To
Alfred R. C. Selwyn Esqre
with the Author's
kindest regards.

28th Augt. 1860.

C. Davis ...
... 3/65.
...
1911.

RESEARCHES

IN THE

SOUTHERN GOLD FIELDS

OF

NEW SOUTH WALES:

BY

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HON. MEMBER OF THE NEW ZEALAND SOCIETY,

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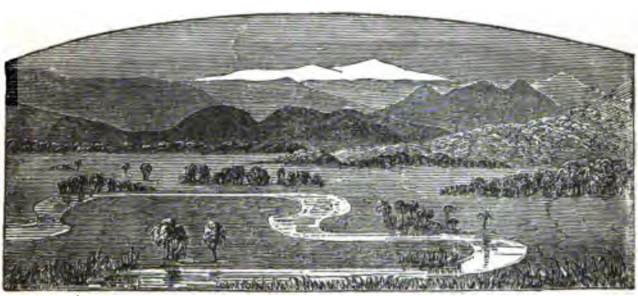
&c &c. &c.



SYDNEY:

READING AND WELLBANK,

BRIDGE STREET

1860.

TO

HIS EXCELLENCY

COL. SIR W. T. DENISON, R.E., K.C.B, F.R.S., &c.,

Governor-General of Australia.

TO

THE HONORABLE SIR W. W. BURTON, KNIGHT,

President of the Legislative Council;

TO

THE HONORABLE T. A. MURRAY, ESQ.,

Speaker of the Legislative Assembly;

TO

THE HONORABLE THE MEMBERS OF THE LEGISLATIVE COUNCIL,

And to

THE MEMBERS OF THE LEGISLATIVE ASSEMBLY,

The following pages are dedicated,

By their obedient humble Servant,

THE AUTHOR.

PREFACE.

THERE are many circumstances which induce me to regret the necessity of putting forth so imperfect a publication as the present, on the geology of so extensive a region. But I have had no alternative. The little leisure of only seven weeks, amply occupied by constant and wearying duties, has been allowed me to meet the demands of those who have earnestly desired and pressingly urged the re-issue of the Reports which I presented to the Government, in order to supply some information to persons thronging to the Alpine region, the auriferous capabilities of which were first made known in those Reports.

It is not to be supposed, that in introducing so many geological details, the subject is exhausted. A considerable quantity of my notes in the field, has not been at all employed. Should I ever be enabled to realise my desire, of describing the Colony in a more definite manner, they will find their appropriate place hereafter.

Had time allowed, I would have endeavoured to supply, so far as the want of a complete topographical survey would permit, a geological map and sections, without which the book is compelled to be now issued from the press. This defect, however, cannot be remedied. Maps and sections are not made in Australia without great difficulty and prolonged labour. The map appended to this volume will point out all the localities known to me in which gold, in the region covered by the map, has been found; but I wish it clearly to be understood, that that is the sole object of the indications. With the extent of auriferous soil or rock, or with the probable richness of any of the localities, the map is, in no wise, concerned.

I present what I have been able to accomplish, in the incorporation of my Reports with much additional new matter and a variety of useful information subordinate to it, in the form of letters and extracts which I have not had leisure to condense, and, therefore, am obliged to reprint from the originals, in the hope, that, whilst the general observer may derive some geological knowledge from the perusal of these pages, the gold-producer may also obtain some assistance in his pursuits.

I have endeavoured, by frequent references, to make the various portions of the volume illustrate each other.

The personal style of communication, is almost inseparable from such a work as this, and I have been obliged to speak of myself much more than I desired. Gladly would I have avoided it; but the candid reader will admit the necessity, when he has gone through the whole. In addition to its chief object, this book furnishes a vindication of the honesty of its author.

It was originally intended to print nothing more than could be sold at a very trifling charge; but the volume has grown beyond its proposed limits, in order to be more effective; and the increased cost of it will now scarcely pay the mere expense of publication. So far as the *author* is concerned, it is, *literally*, and without any metaphor, *given to the public*. The publishers and myself have taken more than ordinary pains to free it from typographical errors; but a few have crept in, especially in Report XII., (part I. of which is wrongly printed as XI.) These the reader is requested to pardon and correct.

I have only, in conclusion, to express a hope, that persons who are not so unreasonable as to neglect warnings, but, who are still anxious, before October to rush into the risks of migration to the Alps, may find, in Chapter XIV., sufficient information to cause them to suspend their journey till the Spring.

Parsonage, St. Leonard's,
28th August, 1860.

CONTENTS.

CONTENTS OF THE APPENDIX.

THE SOUTHERN GOLD FIELDS.

CHAPTER I.

INTRODUCTORY.

STRICTLY speaking there is no Gold Field *South* of Sydney, except it be at the bottom of the sea;—the term Southern is, therefore, used to designate the Gold Fields in the Southern parts of the Colony of New South Wales; and as defined in the following memorandum, which was drawn up by me in November, 1854, at the time of the Sydney Exhibition, preparatory to that of Paris in 1855, and which was published in the Descriptive Catalogue, entitled "*Products of New South Wales*," they embrace the districts there mentioned under the heads of "Southern" and "South Western," as well as those portions of country along the Alps and on the borders of Victoria, which, though proved auriferous by me in 1851 and 1852, had been only partially worked in 1854, especially such as are included in the fourth section of that memorandum.

THE GOLD FIELDS.

Without any attempt at comprising, within the insufficient limits of a brief notice, an extended view of the important topics connected with this subject, it is thought advisable by the Commission to introduce the following Sections of certain Gold Fields, with a few remarks illustrative of the geological distribution of the chief sources of Gold in this Colony.

With reference to the capital of the Colony, the Auriferous Region may be divided into four Districts; namely, 1, The Southern; 2, The South-Western; 3, The Western; and 4, The Northern District.

1. The Southern is chiefly confined to the basin of the Shoalhaven River, between the parallels of 35 degrees and 36 degrees South, on the *Eastern side* of what is sometimes called "The Coast Range." The whole of the affluents of this River, from east and west, supply more or less Gold; and the rich Gold Fields of Araluen are, although on the head of the Moruya River, only separated from the waters flowing to the Shoalhaven by a distance of less than three miles. The principal north-flowing streams of the county of St. Vincent, which join the Shoalhaven, are also auriferous. The Gold is found, chiefly, within that part of the county, which exhibits the presence of abundant hornblendic granite and associated metamorphic schists.

2. The South-Western District embraces the north-flowing affluents of the Murrumbidgee between the Coast Range and the meridian of 147 degrees east, and also between the parallels of 35 degrees and 36 degrees. Coupled with the preceding district, we thus have an area of nearly 4000 square miles in which Gold is generally scattered in the soil; and in which, the Yass River is known to contain much Gold, and the Adelong River has been worked for a space of nearly 30 miles from its source to its junction with the Murrumbidgee. Although, at present, other affluents in this District have not been worked, it is not doubted that they would be found equally rich. The specimens from the Adelong diggings show that the principal rocks are igneous. The conspectus of that field is interesting, as exhibiting a relative proportion between the distances from the head of the creek, and the amount of Gold procurable.

3. The Western District comprises the Abercrombie, and some other heads of the Lachlan River, together with the Turon, the Pyramul, the Meroo, the Cudgegong, Lewis Ponds, and various other affluents of the Macquarie River; the area being not much less than 9000 square miles—in which occur various rich and extensive Fields. There is every reason to believe, that other localities besides those now worked in this District, will be hereafter proved to be equally prolific. The writer has examined the detritus of the basin of the upper Bogan River, and finds that it is rich in the peculiar minerals which distinguish the known gold fields; and amongst them he found Gold, as well as Tin and magnetic Iron.

