most concentrated patch of alluvium was found (the only deep ground on the field), and there are also two or three extremely rich reefs.

There is a rich patch of alluvium on the Northern shore.

The Cue is about ten miles due North of the island, and on the slopes of the hill some very rich patches of "surfacing" have been found. There is also a very promising belt of reefing country extending from it in a S.W. direction for eight miles, on which many very good reefs are being tested.

The Dead Finish or Cuddingwarra is twelve miles West of the Cue, and here several nice patches of gold have been found, as well as a few promising reefs.

Fifty miles North of the Cue is the Nannine, which is situated on the North side of Lake Annean. Here again several nice patches of alluvial, as well as a few promising reefs, have been found, the former occurring both on the islands in the lake and on the slopes of one hill to the Northward, on which the principal rich reefs are situated.

Thirty miles to the East, near Yagahong, are the Star of the East and two or three more areas, while twelve miles S. near Norothanna is Quin's, where some small gullies proved to be very rich in alluvial gold; and a few reefs are being tested.

From this point I proceeded West, examining the Weld Range, near which there are some small patches of country which should be prospected. In the range itself is the celebrated Wilgie Myah, which is merely an immense iron lode, of which the soft bands of decomposed red hematite have been worked by the natives.

From this Northwards to the Murchison the country changes, the auriferous character entirely disappearing, the rocks becoming more granitic and micaceous, with an East and West strike, owing to a great dislocation, which has thrown the line of gold-bearing country far to the Eastward.

Down the Murchison from Moorarrie to the Roderick, across by Mount Luke to Meka, on the Sandford River, and thence South to Warra Warra, the rocks are mostly granite, of an intrusive character. To the south of this at Yilgaddy, Edamurta, and Yuin several small patches of mineral-bearing rocks are to be found.

At the Gnou's Nest (about 50 miles East of Gullewa), on the Ninghan Range, are some quartz veins containing galena, while in the clay-pans on the Eastern side several areas have been taken up on a belt of decomposed talcose rock, on the idea that it is a silver lode. This belt runs South to Ninghan.

From this point I returned overland *via* Newcastle, reaching Perth on Saturday, the 1st October.

On this trip I travelled about 2,500 miles, and examined a large extent of country; but when the vast size of the Colony is considered, it appears as nothing, and makes the task seem hopeless even in contemplation of ever examining the whole upon systematic lines.

I have been greatly hindered by rains, which rendered the country so boggy that it was almost impossible to travel, while another great impediment arose from the extensive thickets, which were very difficult to penetrate, and in which there was very little water.

To have attempted anything more than I have done would have extended this trip into a year.

I therefore have the honor to hand you now a Report upon the Mines; the remainder, in which I have endeavored to follow as closely as possible the lines of your instructions, I will send as soon as I can prepare it.

I have, &c.,

HARRY P. WOODWARD,

13th October, 1892.

Government Geologist.

From the Government Geologist to the Honorable the Commissioner of Lands.

SIR,—

I have now the honor to hand you the whole Murchison report, and to reply to your questions in order.

1st. **EXTENT OF AURIFEROUS COUNTRY.**—The auriferous country may be said to extend from the Yilgarn Goldfield at the South, being bounded on the West by Mt. Churchman, Mts. Farmer and Charles, Telegortherra; on the North-East by the Weld Range, and Mt. Leake; whilst to the Eastward it probably extends in patches to the boundary of the Colony. The granite belt, about 100 miles wide on the West of the points named, might as well be left out of the goldfield, as small patches like Yuin should be placed under the Government Resident at Geraldton. The auriferous belt probably trends to the North-East round the Robinson Range.

2nd. **GENERAL REPORT WITH THIS—**

- a. As an alluvial field, rich patches will be found from time to time over this large area, but a large population are not at all likely to remain stationary, as the ground being very shallow is quickly worked over; even if fresh patches are found amongst the old diggings, they would not keep many men long. The only chance of it becoming a more permanent alluvial field is the discovery of gold in the deep ground, but of this, at present, there is no prospect, as there is not sufficient encouragement under the regulations for men to prospect this class of country.
- b. Deep leads probably exist in the made ground along this auriferous belt, and there are some nice patches to the North-East of the Cue, which should be prospected.
- c. There is no water, except what is obtained from shallow wells in the lakes, that can be used for alluvial purposes, except immediately after rain.
- d. This field as a reefing district is very promising; most of the reefs opened up are true veins, and have every indication of going down carrying the gold. Many reefs are extremely rich, but in every case they are not true veins. These the prospectors should work as long as it pays them, for it is no good prematurely launching too many companies upon the market.

There are many reefs which are not so showy, that are now being worked, but which will probably prove permanent.

- e. Water is abundant at present on the reefs lines, but when they are worked the water level will go down, and probably in some cases become brackish.

There is plenty of fuel for machinery purposes at present on the field.

- f. I have not the least doubt that, if properly worked, the Murchison goldfield will prove permanent and rich.
- g. The miners are very desirous of getting regulations with regard to reefing and alluvial workings altered so as not to clash. There is no reason why a digger should not work the surface of the ground whilst a miner is working the reef, provided, of course, he keeps a certain distance from all workings on the mine, so as not to damage or endanger them or life in any way. This alluvium, a reefing leaseholder fancies, belongs to him, and hence the friction between the two branches. If this were altered, no diggers would oppose the granting of a lease on diggings, for they could still go on working the surface, hence a lot of unnecessary trouble would be got over.

The Warden had instructions to issue no more licenses to sell spirits, &c., until there were more police on the field. This is decidedly a mistake, for now every one nearly does more or less sly grog selling; this must strike you as very unfair to the man who has paid for the right and built a house.

If everyone were granted a license there would be no more drinking than there is now, and the police would not be obliged to take up these objectionable cases, which cause ill-feeling all round, and the Government would be a large gainer in revenue.

I believe I have now answered all the questions you put to me, but if any have been omitted, or any others have occurred to you, I will reply to them at once.

I have, &c.,

HARRY P. WOODWARD,

Government Geologist.

21-11-92.

THE MURCHISON GOLDFIELD.

Proclaimed area, 32,000 square miles.

The principal auriferous belt is situated at the Eastern side of this area, about 200 miles from the coast. It runs in a North and South direction from West Mt. Magnet to Austin's Lake, then in a North-Easterly direction to Lake Anneen and Yagahong. Other rich patches and belts exist further East, and a few patches have also been discovered nearer the coast.

This field was discovered in the year 1891, by Messrs. Macpherson and Peterkin, who found a very rich patch of stone near Lake Anneen, which is now being worked as the Nannine Mine. It is true that gold was discovered at two places on this field previous to this, viz. Mulga Mulga and Yuin, but in neither case did it prove to be in payable quantities.

Geographical Features.

The Geographical features of the portion of the field on which gold has been discovered are not very striking, being only the ruined remains of a vast high sandy tableland, presenting to-day a broken surface consisting of salt marshes or lakes fringed by salt, sand, clay, gypsum flats, from which rise low rough hills of metamorphic rocks or white cliffs, on the top of which are sandy plains, the remains of the ancient tableland. There are no well-defined rivers, but the few creeks discharge themselves into the salt flats, where the water evaporates, except after excessively heavy rains, when they overflow into the rivers which run towards the coast. The hills are mostly small and low, consisting for the most part of ridges of hard metamorphic rocks, near which the rich finds of gold have been made. These are often capped by the same horizontally bedded formation exposed in the cliffs at the edges of the broken tablelands, which are generally covered by dense thickets of low scrub.

Geology.

There are only four formations on this field, which are:

<i>Recent</i>	...	{ Alluvium of the water-courses, flats, and salt marshes, travertin, and other surface deposits.
<i>Mesozoic</i> (?)	{	Desert sandstone, horizontally bedded sandstones, clays, pipeclays, gypsum, and ferruginous beds.
<i>Metamorphic</i>	{	Slate, schists, quartzite, sandstones mostly ferruginous, limestone or granite.
<i>Plutonic</i>	...	Granite, diorite, and other dykes.

The recent formations are always of very limited thickness, rarely, as far as yet tested, exceeding 15 to 20 feet. They have been derived directly, for the most part, from the denudation of the desert sandstones, but, also, in some cases, from the metamorphic rocks, in which latter case this deposit often overlies the alluvium derived from the sandstones, hence we do not find the auriferous wash on the true bottom.

This is due to the fact that the metamorphic rocks being harder resisted the weathering action longer than the more modern and softer rocks, therefore stood up as hills and ridges out of the flats. These hard rocks with auriferous quartz reefs in their turn disintegrated, and blocks of stone, rich with gold, rolled down the sides of the ridges on to the top of the previously deposited alluvium, where the process of weathering still continuing the gold was mostly, but not altogether, eventually freed from the matrix.

As the action of denudation which has taken place since these auriferous rocks were exposed has been due to the heat of the sun, showers of rain, and the wind, but as the detritus has not been subjected to the sorting action of running water it remains scattered over the surface instead of being concentrated on the bottom as is generally the case in other parts of the continent. This feature at first was very perplexing to many old and experienced diggers, who naturally sank to the bed rock to prospect, instead of trying the surface.

The mesozoic formation, if represented by the remains of the old tableland, can be seen well in many cliff sections, but up to the present no organic remains have been found in them; but to judge from the associated gypsum and iron beds it is highly probable that some will yet be met with. It is probably a portion of the great plain of the interior of Australia, the age of which has been determined as mesozoic, but until fossils are found we shall not be able to determine their correct age.

It is very strange that no gold has been found in this formation, although it rests directly on the gold-bearing rocks and capping hills, at the base of which rich reefs have been found; this of course may be due to the fact that up to the present very little systematic search has been made, as patch after patch at the surface was found. That gold will be found in rich deposits at the junction of these two formations one would naturally expect, as the auriferous reefs must have been infilled prior to the deposition of the more modern formation, otherwise we should have had the fissures continued on up from one into the other, but this is never the case.

Allowing that these horizontally bedded rocks were deposited in very deep water where no washing action took place, still, prior to this submergence, or during that time, a certain amount of denuding action must have taken place, and as the gold could not have been washed away altogether as lighter material often is, there still must remain pockets or gutters which will in the future be worth looking for between these two formations.

The metamorphic rocks out-crop, rising as low ridges wherever the overlying desert sandstone tableland has been removed; they are mostly hard, large quartz reefs, often forming the main axes of the ridges, but more generally beds of highly-altered ferruginous quartzite, nearly approaching a mineral vein in character, at the intersection of which the quartz reefs are always richest.