4. The Northern District may be considered as embra-

cing, 1st, the Gold Fields along the Peel, the Macdonald and other sources of the Namoi; 2nd, that along the Uralla, or Rocky River; and 3rd, that along the Bingera Creek—the two latter being the upper portion and one main affluent of the Gwydir River. In this District there is an area of about 5000 square miles, in which Gold has been found distributed in a great variety of places; and in which it is prolific at the head of the Peel, on the Uralla, and for fifteen miles along the Bingera and neighbouring creeks. These waters, their dividing ranges, and the strike of the formations, run all nearly N.W. or about N. 30 degrees W. The chief auriferous region lies along the 151st meridian, and between the parallels of 32 degrees and 29 degrees S. The gold of the Uralla is found over, and in the detritus of, hornblendic granite; that of the Hanging Rock and Peel, as well as that of Bingera, is associated with the transmuted members of the base of the Upper, or the top of the Middle Palæozoic Groups, with which Serpentine, charged with Chromate of Iron, is in close connection, and which have been, doubtless affected by Diorite or Greenstone.

Besides these Fields which are being worked, there is a District more northerly than they, along the 152nd meridian, and between the parallels of 30 degrees and 29 degrees S., and which is watered by the north-flowing heads of the northern branch of the Clarence River, but which has not yet been wrought, except experimentally. owing to the abundance of water. This District comprises the country about Mount Mitchell and the Timbarra; and the Gold is found in association with granite, of the same character as that which constitutes the principal formation on the other "Rocky River," or Uralla, near Armidale. From 1000 to 1200 square miles in this District may be considered as exhibiting the presence of Gold, associated, as in other granite regions, with garnets, sapphires, and tin ore.

In the more southern counties of Maneero, between the parallels of 36 degrees and 37 degrees S., and between the Alps and the Coast Range, and for half a degree on each side of the 149th meridian, there are also minor Gold Fields not yet worked, along the Deleget and Bendoc Rivers, which flow north to the Snowy River; on the Eucumbene, which is the chief branch of that River; and on the various waters, flowing from the western side of the Coast Range to the Upper Murrumbidgee, as well as from the eastern side of that range to the coast of the County of Dampier. There are also little tracts auriferous, on the waters of the Macintyre River; the Condamine; the Brisbane; the Mary; the Burnett, and the Fitzroy, at the Back of Port Curtis. These are mentioned to show that Gold is dispersed in some quantity over all the older portions of the Colony, throughout *thirteen* degrees of *latitude* and *four and a half* degrees of *longitude*, or more than 200,000 square miles of country. But the chief productive sources, at present known, are on Lewis Ponds Creek, (as Ophir); the Turon, (as Oaky Creek and near Sofala), at Tambaroura; Pyramul; Louisa Creek; the Meroo and its tributaries; Burrendong and Muckerwa; at Tuena, on the Abercrombie (all to the westward of Sydney);—at Araluen, on the Moruya; and at the Mongarlow, a tributary of the Shoalhaven:—at Adelong, a tributary of the Murrumbidgee:—at Hanging Rock, and for some miles below, on the Peel:—at the Uralla, which is at the head of the Gwydir; and at Bingera, which is an affluent to that river.

No mention has been made of the Tumut, the "Crack-em-back," or the Wollondilly; but Gold is known to exist in these rivers, and has been procured by various persons, as well as in other places not alluded to. To complete the statement respecting the almost universal occurrence of Gold, it may be mentioned here that it has within a few weeks been found in Gipps' Land, so low down as the crossing place of the Tambo River, and at the tidal junction with the water of Lake King, within less than 25 miles of the sea.

Without, therefore, wishing to assume that all parts of the country are equally rich, or to raise expectations which may never be realized, it may fairly be stated that, when considered in relation with the known Gold Fields of Victoria, with which there is a clear connection along the Alps, the whole of the region of "Australia Felix" and New South Wales Proper is auriferous towards the sources of the great rivers flowing in the basins of the Murray and Darling; and that some of the region also is auriferous, which lies to the sea-ward of the mountain chains whence those waters rise. It is worthy of remark, that the waters which flow *northerly* or *north-westerly* are almost invariably found to traverse the principal tracts of auriferous country.

Sir T. L. Mitchell and Mr. Stutchbury have reported to the Government on the Western Gold Fields; and the Rev. W. B. Clarke has reported on the Northern and Southern Districts, and generally on the geology of about 108,000 square miles of territory.

Previous to the year 1851, the Southern districts had gained my attention, and by aid of persons in communication with me, and who at my charges carried on researches in parts of the country to which my own opportunities did not then extend, and who forwarded to me their collections for examination and comparison, I was enabled to come to conclusions on the structure and metalliferous character of the Southern country, which enabled me to point out localities as auriferous which have since been found abundantly prolific in gold.

My chief ally in this work was Mr. Hero W. Nichols, at that time residing on the Murrumbidgee, but who now has returned to his family in the United States. The services which were rendered by this gentleman in collecting, reporting, and following out carefully my directions as to the Geology and Mineralogy of the country between the head of the Murrumbidgee and the junction with the Coodradigbee, as well as in other parts of the colony in which he was occupied for several years, deserve this remembrance at my hands; and I have great pleasure in thus recording my sense of the value of his services, for, in following afterwards his traces through a part of the Murrumbidgee and Maneero country, I found his geological observations perfectly correct. Mr. Nichols did not however, actually, find gold. But in 1849 a gold specimen was reported to me by Mr. Charles M'Arthur, as having been found at Nackie Nackie.

It was in this way, combining my own researches with those of others employed by me and carefully studying the results, that I was prepared when the time came for it to point out how far the Gold-fields extended to the southwest, and in what meridian in New South Wales, the probability was greatest of auriferous wealth. There can be no impropriety in thus explaining further how in the month of June, 1851, the following indications were published of gold regions, which by personal investigation and private assistance during my official explorations in that and the following year were fully proved, as will be exhibited in extracts from the Reports made to the Government.

The results of Strzelecki's researches in the Alpine country, so far as gold is concerned, were confined to the discovery of a specimen of auriferous pyrites in 1839, in the Vale of Clwydd, which he declared to be without commercial value, and which was considered by him as undeserving of commemoration in his work, "Physical Description of New South Wales and Van Dieman's Land," published in 1845; but he made no discoveries of gold in the southern districts. He has, however, left his opinion on record, in letters never published till 1852, that he believed some portions of the colony to be auriferous.