Along the principal belt of auriferous country, the rocks for the most part strike a little to the Westward of North, and underlie to the Westward, consisting largely of talcose and granitic rocks, although hornblendic and micaceous slates are also met with. Where there are patches of limestone the surface is covered by travertine deposits, and the veins are mostly of a ferruginous calcite, in some of which gold has also been found.

The rocks at the North end of the field take a sudden turn to the North-East and East. Dykes are met with in many places; these are generally either granite or diorite, the latter being of great variety, whilst the former generally contain crystals of foliated talc in cavities.

The mineral veins consist mostly of quartz, but ferruginous lodes and veins of calcite and dolomite also exist.

The quartz is of great variety, from pure white, with talc in the white granite country, to white, blue, and highly mineralized in other places, whilst the dolomites and calcites are mostly ferruginous.

Where the reefs have been opened up to the water level many of them contain galena as well as iron pyrites, and veins seem for the most part, as far as one can judge at present, to be true fissure veins, most of them probably continuing in depth; but they will vary greatly in size, direction, and thickness, and many will have to be traced by a mere line or face for a considerable distance.

The veins rarely follow the strike or dip of the other rock, but cut across them in all directions, and when they are lost at the ends they generally seem to turn and strike along the line of bedding of the rocks as a mere thread for some times a considerable distance, making again into a large body of stone, when they strike off more or less on their old course.

The reefs are found to be very rich in shoots, the gold being mostly met with at the intersection of certain beds, whilst at other places either large bodies of stone or pinches are accountable to the same cause. The question as to which are the true veins cannot be decided until a more systematic survey of the fields has been made, but in most cases, where there is a large main line of reef, parallel lines are met with which it is quite impossible to trace for any distance; these latter are in all probability not true veins, but only infilled lateral fissures, which although often very rich, will not extend for any distance, either along the surface or in depth.

The main lines of reef seem to follow a more or less North and South course, but there are some very rich ones which strike East and West; these also vary greatly, some being small cross-courses, extremely rich at their intersection with main North and South reefs, and others, such as the Star of the East, which seems of quite a different character to anything else on the field, but which still presents all the characteristics of a true lode of a very broken character, but from the nature of the stone this must be expected until sinking is carried into the solid country. The ferruginous reefs are met with mostly at Quin's; many of these will prove to carry a very great deal of pyrites in depth, but, as a rule, the reefs on this field are exceptionally free from any objectionable mineral.

Water.

The field, as a whole, is well watered, and, as a rule, the water is good, the only exception being near the Salt Lakes, but even there, if a well is sunk a short distance away, the water is found to be fresh.

At the island in Austin's Lake there is nothing but salt water, and at the Cue over 100 feet in depth had to be sunk to obtain a not too good water.

In most of the mines good water has been struck at considerably under 100 feet, and if a supply is to be found at all, it will be found along these lines of fissure.

There is no immediate prospect of the water question standing in the way of the development of this field, as it has of so many others in this colony; but the timber question will be far more serious, particularly at the South end of the field where there is nothing but mulgar.

Extent.

The gold-bearing belt, as far as at present worked, extends in a North and South direction for a distance of about 100 miles, but it will probably be found to extend in patches all the way South by Boodano and Mt. Kenneth to the Yilgarn Goldfield, as it is on the same belt which runs South to the Mt. Barren Range on the South coast.

To the North-West it is either suddenly cut off or thrown to the Eastward by the change in the strike of the country, which here runs North-East and East; the rocks, too, lose their auriferous character, being replaced by hard crystalline and granite rocks.

It is highly probable that this belt will be found to run in the direction of Windich Springs, but it is difficult to trace owing to the auriferous rock being mostly covered by the desert sandstone formation.

To the Eastward rich patches of auriferous country seem to be met with wherever the more modern formation has been removed; and from Sir John Forrest's description of the country there is every probability of gold being found all the way to the South Australian boundary along the lines of depression where the old rocks outcrop.

To the Westward there is little prospect of the field extending, as it lies immediately to the Eastward of the main belt of intrusive granite, which is about 100 miles wide, in which, however, there are one or two little patches of likely-looking country. On the Western side of this belt, at Yuin, gold has also been found, but this is on the same line of country as Kendinup, the Darling Range, Bindoon, the Wongan Hills, and Peterwangy, and although it may be a very nice little patch, an extent of rich gold-bearing country is not likely to be discovered.

MOUNT MAGNET.

The Mt. Magnet diggings are situated a few miles to the South and West of West Mt. Magnet, which hill is principally composed of metamorphic rocks capped by a flat top of desert sandstone.

The rocks strike mostly a little West of North, dipping to the Westward; they are slate, dolomite, talcose schist, and ferruginous jaspery quartzite, all of which are very decomposed.

The reefs follow much the same strike as the rocks, and dip also to the Westward. They are small but well-defined, and in some places appear to carry gold pretty well through the stone. The quartz is mostly white and rather greasy with ferruginous stains and yellow clay partings, but nothing very rich has been found in the reefing line on this part of the field except the Monarch Mullocky

Leader, which is not a true reef, but a mass of decomposed talcose schist through which there are a number of small ferruginous quartz veins. The whole mass carries fine gold, but up to the present only the soft part has been worked, which has proved very rich in gold. On the surface here a small but very rich patch of alluvium was worked along the side of a large ferruginous quartzite bar.