(1.) "It is not necessary now to detail the careful processes by which the author had convinced himself that gold must exist in "considerable abundance," and that it would be found along the 149th meridian, to which he recommended, in 1850, the then expected Geologist (the late Mr. Stutchbury,) to be sent; nor is it necessary, to the vindication of scientific claims, to draw any comparison between his own convictions and the experience of others." —*(Plain Statements, by Rev. W. B. Clarke, M.A., Sydney, 1851, p. 6.)*

(2.) "As *New Guinea* is also geographically connected with Australia, and as New Caledonia and *New Zealand* are evidently merely outlying summits of the great submerged land, of which the Australian Cordillera is the main parallel, the older rocks of all these countries being identical, there can be little doubt that, hereafter, those islands will be added to the list of auriferous countries."—*(id. p.* 10.*)*

These indications were not long unproved. In Mr. Macgillivray's Narrative of the Voyage of H.M.S. Rattlesnake, which was not published till 1852, occurs the following passage:—"That gold exists in the western and northern portions of New Guinea has long been known, that it exists *also on the south eastern shores of that great island is equally true*, as a specimen of pottery procured at Redscar Bay, contained a few small laminar grains of this precious metal. The clay in which the gold is embedded was probably part of the great alluvial deposit on the banks of the rivers, the mouths of which we saw in that neighbourhood, doubtless originating in the high mountains behind, part of the Owen Stanley Range.—*(Vol. II., p. 69.)*

As to New Zealand, the New Zealand correspondent of the *London Illustrated News* thus describes the commencement of gold diggings there, and gives a good engraving of the diggings at Kapunga, in the number for December 3rd, 1853, p. 465. "The New Zealand settlers were first led to search for gold in their country by *an opinion of the Rev. W. B. Clarke*, the Government Mineralogist in New South Wales, *expressed in the Geological Reports of that gentleman* on *the Australian Gold Fields*, and which was to the effect, that a similar geological formation to that of the auriferous mountains at California, and of Bathurst, N. S. Wales, might be expected to exist in the principal mountain ranges, extending in a direction north and south in New Caledonia and New Zealand."

"*About the month of June*, 1852, some specimens of quartz, from the vicinity of Wellington, Cook's Straits, were transmitted to Mr. Clarke, and were found by him to contain gold."

The facts themselves are correct, but the reference should have been to my pamphlet of June, 1851, as well as to my Reports.

(3.) "There may be a recurrence of certain formations on different meridians parallel to each other, and thus, then, in Australia, the very same rocks that can be found fertile in metals along the 149th meridian, may be also fertile on the 152nd, and thus also Gold ought to be found, if at all, in the province of Victoria between 143° and 145°, north and south of 37° south latitude; and in Tasmania, in 146° east and 42° south latitude.—(*Plain Statements, &c., page* 12.)

(4.) As a guide to such as can decipher the equivalents, it may be stated, that . . . such rocks occur south of the present Ophir works, about and between the 35th and 36th parallels of latitude, where, therefore, gold may be expected."—(*id. page* 16.)

(5.) "It has been suggested to the Government . . . . that the 149th meridian passes through a rich metalliferous region and where schists traversed by quartz rock, and which have been *transmuted* by igneous rocks, occur, are localities in which creeks running laterally into waters falling north should be examined. It is also stated that south of Bowning the main creeks run south into the Murrumbidgee, and from the lofty summits of the Alps creeks run north to the Murrumbidgee, which deserve attention; and the heads of the Tumut and Coodradigbee, Tarcutta, Yeven Yeven, Adelong,* &c., are mentioned as likely places to supply gold. The whole 149th meridian indeed ought to be examined."—(*Instructions to Mr. Hargraves by the Hon. E. Deas Thomson, Esq.*, 10*th June*, 1851.)

These indications have all been verified to the letter.

The 149th meridian, not, of course, meaning thereby a *mere line upon the map*, but some of the country between the 148th and the 150th meridian, and near to that meridian, has been found already to run through a rich metalliferous region. Within 20 miles of it to the East, we have the Tuena gold field, and 20 miles to the West the Eucumbene field, whilst the line itself cuts through the Deleget and Bendoc gold fields, not to mention the minor localities; and especially between 35° and 36° we have numerous gold localities. In like manner the 152nd meridian itself runs close to the line of the Clarence River gold fields from Tooloom to Oban; and the localities marked in Victoria between 143° and 145° E. North and South of 37° S. turned out, four months after the statement was made, to be the rich gold fields of Bendigo and Castlemaine.

If in Tasmania the locality indicated has not been found prolific, this is yet the fact, that on that meridian and within no great distance from the parallel of 42° S., Mr. Gunn and other explorers have found an auriferous region, and the gold when compared by me with that I obtained from Umeralla and Mitta Mitta, can hardly be distinguished from it.

As to the heads of the Turon, and Coodradigbee, and the other Creeks, mentioned in the "Instructions" of June, 1851, all of these have also turned out as was expected.

It is not vanity, nor any desire to over-estimate the fact which induces this summary of indications made before any of the gold fields indicated had been worked; but it is due to myself to show, that when I stated these things, I was merely giving the results of previous study

* Adelong is introduced because it was in the original Manuscript which I wrote at the Colonial Secretary's request, and at his table, in presence of Mr. Hargraves.

and research, and that as in the Northern and Western, so in the Southern districts, I had long before, as I pointed out by my collections, maps, and MSS. to Mr. Hargraves on 11th June, 1851, become acquainted with the auriferous localities.

When in the month of August of that year, the Government did me the honor of accepting my services, I was directed to go in the first instance to the north; but, in a personal interview with Sir Charles Fitzroy, on the 28th of that month, I laid before His Excellency an account of the auriferous indications of the Yass district, exhibiting 16 or 17 grains of gold, and suggesting, that it would suit my own wishes better to explore the Southern districts. I was directed so to do, and the results of my exploration are stated in the Reports that follow. As in setting out for the southern districts, I produced proofs of their character by the report on Yass, so on my return I had the pleasure of first communicating to His Excellency the discoveries made just before upon the Ovens.

It was, therefore, not a mere accident which directed me in the first instance to the southward, but a settled conviction, which will in a few months establish itself in the minds of all, that in the localities before indicated, and especially along the Snowy River basin, there exists an enormous amount of mineral wealth.

Whatever there may be of necessity to set myself right, with respect to the jealousy of those who would fain place the clearest and most positive local indications before hand, below the level of a broad and sweeping generalization made in England, which, wherever verified, would be equally applicable, and which would tend to undervalue the labours, fatigues, and ingenuities of actual research in the field; or of others whose claim to notoriety is accident, and not altogether of a creditable character,—I shall find opportunity in the Appendix of clearly proving.

It will be sufficient to point out in this place, that in printing the Reports presented to the Government, my object is to assist the multitude who are about to commence the search for gold in the Southern districts. But little alteration has been made in any of them: nevertheless, as they were written in camp after the exertions of the field, they contain but a summary of facts, and, therefore, where it is needed, I have illustrated and supplemented the published documents by additional matter from my M.S. notes. New passages are in Brackets, thus [ ]

It was not my intention originally to publish any work of this kind till *ten years* had elapsed from 1851, because I wished my Reports to have the fullest verification. Circumstances with which I have had no connection and over which I have had no control, and the excitement that has been created by the disclosures made on the Ranges at the heads of the Tumut and Snowy River, have hurried me onwards; and I am, therefore, compelled to do imperfectly what I wished to do deliberately, even some months before the intended time. Nevertheless, it is in the design of meeting the wishes of numbers who have requested this work at my hands, that, in deference to them, but not altogether satisfying myself, I now lay before them what I have to say on the Geological structure and Auriferous importance of the Southern districts.

CHAPTER II.

SHOALHAVEN & ARALUEN GOLD FIELDS.

REPORTS *to the* HONORABLE THE COLONIAL SECRETARY.

No. I.

Bungonia, 20th September, 1851.

I have the honor of communicating to you, for the information of His Excellency the Governor-General, the progress made in the geological exploration of the country, since my departure from Sydney, on the 12th instant.

Believing it to be the wish of His Excellency that my researches should be conducted on a regular plan, I considered it right to commence my operations where my former private survey of the country in the southern districts terminated.

I therefore took my departure from Marulan, and have devoted the present week to a careful examination of the creeks and ranges lying between that place, Jacqua Creek, and the Shoalhaven River, having in view an enquiry into the probable auriferous character of that district.