All the alluvial work here has been surfacing, the patches being worked by dry-blowing places, when a mixture of quartz and ironstone are found scattered over the surface.

A good deal of gold will probably yet be found around here, but most of the men are away at the richer finds further North.

The Monarch Mullocky Leader.—On this area a mass of decomposed talcose schist, with small ferruginous quartz leaders, often jaspers, is being worked.

The gold is mostly very fine, but is plainly visible on the faces of the schistose rock and all through the quartz; many specimens being extremely rich.

There is a large mass of this rich gold-bearing material, but the full extent is not at present known.

The country strikes a little West of North, and dips to the Westward at a high angle.

The auriferous nature of this patch of country has apparently a certain connection with a large ferruginous dyke which lies close to the Westward of the workings, and which does not follow the exact strike of the country. A very great deal of gold has been obtained from this claim by simply puddling and washing the decomposed rock, whilst the stone has been reserved for crushing. This seems to be an extremely rich deposit, and the gold will probably be found to go down associated with iron pyrites, and should pay very well, considering the richness and quantity of the gold-bearing stone and the ease with which it can be worked.

Two or three adjoining areas have been taken up, but nothing so rich as the first mentioned has been discovered.

The New Chum.—This small, but well-defined reef, has been opened by several small shafts, and proves to be from 3 feet to 3 feet 6 inches in width, striking North to South, and dipping at an angle of 75 degrees to the West. The stone is of a white glassy nature, with yellow ferruginous bands, which generally show gold, and it is also visible in the solid stone.

The lode has good walls, particularly the footwall, on which side there is a clay casing, in which gold is visible.

The country is talcose schist, with hard beds of magnesian limestone. It strikes about 20 degrees West of North, and underlies in a westerly direction.

This is a very promising little mine, as the reef is rich, well formed, and in soft country. There are two or three other areas on this line, but the reef is much smaller and broken, although gold shows pretty freely in the stone.

The Mount Magnet.—This reef where worked is very small, varying from 2 or 3 inches to 1 foot, but there are bunches of stone in places where the reef is 2 feet 6 inches wide. The country is yellow decomposed slate, and the stone is glassy, with a little manganese.

LAKE AUSTIN.

Between Mount Magnet and Lake Austin, where the next rich patch of diggings are situated, the country does not present such an auriferous appearance, as most of the rocks are intrusive granite, often overlaid by desert sandstone, but there are one or two small patches of promising country.

The distance between these two points is about 35 miles by road; but this might be considerably reduced if a proper road were cut.

The island is a high ridge of metamorphic rock, the main axis of which is a bed of ferruginous jaspery quartz (ironstone). It runs in a nearly North and South direction for a distance of about two miles, being divided from the North and South shores by two narrow arms of the lake, each about half-a-mile wide, which are quite impassable after heavy rains. This, added to the fact that there is no fresh water on the island, render it anything but a pleasant place to get weather-bound in.

The diggings on the island were some of the richest and most concentrated on the field, and it is the only place where anything like deep ground was met with, a defined gutter being found on the bed rock at 15 feet from the surface.

The alluvial ground ran down from a saddle near the centre of the island, in an Easterly and Westerly direction, towards the lake, but no auriferous reefs have yet been found immediately on its course. The sinking was pretty tough in places, as the alluvium was cemented together by gypsum.

The reefs are phenomenally rich, but do not seem to carry gold for any great distance along their outcrop. The one on the main island runs in an East and West direction, cutting a main North and South reef at its intersection, with

which very rich stone was found. The other, on a small island to the North-East of this, was also excessively rich, but in this case the main reef carried the gold at its junction with two leaders, one of which strikes to the North-East, and one to the South-East.

Other reefs should be prospected for upon the saddle at the head of the leads, for the very heavy gold found there had not been carried far. As on the other parts of the field the richest shoots in the reefs were found where they crossed the ironstone bars; this should be borne in mind in prospecting for reefs here.

Other rich patches of diggings exist on the main land to the North side of the lake, and a patch of country well worth prospecting lies to the Eastward from it.

The Chicago.—This is a small but immensely rich cross reef, which strikes in an East and West direction, dipping slowly towards the North. It is very rich near the point where it is crossed by a large main North and South reef, which is probably the cause of this very rich deposit.

It underlies at such a slight angle that it quickly passed out of the first claim, which was taken up on its outcrop into this area, where it was struck somewhere about 20 feet from the surface, whilst in the next shaft, which is about 30 feet further north, had only to be sunk about 10 feet deeper to cut it.

A good deal of the stone which came from this mine may truly be said to carry more gold than quartz; but, unfortunately, this class of reef rarely continues to pay in depth, and as no gold-bearing stone has been found along its outcrop, it is clearly quite a local patch or bunch.

Several other claims are taken up around to try and cut this reef.

Lawrence's.—This area is very similar to the last named, as a very rich mass of stone was worked out to a depth of 10 feet close to the junction of some cross reefs with the main line, which main line does not seem to carry gold in payable quantities anywhere but at the one point.

This sort of reef is a splendid thing for working miners, for if they set to work and *dolby* the stone they can make small fortunes out of them; but it would be perfect folly for a company to put machinery on an area of this description until the gold was proved to go down at least 50 feet, and to extend for a considerable distance along the reef. The puzzle is why attempts are made to float them at all, for enough gold could have been taken from either of these mines to put machinery on them.

THE CUE.

Between Austin's Lake and the Cue, a distance of about 10 miles in a direct line North, the country is mostly covered by salt, sandy flats or clay, covered with thickets; but by the road, which runs more to the Westward, towards some low hills, another belt of auriferous country is struck.

This first patch is called the "Eight Mile," being about that distance from the Cue. Here several very promising and well-defined reefs are being prospected on a flat, and on the East side of a low ridge of metamorphic rock, where the same jaspery ironstone is met with; but as yet so little has been done to open up the country that it is quite impossible to say anything about the formation of these lodes.

This line of gold-bearing country runs in a continuous line in a North-Easterly direction to the "Four Mile," which also derives its name from its distance from the Cue. Here a line of reef rises up abruptly, forming the main ridge, the general characteristics of which are very similar to some of the Kimberley reefs.

This line is called the Day Dawn, after the first claim taken up on it. The stone is of a bluish mottled appearance, and the reef is of great size and well formed. It is a true fissure vein, but does not follow any definite course, striking first West-North-West, then North-North-West, and so on to North; but this is not of the least consequence, as, from its well-defined walls, there is very little chance of it cutting out.

Some very rich patches of surfacing were found on the sides of this and several other reefs about here and all the way in a North-Easterly direction to the Cue proper.

The Day Dawn is a large blue reef, which rises from the flat forming the main hill ridge, and on its slopes some very rich patches of alluvial gold were found, fine gold also being visible in the reef at the surface. This reef, which runs here in a North-North-West and South-South-East direction, and dips to the Westward, goes down on a well-formed footwall, and should the rich stone prove to be of any extent this should be a very valuable property.

The Day Dawn South is on the same line, but the reef here takes a bend and runs West-North-West and East-South-East. The reef is well formed, and carries gold well through the stone, which is of a bluish character, containing a little

galena. This area also is a very promising property, and should the reef prove to carry gold for any distance would be worth working.

Day Dawn No. 1 is to the Northward of the Day Dawn on the same line of reef, but it here has taken a turn more to the Northward. The reef is 6 or 7 feet in width, and well defined, showing gold as far as prospected at present, and will probably, like the other areas on this line, prove payable.

The Union Jack is an off-shoot or split of the Day Dawn reef to the Northward of the No. 1. The reef, which is just like the last-mentioned in character, strikes in a North and South direction, dipping to the West. This, like the others on this line, should prove a valuable property if the rich stone discovered in the workings is of any extent.

This line is a true fissure. The stone is of a good class and size, the walls well formed, the country sound but soft, with abundance of good water at a moderate depth. Many other reefs are being worked where there are rich surface shows, but nothing as to their permanency has been proved yet.

At the Cue itself the largest patch of auriferous country exists that has yet been found on this field; it was quickly skimmed over, as no gold was found by sinking, but all on the surface. Here are situated the celebrated "specking" grounds, over which hundreds of men walked day after day, turning over every stone with a forked stick to see if it might not be a specimen or cover a nugget. A very large quantity of gold was found in this way, and a stray piece is now and then still picked up.

The surface of most of these patches is covered with quartz and ironstone, and a good deal of the quartz carries a little gold. Many of these patches, after being specked, paid to be dry-blown, but in other cases all the gold was either found as specimens or in too large pieces to be missed by the speckers, and therefore is of no value to work afterwards.

There are three distinct classes of reefs about here; the first is the Lady Kintore line, which rises abruptly from the plains, forming a main ridge on the South-West side of the Cue hill; this reef is composed for the most part of a white, barren-looking quartz, and its course, like the Day Dawn, is not in one defined direction, but turns away to the Eastward at the Northern end.

The rocks about here are mostly of a schistose nature, with numerous diorite dykes; but more to the Westward the country consists entirely of a white, decomposed granite, in which the second class of reef is met with. These are of a white, glassy, hungry-looking quartz, with many cavities, which are usually filled with crystals of green foliated talc and coarse gold. Part of the lode is a decomposed green magnesian rock, which also carries gold.

These reefs are well defined, and have every appearance, as they are opened up, of being true, permanent veins; but they are different to anything that has been found before.

The other class of reef is of a blue color. These lie to the North-East of the Cue, but have not been developed enough yet to form any opinion about them.

The Lady Kintore.—This is a large reef, which forms one of the main hill ridges rising in two or three steep blows to a height of 50 or 60 feet above the surrounding level. It strikes in a South-South-West and North-North-East direction, but suddenly takes a sharp turn to the eastward at the northern end, where the reef is largest in size.

At the South-West end, where it is being worked, the reef is quite small, being only some 2 feet or so in width, but appears to be well formed, and has proved to carry gold in depth. The stone is white, often a little iron-stained, with brown bands, along which most of the gold is visible, whilst the country is soft, being composed of decomposed schists. This is a true vein, but its value will depend upon the quantity and richness of the stone.

O'Neil's and Jackson's are about $1\frac{1}{2}$ miles North-East of the Cue. They are small blue reefs, and show gold pretty freely, and are well worth prospecting.