In the neighbourhood of Marulan the principal rocks are porphyritic, supporting masses of conglomerate and sandstone, which have been hardened at the planes of contact and much disturbed. The base of the porphyritic rocks is a petro-silex, and abundance of hornblende is mixed with the felspar. In some cases the base is so predominant as to give the rock the character of a cornean; in others the admission of small quantities of mica gives it a granitic constitution. In this phase it occurs near Glenrock, where also it passes into syenite. A few miles east of Marulan this rock is flanked by limestone, inclined at a very high angle, the contact with the igneous rock being marked by the occurrence of a thick band of quartz rock. The limestone is intersected also by quartz rock and a rich ore of iron, which occurs in bands also. The dip of these rocks is from 52° to 62° N.N.W., and the first mass of limestone has its summit 289 feet below Marulan (by my barometrical measurement.) Marulan itself is more than 2,000 feet above the sea; by former calculations I made it 2,058 feet. The porphyry on which the church stands is 2,104 feet (by the same calculation) above the sea.

The presence of quartz rock in all the other rocks named above, is very remarkable. The porphyry is itself studded by rounded grains of crystalline quartz, which sometimes is almost predominant; and veins of quartz, perfectly white and opaque, run through the porphyritic rocks with the exception of the concretionary syenitic granite of Glenrock. I do not find that this quartz is auriferous, but the country is strewn with fragments of quartz, and these are so abundant as to attract the attention of the most unobservant. They are seldom rounded, and by their distinct rectilinear forms show that they have been broken up from intersecting bands and veins.

I made a journey to the gullies running into the Shoalhaven, a little below Glenrock Creek.

In crossing the ridges I found the limestone passing into statuary marble, white and crystalline, just where it comes into contact with slate; having between itself and the latter, a thick mass of quartzite, and a little distance above the point of contact a band of ironstone. Just in advance, towards the east of this junction, schistose rocks, interstratified by grey quartzite, make their appearance; they are reddish, grey, and blue in color, but very soft, except in the lower parts of the creeks, where the stratification is seen to advantage, and they obtain considerable hardness. The descent of the spurs between the creeks is very steep and laborious, owing to the crumbling nature of the slate. The whole of the detritus is local.

I did not, on this occasion, descend to the Shoalhaven, the day being too far advanced, and there being in sight, from the spot whence the river could be distinctly seen, no gold-diggers at work.

The dip of the rocks, after passing the marble, became reversed, being to E. S. E., at an angle of 52°.

Many of the creeks have been prospected, but without success.

I next proceeded to examine the range of sandstone, and conglomerate, running from Mount Otway, whence building stone is procured, across the bush towards the limestone previously mentioned, and upon which, and upon the syenitic knolls, outliers repose in advance of the main range. These outliers are frequently thrown off from the igneous masses, at an angle of 50° to the west. The latter have transmuted the former.

Between Marulan and this place similar accidents have occurred, the general level of the country falling somewhat, and the porphyritic, as well as other rocks, being covered by a vast detritus of broken up conglomerates and quartzites.

On the road to Goulburn, at Collins' Flat, whence the waters of Bungonia Creek are drained, the porphyry, which is intersected by quartz rock of considerable whiteness, and at the point of intrusion is decomposed, throws off thick beds of fossiliferous limestone, supporting fossiliferous sandstones and conglomerates at an angle varying from 19° to 28°, having a westerly dip. [These beds appear by the fossils to be of the age of the upper part of the lower Silurian formation.] The abundance of water all round this range is due to the contact of the two formations; the height of this swampy flat is about 1,880 feet above the level of the sea.

The limestone of this range is repeated at the head of Jerrara Creek, which takes its rise in the Mount Marulan

Range, on the spurs of which quartz occurs in great abundance, together with some limestone and slate.

In the neighbourhood of Lumley and Inverary I found, for the first time, on this journey, a basaltic rock. The trap* there forms a high and tolerable level range, having at Jacqua, on one flank, a mass of conglomerate and sandstone, much distorted and broken, and dipping to W.N.W., at angles varying from 54° to 65°, and on the other, at Inverary Quarry, a hard, yellowish, fine sandstone, dipping 68° to E.S.E.

The intrusion of the trap has produced metamorphic results, and in one place a singular magnetic pisolitic iron ore with a mixture of black unmagnetic ore in particles not larger than a pea, which are cemented by various crystallized minerals.

Iron is a prevalent metal in these rocks, but a few miles to the westward copper ore occurs in more or less abundance.

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*[It is well to define here what is meant by the terms *trap* and *trappean*. Some continental geologists refining to excess, in their discriminations of igneous rocks of a certain class, have assigned to the terms in question, a specific meaning which English geologists have been slow to adopt. I will give two definitions, the former from the Manual of Geology of my friend J. Beete Jukes, Esq., M.A., F.R.S. "The term . . . . . has often been vaguely used to designate any igneous rocks which could not be said to be distinctly granitic on the one hand, or absolutely volcanic on the other. In this vague and general sense, I shall here use it, its very vagueness being its recommendation, as best adapted to receive a class of rocks, that do not admit of any strict definition or circumscription."—p. 69.

Another definition is thus given :—

"TRAPP, eine altere und sehr unbestimmte, jetzt eigentlich nur noch von englischen Geologen angewendete Bezeichnung fur dichte und dunkelfarbige Eruptivgesteine."—(COTTA. *Leitfaden und Vademecum* der *Geognosie*.—p. 268.

This latter definition I give for the benefit of a Mr. Zachariæ, and any of his followers, who may be inclined to fall into the 'trap,' set for them by English geologists. Cotta's words will convince them, that there is, necessarily, no geological blunder in the use of the terms alluded to, but that they are used purposely. When I was at Sandhurst in February last, with Mr. Selwyn, Dr. Hutchinson of that place, put into our hands some letters which Mr. Zachariæ had published in one of the Bendigo papers, in which he found great fault with Sir Roderick Murchison, Mr. Selwyn and myself, for errors he assumed we had all in different ways committed in geological discussions relating to Australia. He accused me of using the word *trap* improperly, because I used it in agreement with the sense adopted by English Geologists; insinuating

From Inverary I made a visit to the Shoalhaven River, passing the night in an opossum rug, on the rocks of the left bank. The descent to and the ascent from the river is most difficult, and not devoid of danger.

The first part of the way lies along the beds of the deep gullies that drain the higher country. On the banks of these ravines the peculiar stratification of the slates and quartzites is beautifully developed, and some of the most remarkable examples of highly inclined, contorted, and concretionary bedding are exhibited. The windings of the creeks present to view the joints, cleavages, and beds in admirable detail, and a walk through them is worth the toil.

In rainy weather, these creeks must be almost impassable, but they are quickly drained, and even during the late high westerly winds the water has rapidly diminished.

In some places ferruginous springs have formed, at an earlier epoch, a conglomerate, cementing the local fragmentary detritus, which conglomerate now stretches across the valleys at a higher level than the present bottom of the creek running therein.

Some idea may be formed of the little probability of much occupation of the Shoalhaven River in this vicinity, if I state that the only possible access is on foot, all supplies having to be taken down on the shoulders, or in

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that I had mis-stated facts in consequence. As Mr. Z. did not, either courteously or judiciously forward his lucubrations to those whom he impugned, it was not possible to reply to him at the time. And as both Mr. Selwyn and myself owed to an accidental circumstance, our knowledge of the criticism upon our respective statements, it did not appear to me that it was worth while to re-open the subject, in the columns of a journal published at such a distance. Being satisfied, that Mr. Z. had misrepresented some things, relating not merely to myself, but to the existence of certain rocks in New South Wales, of which I imagine he knows very little; and observing that after he had accused Mr. Selwyn, of wrongly classifying the Bendigo slates, as Lower Silurian, he quietly, at the end of his letters, swallowed his own words, I do not consider it is necessary to do more than to define the use made of the term objected to.

Sir Roderick Murchison has, however, thought fit to reply formally to Mr. Z. in a letter to Dr. Hutchinson, which was re-printed from the *Bendigo Advertiser*, in the *Melbourne Argus*, wherein the curious reader may see how completely Sir Roderick makes his case good against his assailant, although he could well have afforded to let the matter pass.]

the hand of the pedestrian, who has to pass for some distance along a spur of a range, which at the narrowest point is first one foot and then one inch in width, being formed by the almost vertical edge of a quartz band; and this surmounted, the descent is down a smooth continuous slope of more than 1,200 feet vertical, the incline being, by measurement on the spot, from 20° to 32°—a difficult path to climb in returning. Some of the slopes of the opposite ranges are 47° and 60°.

The Shoalhaven in this place has no banks unoccupied by ledges or fragments of very hard and sharply inclined rocks; and during floods, as evidenced by the drift, the whole ravine must be occupied by water for at least 30 feet above the present level. On the right bank the highly inclined and contorted alternations of slate and quartzite descend without any talus into the water. Bars are formed by the connexion of the opposite faces of rock, and at these bars the water falls in slight rapids, heaping the sides of the ravine with a thick deposit of broken slate and quartz. The latter mineral has played a very considerable part in the features of these formations; for the quartzite is crossed by innumerable thin veins and threads of white quartz, which do not always pass through the intermediate slate. I saw several instances in which the slate contained embedded quartzite, and, vice versâ, quartzite entangling slate. It is plain, therefore, that the schistose rocks (slate and quartzite) are of contemporaneous formation, and that the white quartz is younger. [Similar rocks occur about 30 miles E.S.E., under the lower carboniferous beds at the back of Jervis Bay; and intermediately in the Yalwal District.]

There is a striking similarity between the Shoalhaven Ravine and the gullies in the basin of the Macquarie, and it is not therefore extraordinary that they should be considered both alike in auriferous character. [I noticed a similar class of features in the gullies about Fingal, in Tasmania, and on the southern flank of Mount Alexander, in Victoria. Quartzites of like kind I found to occur at the bottom of many creeks and rivers in the Clarence River country.]

I found in the place where I camped three parties engaged in gold washing. Two cradles only were at work. The persons now engaged in it amounted to eleven. So far as I could ascertain, about thirteen ounces of gold have been procured, besides one rolled lump of auriferous quartz, which weighs about three ounces, and is said to have been found in a spot, indicated by the finder, a few inches (eighteen) below the surface of the drift. It is singular, I think, that no other lump has been found.

The profits of the gold washers at present have not been great. Two men have gained in a day, from 120 buckets of drift, about three grains.

My own experience produced this result. On a spot very likely to produce gold according to the usual notion, I had a hole dug, and the soil washed; nothing was produced. At another, two cradlefuls of soil produced me $8\frac{1}{2}$ grains of gold; and from the tail washing of a cradle that had been employed the day before I procured one grain. I also requested a person to wash a panful of drift from a heap which he had abondoned, and three particles were produced.

Nevertheless, I think there will be found much gold in and along the banks of the Shoalhaven. The gold already found is not all local; it is flattened and worn by long friction amidst the hard boulders which fill the river bed.

When the water is lower and the bars are dry, and a more numerous assemblage of goldwashers is gathered thither, more gold will, of necessity, be found. But, taking into consideration the particulars mentioned and the difficulty of access, I do not think that it is likely that this part of the river will be found a profitable locality.

Lower down, near Tanner's, some gold has also been found, but the party who went up the river have, I am told, abandoned their occupation; and two men and a boy whose bark gunya was near my resting place, said they were about to leave the river. A person of the name of Gale who has been to the Turon, recommends them to stay. I saw him on the river, and he said that the proportion of gold was about equal to that he met with at the mouth of Summerhill Creek.

I have omitted to mention that, according to the testimony of an intelligent aboriginal, a copper vein crosses the river between my prospecting place and Glenrock Creek. The spot I was at, is between that creek and Jacqua Creek. The climate there is different to that on the hills. It was a frosty morning at Bungonia. On the river at 6 A.M. the thermometer stood at 37°. At 9 A.M., before which the sun cannot shine over the river, it was at 56°, and at 1h. 30m. P.M., it was at 70°.

No. II.

Mount Elrington, 10*th October*, 1851.

I have now the honor of reporting, for the information of His Excellency the Governor-General, that I have examined the country along the Shoalhaven River, up to this point, and that I have also explored the Araluen Country for a considerable distance below the Gold Diggings.

Many circumstances induced me to revisit the Shoalhaven Gullies, in the neighbourhood of Bungonia, and I accordingly carefully examined the limestone ranges, in the vicinity of which several hundred grains of gold had been found by a person named Tanner. I found, as elsewhere in that locality, the junction of the limestone and the igneous rocks marked by the occurrence of a valley, which extends for several miles in a north and south direction, parallel with the strike, and in this valley a band of quartz rock. The limestone rises in beds, inclined at an angle of 90°, and at the commencement of the range, at a height of 80 feet above the valley, is traversed by bands of argillaceous iron ore, which I pronounced at first sight to be auriferous. One specimen of this ore, weighing about two ounces, produced by amalgamation two grains of gold. I consider this a somewhat important fact, because it exhibits a new source of gold; and though I did not see any visible in the ironstone, it is not improbable that such may occur. The occurrence of invisible gold in limestone of the same epoch in Russia has been alluded to by me in the pamphlet entitled "Plain Statements," &c., (p. 2, 3). I was therefore, not unprepared for the discovery. The occurrence of gold in ironstone, has also been exhibited in Mr. Wentworth's estate, but I believe that *that* ironstone is merely quartz cemented by ferruginous matter, and not as at Tanner's, a compact argillaceous iron ore. [It is probably not of the same identical epoch.]

The fossils contained in this limestone were chiefly *Encrinital stems*, *Favosites Gothlandica*, another species of

? limestone

the same genus, *Amplexus*, and *Pentameri;* the latter fixing the age as probably not younger than the Wenlock rocks of the Silurian formation. The whole of this limestone is subject to the occurrence of concretionary masses, but is jointed from N. 15° E. to S. 15° W., and from E. 24° S. to W. 24° N. The colour of this limestone varies from grey to blue; it abounds in calcareous spar. In the line of joints there occur numerous cavernous places, which appear to be the only channels of drainage from the surface; the latter assumes a hollow form around the open holes, and the branches and stems of trees which have been washed from above appear often entangled in the mouths of these openings. I entered one of these caverns, in the endeavour to ascertain their true character. The actual entrance was 71 feet below the ridge in which it occurred; 48 feet below this entrance there was no further possibility of progress, but candles could be lowered about 60 feet further, and stones thrown down reached the end of their fall in six seconds, sometimes plunging in water. The whole depth was about 685 feet.

That water must occasionally find its passage in considerable volumes was proved by the facts that a large tree was actually lodged at the mouth of the cavern, and that the walls were covered in places by a moist deposit of calcareous matter, or stalactitic deposit, which has never dried sufficiently to assume the ordinary character. The exterior surfaces of the rock on the upper grounds are fluted by rain channels, which are parallel to each other over a considerable space.