Peard and Edwards, The Phoenix, Prendergast's, and the Harp of Erin are on a belt of white decomposed granite country. The quartz is quite white and of what would be considered a very barren character, but it shows gold freely. It also contains crystals of foliated talc, and the casing of the reef is also largely composed of this mineral. These reefs are all well formed, having good walls, are from 2 to 4 feet in width, dipping at an angle of from 30° to 70° . The country is soft, and easily worked, but stands so well that it will require but little timber. These reefs have been worked and made to pay up to the present by "dollying" the richest stone, but there is still lots of gold visible in the stone which is stacked for crushing. They are all of a promising character, and should pay well to work.

THE DEAD FINISH OR CUDDINGWARRA.

Ten miles due East of the Cue are a small patch of workings called the Dead Finish.

Mills and Townsend.—This is on a small reef which runs in a North-North-West and South-South-East direction, dipping to the East through broken yellow slaty country. This reef unites with a large ferruginous reef at the North end of the area. A very rich patch of alluvial gold was found here at the surface, on which this area was taken up, but no very rich stone has been found yet.

Perriman's.—This is on the same line of country, further to the Southward of the latter; the reef here has a more settled appearance, but still varies considerably in dip in different parts.

The German line.—In this line are several rich patches, which are being "dollied" to pay working expenses, and on some of these the miners are doing very well.

MULGA MULGA OR BIEREN.

A few miles North of Cuddingwarra, gold was discovered in the year 1888 by a man named Birk, but for some reason very little prospecting was done, or the rich patches of the Cue would have been found sooner.

The reef is small and not well defined, but shows fine gold in places in the stone at the surface, associated with a little copper pyrites, iron pyrites, and antimony.

THE NANGRANG HILLS.

In the early part of 1890 gold was discovered in a reef on a low range of hills, about five miles to the Eastward of Yuin station.

It is a large reef of bluish glassy quartz, with copper stains, striking East and West, and apparently dipping to the North, but going down nearly vertical as far as can be judged. The rocks, which are quartzite and mica slate with granite dykes and ironstone lodges, follow the same strike as the reefs.

There is plenty of good water, and from its nearness to the coast, much poorer stone will pay well here than at the other side of the field.

LAKE ANNEAN.

Between the Cue and Lake Annean, a distance of about 50 miles North, the country is mostly covered by the remains of the tableland formation, portions of which are still left standing on some small hills close to the North side of the Cue. This country is mostly covered with thickets, but it opens out in places into large salt, sandy flats or stoney plains around the bases of the one or two ridges of metamorphic rock which outcrop here and there between the two points. There is also a large patch of limestone country near the Milley Spring, at which place there is a nice little forest of white gum and morrell, which latter timber is of great value for mining purposes. Lake Annean is only shown on the map as a small round clay-pan, but in truth it extends for about seven miles South, consisting of a succession of sandy ridges and marshes, which are impassable after rain.

The main line of reef runs North from the lake up the spur of a rough ironstone ridge. It stands up in huge blows in places, and would, to anyone used to gold-mining in other parts of the world, present a very unpromising appearance. But in spite of the fact that gold rarely occurs near these great blows, patches were found along this reef, of great richness, and from holes a few feet in depth small fortunes were taken.

On sinking, these rich patches were lost, as the shoots dip to the north at such a slight angle, when it was supposed that the reef would prove to be barren in depth, but fortunately the sinking was continued to the water level, when the next rich shoot from the South was struck, and in driving at this level to the North-West the first shoots worked were again found. These rich shoots in the main line dip North at an angle of about 30° following the intersection for the most part of the ferruginous jaspery beds; besides these shoots of rich stone, the heavy bunches of rich stone, and the breaks in the reef, all follow the same dip as well as the striations on the walls.

The rocks are mostly schistose with hard bands of ferruginous jaspery quartzite; these strike North and South, dipping at a high angle to the Eastward, whilst the reefs strike a little to the East of North and dip a little to the West where they do not go down vertically.

The main line of reef is well defined for a considerable distance, following a true course with rich patches of gold occurring here and there along it, but at the North end, on the Mt. Hall area, it pinches out, and is lost at the surface, but is almost sure to be found in depth, as all the rich shoots are dipping this way. To the Southward, on the Connelly-Murchison area, the main reef begins to split and change in character, losing its very defined appearance; whilst South of this it splits and makes again, but nothing of any great value has been found along it here.

This reef, which is mostly white at the surface, is of a bluish color, and contains a little galena and pyrites in depth, and is altogether of a very promising appearance. It is decidedly a main fissure vein, and the rich shoots will most probably be found to go down for a considerable depth.

On the Westward side of the Nannine line, in the valley, are a series of reefs more or less on one parallel line with the first-named. They are evidently due to the lateral dislocation which took place when the main fissure was opened. Although following about one line there is nothing to show that they are one and the same reef; in fact, on the other hand, when attempts to trace them have been made they have always failed. They are in all probability a series, not one reef, and will be found to dip to the Northward, following the same lines as the Nannine.

On the Eastward side of the main line are also some more reefs, but, like those to the Westward, they cannot be traced for any distance; but on all those on which gold has been found the rich stone should be followed rather than spending money in sinking shafts to cut the reef where it is not.