Towards the gully in which Jerrara Creek unites with the Shoalhaven, and from which the locality in question bears W. 20° N., there is a vertical precipice about 1400 feet in depth, and the water from the surface draining through the caverns, probably discharges itself midway, or perhaps near the bottom. It is impossible that, under such circumstances, there can in such a country be any permanent supply of surface water.

The limestone is interstratified with slate and bands of quartzite, which latter decomposes in regular fragments, resulting from joints that traverse the bands, which crest some of the summits. The quartzite occasionally assumes a granular instead of a compact texture, and looks extremely like the Lickey Rock of Bromsgrove, in Worcestershire.

These alternations of limestone, slate, and quartzite or other siliceous bands, continue for many miles to the southward; but on exploring the creeks which enter the river by Werrimungo Creek, such as Nettle Creek, Main Gully, Jacqua, Strawberry, Windellama, Budjong, Nudgingomar, in all of which the slates and quartzites occur, I discovered various changes of strike and dip, and other local phenomena, which prove that these remarkable ravines are the result of mechanical violence and disarrangement, which have produced faults and dislocations; the principal strike is, however, N.N.E.

In the neighbourhood of Wagamurra and Barramungal, a trappean rock, having a greenstone character, has produced similar disturbances in overlying sandstones and grits; but the disturbances in the older rocks of the schistose formations, are apparently due to the intrusion of a syenitic rock or hornblendic granite, of which I have previously made mention.

The ranges are covered by innumerable fragments of the local rocks, amongst which occur many pieces of white quartz, which have led to vain expectations of gold in various instances; these are portions of veins traversing the ordinary quartzites imbedded with the slates. Gold does, however, occur at the mouth of Jacqua Creek, and on the ridges near Werrimungo Creek, but in very small particles. [It occurs also on Nudgingomar Creek, and that district in September, 1856, was reported in the *Empire* Newspaper, as a paying gold field.]

Between Jacqua and Windellama bands of limestone occasionally appear, with grey and black slates, and hard micaceous sandstones, belonging to the same formation, ranging N. and S., and dipping 70° to West. A very remarkable rock, filled with ferruginous concretions, and so magnetic as to affect the compass, was also observed. It crests a range bearing N. 52° 30′ E. from Talerang Pic, and occurs there in large masses. I think it might perhaps prove valuable.

Some hard siliceous sandstones and conglomerates much tilted occasionally occur; and about Boro a porphyritic rock is met with, which, within a few miles of Arnprior, gives place to a grey granite for a short interval. Other igneous rocks, of porphyritic or granitic character, mark the vicinity of Arnprior, elevating and altering schistose and limestone rocks. The former are filled with chiastolite, and the latter are converted into highly crystalline marble; but notwithstanding the transmutation, there is evidence of the age of the limestone in the occurrence of fossils similar to those at Tanner's, such as *Favosites* and *Pentamerus*, the latter genus being the most frequent. The surface of the limestone is extremely waterworn, and there are indications of caverns. On Arnprior flat, slate ranging N. and S., dipping 34° to W., is in association with porphyry, on the left bank of the Shoalhaven; the limestone dips 58° to West. Further west the chiastolite slate, limestones, and quartzites alternate, all standing at a high angle. Copper and iron occasionally occur.

At Boro Flat and at Arnprior gold is to be found in thin scales. At the latter place I did not wash a single panful of soil from the bank of the river without finding from 3 to 16 particles of gold. It also occurs in the Long Swamp (Scott's farm), and in all the creeks falling to the Shoalhaven from the Narriga District. Indeed, wherever I have prospected in that river I have found gold, but in such small quantities and minute particles as to be almost unworthy of notice. [Bulee Creek and the Endrick river and all the country so far as Araluen have since been found auriferous in a greater or less degree.]

Durran Durra and the runs on the back of the Church and School Lands also produce similar quantities, and generally the whole country. It has been stated that a more considerable abundance may some day be found in Captain Coghill's property, near Braidwood; and I believe it was found there by a shepherd, who revealed the locality to Mr. Blaxland. I could only discover it in minute particles, owing to the want of means to make a very elaborate search by sinking or boring.

Between Arnprior and Braidwood, a grey granite, passing into syenite and porphyry, and very full of hornblende, occupies many miles of the country; and having traced its boundaries in various directions, I find it to support slates and quartzites. It is oftentimes nodular, and its prominent bosses and summits stud the country for many miles.

It rises into very lofty ranges around the Araluen Valley, and on this side is succeeded by a grey quartziferous porphyry. This granite undergoes various modifications;

but its principal features are its abundance of quartz and hornblende. Having examined its frontiers in the Budawang and Moruya Districts, I find it always there succeeded by schists and quartzites, which pass into roofing slates in some localities, as along the Deua River, and occasionally along the country near the sea, admitting bands of limestone; veins of ferruginous white quartz also frequently occur. My opinion is, that the gold found in the Budawang Country, as along the Mongarlow River, and the Wombagugga and Tan-tu-li-an Creeks, is due to the presence of the hornblende. Hornblendic rocks are well known sources of transmutations associated with the occurrence of gold. My time did not allow me to cross the Budawang Range; but I have information of the occurrence of gold in similar small quantities on the east side, in the feeders of the Clyde River, and about the head of the latter. I may add that I found gold in minute particles along the Jembaicumbene Swamp, which occupies a depression in the granite, and at the Lagoon Flat at Bendoura, between it and the Shoalhaven, where a running creek flows over porphyry. I have prospected also on the Shoalhaven, in this vicinity, and with like reward. But I regard the gold as a mere proof of the universal distribution of the metal, and otherwise as of no value. It can never, in such minute quantities, repay the trouble of procuring it.

But as it is not always so minute in size and quantity, as for instance in the Araluen Creeks, it is still open to conjecture as to its origin in more distant localities, which will require further research. All that can be now asserted is that the whole region over which I have passed from Marulan to this place, supplies gold in small quantities; and that the minuteness of the particles often requiring the aid of a lens, seems to point out the vast amount of friction to which the original metal has been exposed. I cannot help suspecting that the source of much of it will be found in the mountains to the south and south-west, whither I propose in a few days to proceed, after I shall have examined some localities to the westward of the Shoalhaven.

Having visited various creeks and ranges between Braidwood and Budawang, I proceeded to Araluen, and on Sunday last assembled a congregation of about 40 persons under an Acacia tree. In consequence of the rain of the following day I could do nothing, but so soon as it was fine, I commenced my exploration. Araluen is a valley lying between ranges of hornblendic granite, passing into syenite and porphyry, in which the proportion of quartz is very remarkable. Spurs run down at a very steep angle of inclination into the valley, and these are composed of hardened bands of quartzose or porphyritic rock with veins of trap; occasionally a highly micaceous sandstone lies next the granite from which it has been derived. The descent to the valley is abrupt, and by the pass at its head, the slope is in places at an angle of 28° or 30°. The whole height from the summit of the mountain near Jembaicumbene Swamp to the bottom of the creek opposite the cattle station, I made 2,007 feet descending, and 2,005 feet ascending. The creeks being rapid and barred by bands of intrusive and hardened rocks, have occasional waterfalls; and it is in one of these creeks, at a depth of about 827 feet below the top of the mountain where the water falls over ledges of hardened granite, in which a dyke of very siliceous trap runs along the bed of the creek, that a considerable number of persons are employed. Most of these appear to be earning something more than ordinary wages, and a few are making considerable gains. One cradle belonging to a party of three was washed out in my presence, and about $3\frac{1}{2}$ ounces of very good gold were taken out, the produce of the day's labour. The persons engaged in work in those "Upper Diggings," appeared to me to be too closely assembled, and in a short time from the perpetual influx of strangers will become, I think, too numerous to find room to work to any advantage.

I was unable to discover any but alluvial gold in this locality, but about two miles to the north-eastward, there exists a considerable vein of ferruginous cellular quartz which may be found auriferous. Besides this "Waterfall Creek" there is another called "the Major's," which has been recently occupied, and in which a considerable number of persons are employed. The Gold in these "Upper Diggings" is certainly larger than it is below; but whence it is derived is doubtful.

The Lower or "Middle Diggings," where I found upwards of 100 persons on the 5th instant, were nearly deserted on the 9th, the parties having migrated to the "Upper Diggings." The latter are about 977 feet above the former. About 238 feet below, and about 5 miles in distance, I found at the lowest Diggings 16 or 17 bark huts, and from 12 to 14 persons, of whom several were new comers. One cradle very carefully and skilfully managed, was producing a small quantity of gold; but there is no doubt that much very fine gold is distributed in the creek, and along the ridge of quartzite, which here bounds the channel by a vertical wall. The impression left on my mind, was that either the gold washers find the results not sufficiently remunerative, or that they are very capricious. It is very certain that the continual influx of persons who are thronging from all quarters, will sooner or later produce inconvenience, and that many will be greatly disappointed.

Before I left the valley I ascended some of the lateral spurs to ascertain the structure of the country. On one of them at about 1,000 feet above its base, I found a singular bed or dyke of ferruginous quartz, in which I detected a small particle of gold; and on the summit of the range on the eastern side, other particles were taken from the surface.

The more expanded part of the valley has evidently been a lake; and on the banks of the creek at about what I think was its entrance, I found exposed seven alternations of sand and clay deposits. These are also found in the flat itself, and from all I can learn, the flat was within a recent period overgrown with rushes, as in the case of the Kangaroo ground at the back of Illawarra, and in other ravine valleys of similar construction. The present floods which are occasionally very violent, are not now filling up, but excavating creeks, of which I had ample proof. If this lake has been filled up by deposits from gold bearing rocks, it is reasonable to imagine that at the lowest level of the ancient detritus gold will be found along the ancient line of drainage of the flat; but I did not penetrate to that depth. The settlement of that question would throw light upon the probability or improbability of the gold being local or otherwise. [It seems that up to 1860, this question has not been set at rest. But all that has been during the interval developed, only confirms the conclusion, that the amount of gold not yet obtained from the ancient lake-bed must be very considerable; and that a great proportion has been carried into the valley from Bell's paddock and the swamp above, though some has been derived from the rocks in situ below, which are still yielding gold.]

Many very interesting Geological phenomena attracted my attention in the mountains around Araluen; but the detail of them would probably not be desirable in this place.

I have been anxious to obtain as accurately as I can by means of contemporaneous barometrical observations, and by the theodolite, the approximate elevation above the sea of all remarkable localities; knowing the value of such data in general Geological surveys, and in questions such as that of the habitat of gold.

No. III.

Jineroo, 21*st October*, 1851.

In my last despatch I stated that it was my intention to examine the Gourock Range and the Carwary Country. I have now the honor of reporting to you, for the information of His Excellency the Governor-General, the accomplishment of that object.

It was my wish to proceed at once from Carwary to Cooma and the Snowy River, but having had the misfortune of breaking my best barometer, I have been obliged to return in this direction, in order to procure another, which I had left for the purpose of simultaneous observations, in Braidwood.

I now propose continuing my route, either across the main range to Jingery, or by way of Manar, Lake George, Yass, and Micaligo; in order in the latter case to accomplish the examination of the rivers about Yass, to which I was directed by His Excellency, in a private communication, and which I deferred, because I had been informed that the rivers were in flood and could not be examined.

I have already mentioned the existence of porphyry, in this neighbourhood. Knowing its relations in other parts of the Colony to the carboniferous formation, I made it my business to examine its relations in this region, not only to the older but to any younger formation which might occur. I have now traced it in a continuous series of elevations, and in ranges, from the neighbourhood of Marulan to the north-east borders of Maneero, and I have found it invariably rising through the granitic rocks, upon which in many places it has exercised a remarkable influence, and bearing upon its flanks masses of conglomerate, grit and sandstones, the base of which, as in the porphyritic regions of the Hunter and its affluents, is clearly derivative from the porphyry of some part of the ranges; and, as in the northern districts alluded to, has been so transmuted as to exhibit a texture and structure so like those of the original rock, as frequently to be distinguished from it only by fragments and pebbles of the quartzite associated with the granitic rocks, (and which themselves before destruction had also been transmuted) disseminated through the conglomerates.

As pointing out the direction of ranges of the above character, I may mention that they run in lines parallel with the higher mountains to east and west of them, and that they form the Bendoura, the lower Tillegandria Hills, and a series of "bald hills" from Oronmear, such as Bonwhybee and others, running southward on each side of the Shoalhaven, as far as the head of Wianbene Creek, and the head of Woulee Creek, one of the feeders of the Cadgee River, running into the Bega country, which was the last point to which I traced them, at the base of the Uranbeen Mountain, a connection of Bigbadja (from which it is but a short distance,) the summit of which I found to be upwards of 1500 feet above the Verandah at Carwary; (? between 3800 and 4000 feet above the sea;) Bigbadja Mountain being a higher elevation to the westward; and immediately opposite, to the eastward, Jindulîan Mountain being still higher (upwards of 4300 feet).

These "bald hills" in their succession of anticlinal summits form a great contrast with the more rounded and level summits of granitic ranges, and present the most rugged and dreary surfaces. Being clothed with a scrub of *Casuarina*, seldom more than two feet in height, and mostly not more than one, they present an appearance of vegetation (from a distance) very like that of the hills above Double Bay, near Sydney; but there is no grass in these ranges, though abundance of pebbles to form excellent roads.

The porphyry varies in composition, but it frequently presents a whitish base of felspar (decomposing into cold wastes of pipeclay perfectly naked,) studded by crystals of quartz whose form is a double hexahedral pyramid. This species I have observed before, near Béënba, on the Page River, and at Arthursleigh on the Wollondilly. [These pyramids are considered to distinguish porphyries of Devonian age, and this would agree with the relations of the other formations in the district.]

Some of the beds of conglomerate and sandstone, reposing on the flanks of these porphyry hills, are identical with those of Kingdon Ponds, between Scone and Mount Wingen, in which occur pebbles and fragments of porphyry.

The occurrence of these evidences of the extension of this formation, into the narrow basin of the higher Shoalhaven, amidst granitic rocks, and parallel in orographical direction, is interesting; and no doubt remains in my mind that the porphyry has burst through the older formations in fissures parallel with their bases, breaking up the bands of quartzite and veins of milky quartz which traverse them, and forming the conglomerate fragments, which now stud the lower beds, and the pebbles, which were rounded out of similar fragments by the waters into which they were projected.

In addition to these indirect testimonies as to the relative ages of the formations, I will mention one more direct, viz., that on the slopes of the marble at the head of Wianbene Creek, and which is a transmuted band of inconsiderable breadth, rising at an angle of 78° from N.N.E., the reddish porphyritic conglomerate reposes, dipping W.S.W.; and at the point of contact some transmuting influence has apparently hardened the latter. The porphyry itself seems to have affected the limestone at its intrusion, for the latter is filled with veins of ironstone, the direction of which is towards the porphyry. This patch of limestone bears by compass S. 20° E. from Gourock.