A very rich patch of alluvium workings were on an island to the Southward on this same line, and several other rich patches of surfacing were also found on both sides of the main ridge.

There is plenty of fresh water on this field, and timber within a reasonable distance. The only drawback to the water is that it will in all probability become slightly brackish when heavily drawn upon, particularly towards the end of the summer.

Mount Hall.—This is held as a protection area at present, being 400 square yards.

A shaft was sunk 70ft. on what was supposed to be the course of the Nannine reef, but no stone was struck. Several trenches were also cut, in which a well-defined but small body of stone was struck, which is evidently the Northern extension of the Nannine reef thrown off its course, but it is poor in gold. Northward, this reef, which is so well formed to the Southward, is entirely lost.

At the West side of this area a shaft has been sunk 35ft., with a drive at the bottom 100ft. long, running in a North-West and South-East direction, but nothing but a few ferruginous leaders have as yet been struck.

The work on the small reef, which is the same reef as worked on the Nannine should be continued, as all the shoots of gold dip in a Northerly direction; therefore the rich shoot struck in McPherson's shaft should be struck in depth on this area.

The work at the Western side should be abandoned, as there is nothing to indicate that the Caledonian reef runs into this area. A very great deal of work has been done on this area, which it is a great pity should go unrewarded; therefore it is to be hoped that they will devote their resources to develop that portion of this area where they have the greatest prospect of success.

The Nannine is next to the Southward of the Mount Hall. At the surface it consists of a series of large quartz blows, with some very rich patches. These patches, on opening it up, proved to be rich shoots, which dip at an angle of 30° North. The reef strikes North-North-East and South-South-West, dipping mostly vertically, but sometimes slightly to the West; the stone is mostly white or iron-stained at the surface, but becomes bluer in character as it goes down, and also contains galena at the water level. It is well defined, of good size, and carries gold well through the stone, and is a true lode, therefore it should be a very payable mine. The country is mostly talcose and schist, with bands of ironstone striking North and South, with a dip at a high angle to the Eastward. There is also abundance of fresh water in the mine itself, which is a great point in the successful development of this property.

The Royalist is a small area joining the Nannine on the South side, and on it the same line of reef is being worked, which presents all the same characters as the last mentioned. There was a very rich patch of stone discovered at the surface, and at the water level a rich shoot of stone has been struck at the South end of the drive, which is probably the same shoot as was opened up at the surface on the next area to the South. This is also beyond doubt a good permanent reef, and should pay handsomely.

The Connelly-Murchison and *Robinson-Murchison* are the next further North. These areas, with the Caledonian, Queen of the Lake, and the Murchison South, are all being worked by one company under the name of the Murchison Consolidated. This reef is the same as worked on the Nannine, and presents all the same characters except at the South end, where it splits up, one or two small veins striking off with the country, and from this point the reef is poor in gold.

There are several rich shoots which have been tested down to the water level, and these follow just the same dip as the Nannine. This property is like the two preceding, undoubtedly good, and should pay well to work.

The Home Rule, Murchison South, and Star of the South come next on this line, but nothing sensational has yet been discovered on them. The lode splits up into several reefs, particularly at the extreme South end, and, although there is one continuous line of large blows, these are mostly barren.

Du Boulay's is on what is supposed to be the Northern extension of the Caledonian line, but as this line is so broken and cannot be traced for a considerable

distance, it is not at all probable that it is one line. On this area there were good prospects at the surface, but the stone pinched so in depth that it would not pay to work.

Watt's is next further South, on about the same line as the last. It is similar in all respects to it, as large blows outcrop here and there along the line of reef, whilst between these it pinches to almost nothing.

The Caledonian Extended is being worked to open up the Caledonian reef, which has been traced for a short distance into this area, but then is lost.

The Caledonian is the area which gives its name to this line, owing to very rich stone having been found on it at the junction of two reefs. It has been opened up in several places along its cap, and seems to be a well-formed reef of good size, and carries a fair quantity of gold, but it is only particularly rich at the one point. This reef can be traced into the claim to the North, but cannot be traced South, so it appears to be a reef of no great outcrop length, and therefore cannot be depended on to go down. On the next area South the reef was never cut, but on *Pearl's*, *Ramsey's* and *Barrett's* reefs have been struck, which follow much the same course, but there does not appear to be a defined line of reef, but a series of small ones which follow generally the main Nannine line, being in fact parallel fissures caused by the strain which caused the main fault, but these latter do not run as one vein for any distance.

Of these *Barrett's* is very promising, there being a large body of stone which shows gold freely, and the reef has a very settled character.

The Queen of the Lake is about $1\frac{1}{2}$ miles North-East of the Nannine; the reef runs in a North-East and South-West direction, when opened up underlying to the North-West. It varies in width from 2 to 6 feet, and where opened has a well-formed character, showing gold freely in the stone. This reef is sufficiently good to work on this area, but it cannot be traced on to the adjoining claim.

GARDNER'S.

Gardner's find is situated near the Yagahong, a hill about 20 miles East of Lake Anneen here; the gold appears to have been quite accidentally found by a party who had lost their way in a thicket. The reef does not out-crop at the surface, and there are no rocks visible, the whole being capped by a white deposit called "opaline" on the Murchison. This deposit generally consists of either gypsum and sand or magnesia, and is often very hard; it is deposited by the action of water which is in most cases found in close proximity, but this locality proved the exception to the rule.

The Star of the East.—The reef here strikes East and West, but it has at present no true formation, consisting of a broken mass of country with bunches of quartz about eight feet wide, the whole of which is rich in gold, but better formation will in all probability be met with below the water level, which is here about 60 feet from the surface. The reef has been traced for a considerable distance at the surface, carrying gold all the way, but it seems to be lost or splits in the adjoining claims. This might easily be determined by removing the cap from the last hole on the *Star of the East* on to the next claim, and in spite of the hardness of the cement cap, this would be found the cheapest way in the long run.

The stone is brownish and whitish quartz, intermixed with a certain amount of broken country and casing, measuring together about 8ft. in width, which carries a large quantity of fine gold all the way down to the water level, which is 59 feet here. This lode strikes in an East and West direction, dipping nearly vertical, or a little to the Southward. It has, at present, no defined formation, but can be traced for a considerable distance along the surface. It is of a very different character to any other stone on the field, and although no showy specimens are found the stone is extremely rich, as it carries fine gold all through. The country is very decomposed and much broken near the lode, but this will probably greatly improve in depth. Gold has been found all along the outcrop of the lode from one end of the area to the other; therefore, considering the size of the lode, the richness of the stone and length that it carries gold, it may be considered as a very valuable property.

The John Bull and Grand Old Man.—These two areas join this one at either end, and are now engaged in prospecting.

QUIN'S.

Quin's is about 12 miles South near Nowthanna, the country between the two points being mostly loamy without outcrops of rock.

At Quin's some low rough ranges of metamorphic rock rise from the plain, which, for a considerable distance from them, is strewn with stones.

The reefs here are mostly large and very ferruginous; in fact in some cases, would be better described as iron lodes. These of course, although consisting of hæmatite at the surface, will make into pyrites in depth, which will be more troublesome to work; therefore, only those reefs which are very rich will be worth working after they cease to pay the prospectors to do so by hand.

Some of the gullies in those hills proved very rich in alluvial gold, and were easily worked, as the gold was found in a defined gutter, but up to the present no reefs along these gullies have been found which were rich enough to work.

The Sir Garnet is a large lode mostly composed of hematite, in which there are some bunches of quartz which show gold freely. This hematite is the result of the decomposition of sulphides, which will be met with in depth. Considering the richness of the stone, length of outcrop, and size of lode, this mine should pay.

The Premier is also on a large ironstone lode, but seems to carry the gold only in small veins, on the extent of which will depend the value of the mine.

There are several other reefs being prospected, but on these very little can be said at present.

THE WELD RANGE.

Wilgie Myah.—In the Weld Range is situated the celebrated Wilgie Myah, which is certainly one of the most striking things that is to be seen in this Colony.

It is probably one of the largest iron lodes in the world, consisting almost entirely of hæmatite, which at the surface and in the cavities assumes the botryoidal form, which has given rise to the idea that it is a lava flood.

It is situated on the East side of the Weld Range, and runs East and West, dipping North, following the main strike of the rock.

In these lodes there are soft bands, often clayey. These the kangaroos scratch out, forming caves, and it is probably in this way that the natives first made the discovery that this lode could be easily worked by following these beds.

It has now been opened up, as a huge pit or quarry, to a depth of about 100 feet. This is entered near the top of a hill (about 70 or 80 feet above the plain) by a hole about 50 feet across; then a steep descent commences over the talus in a South-Easterly direction. At the bottom it spreads out to about 50 yards wide, with the roof some 50 feet above, and numerous cave-like galleries running into the face in all directions.

The Wilgie is worked by cutting round a mass of it, then wedging it off. This work, although very primitive, is very interesting, as these natives work with their wooden tools much in the same way that the ancient miners did in Great Britain with stone hammers. There are also rude attempts at staging, to allow the miners to work up into the roof, when veins of sufficiently good quality run that way.

In contemplating this pit, one is struck by the vastness of the work, and when we consider the small quantity of Wilgie that can be required, it must have been worked for centuries. Of course it was worked on a much larger scale before the white invasion of Western Australia, and was probably traded great distances.

As far as the lode itself is concerned, it is most magnificent iron ore, and, considering its size, will, without doubt, be of great value in the future.

It has been generally supposed that cinnabar existed here, associated with volcanic rocks; but there is nothing of the sort, the Wilgie itself being red hæmatite and red and yellow ochre.

CONCLUSION.

This field, taken as a whole, is exceedingly rich, and will in all probability be found to extend for a great distance to the Eastward, but there is no prospect of it extending far to the Westward owing to the belt of granite country.

Water is abundant and at shallow depths, as the Murchison district is celebrated for this.

Timber for mining purposes is one drawback, for except at the North end of the field there is nothing but scrubby mulga and snakewood, which latter is too crooked even to burn.

The roads are in a fearful condition, owing to the heavy carting in the wet weather, and the invasion of the celebrated Murchison roads by the one-horse fiend.

Everything considered, this find has a brighter outlook than any other in the Colony, owing to the fact that it has neither the distance to Kimberley, nor the salt water of Yilgarn to contend with. Pilbarra and the Ashburton have neither proved yet to be large reefing districts, so need not be mentioned.

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