It would be in vain, I think, to expect these porphyries and their derivatives to produce gold. But they have been subjected to the influence of the intrusive action of dykes of a greenstone trap, which intersects the porphyry in places as well as the granitic formations, producing by disintegration the soil of numerous black patches (amidst the barren clay derived from the porphyry) which are well grassed. These dykes have also assisted in producing the various local alterations of strike and dip which occur, and in dislocating the original masses of rock; one result of which is the formation of numerous lateral valleys and channels abundantly supplied by water issuing from springs, at the planes of junction of the formations, and from the swamps which there, as in other parts of New South Wales, are the chief sources from which the rivers are supplied. There is scarcely a range of any importance in the district under review which does not rise from a swamp; and I am convinced that the deepest injury that could be inflicted upon the pastoral, and other rural occupations of the Colonists, would be the introduction of the system of swamp drainage which obtains amongst the agriculturists of Europe. It would be worth the attention of the Legislature, how best to preserve the integrity of the swamps.

Having now explored the basin of the Shoalhaven River to the spot where its first drop of water is formed, and having observed how much its supply is dependent on swamps at the heads of its various feeders, (as for instance at the sources of Oronmear Creek rising in the ranges round Jerrabat), I do not know what this beautiful and well watered country would do, if (which is not, perhaps, probable) any attempt should be made to drain the swamps and boggy places which so often occur in traversing the country. The whole of the ranges may be said to stand in swamps and bogs, but their highly siliceous detritus would, without these wise arrangements of a bountiful Providence, produce nothing but a sterile wilderness.

I have mentioned Oronmear Creek. Just above its junction with the Shoalhaven it is a mere brook, though occasionally expanding into large ponds; but below, the flow of water is very much greater and the current more uniform and important. The whole river exhibits a succession of ponds and small rippling falls from its first collection of water to its union with the tides. [Jerrabat Gully, which joins the Oronmear, was found in July, 1854, to produce a considerable amount of coarse gold.]

I have dwelt thus long on the features of this river, because there is something very remarkable in its origin.

Surrounded as that source is by high ranges, viz., those separating it from Maneero on the one hand, and from the coast to S.E. and from the Deua on the other, it might be supposed that a river of such extent, would exhibit something striking in its commencement.

On the contrary, its highest source is in the very bed of a low narrow watercourse, the fall of which it is difficult to determine without the most careful measurement. A small knoll on the side, not 2 feet above the channel, marks the spot where the drainage of the spurs from the Uranbeen Range runs into the low ground. This knoll is about 50 paces long and 25 wide. On the Shoalhaven side, the water is first retained further off than on that nearest the Woulee Creek; but a small boggy place marks the spot where the water first collects in running to the latter, close to the mouth of the east side of the drainage along the knoll; and this boggy place owes its character to the existence of a trappean dyke. Although it is some distance before the Shoalhaven begins to flow, yet, on the Woulee side, the country immediately breaks into gullies, and the main branch of that creek is seen flowing over ledges of porphyry in a brisk and plentiful current, and in the pools between the ledges of rock, I noticed several fish six or seven inches long, although in the Shoalhaven there are only a very few diminutive fish and eels. Woulee Creek shortly falls into a tremendous ravine, between Jindulîan and Uranbeen Mountains. So great a contrast between two channels, or rather parts of one channel of drainage, within such a short space, is a striking phenomenon in the history of rivers. But the actual cause of this contrast is to be sought in the geological structure of the country, which, irrespective of local obstructions and derangements, has a gradual and gentle slope to the northward, as is exhibited when a wide extent of the country is viewed from a commanding eminence. In this way, I once saw the heights of Womballeway and Talaterang, on the north-east side, from the summit of Cooloomgatta, the remarkable mountain near the mouth of the Shoalhaven River, and lately on the south-west side, from the slopes of the Gourock Range, declining sensibly to the northward from the uplifted formations near Budawang; and in this way the bed of the Shoalhaven declines from the uplifted formations at its head, which, to the southward, become broken into precipitous escarpments formed by the planes of the tilted masses of rock; and in this latter way, the sides of Jindulîan exhibit vertical faces and knife-edge ridges of hardened rock, over the connecting bars of which, between that mountain and Uranbeen, the Woulee Creek finds its descent.

I have information, that gold in small quantities has been found at Wondilla in that lower country. The granite of the Araluen Ranges is, in that direction, succeeded by slates and schistose quartzites, as I discovered on a former occasion, when I followed out the edge of the granite to the south-eastward.

The gold, however, as will appear shortly, is in this part of the country not so much connected with the schists as with the granitic rocks; and to the relations of the latter with that metal, and the other (igneous) formations, I now beg leave to call your attention.

I will first endeavour, as briefly as possible, to describe the western boundary of the Shoalhaven basin.

The Main Range from opposite Jungemonia to the Uranbeen* consists of granitic rocks, composed of felspar, quartz, and hornblende with mica, and occasionally talc and steatite; the quartz and hornblende occasionally occupying, to the almost total exclusion of felspar or mica, the principal features. Sometimes this granite is so coarse in its constituent particles as to look like a grit or conglomerate, until broken, the quartz standing out in relief; and the ground about it seems as if it was covered by the quartz pebbles of conglomerate. The prevalence of hornblende is also very remarkable, crystals of considerable size marking its occurrence.

As in other granites of the epoch to which I am inclined to refer it, there are all kinds of transitions of composition,—into ternary granite of various proportions; and into binary compounds of quartz and felspar; felspar and mica;—mica and quartz;—quartz and hornblende. Patches of true felspar porphyry, of large composition, occur under the form of dykes, the joints altering at the planes of contact of the varieties, and the apparent dykes assuming a transversal cleavage. But not unfrequently, this appearance of intrusive dykes is imaginary. Followed out and carefully examined, these apparent dykes and veins are often found

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* Uranbeen itself is a very rough terraced mountain formed of hornblendic granite, traversed by porphyritic bands, porphyry issuing from its base; the strike of the range North 29° West. The rocks stand at a very high angle, and are transversely jointed; the whole of the slopes are covered by a dense vegetation of scrub and mountain ash, and the surface is cumbered by loose masses of rock; the mountain bears from Budawang, South 28° West (magnetic.)

to be mere segregations of the crystalline materials of the rock, of a smaller size; there are, thus, passages of indefinite variety from true granite into syenite, porphyry, and compact felspar, as well as into hornblendic rock. The absence of mica and the occasional presence of talc in small crystals, reduce the granite to one form of "talcose rock," which in America is a matrix of gold.

Similar transmutations occur in granitic rocks all over the world. I have myself studied them in England, in France, and in Africa, and especially in Cornwall. Instances of these changes are so common, that Dr. Boase in his work on Primary Geology, distinctly refers to them. The change from these varieties to others, perhaps more striking to a casual observer than to a Geologist, is not difficult to understand; and, therefore, it may be seen how easily bands of quartz rock, formed of one granitic material, and slates formed of two or more, and greenstone dykes formed of felspar and hornblende, and again crystalline or opaque white quartz threads and dykes, traversing any of these, may, by the influence of segregation, chemical affinity, galvanic or other forces, be derived from the same original source, and be indefinitely varied in the order of their arrangement and relations to each other, at different intervals. Now, along the ranges of Mount Elrington, as well as farther south, I have seen all those changes, without the necessity of calling in aid the influence of various epochs to explain them. I saw the same phenomena at the vale of Clwydd, and elsewhere in Australia. I can therefore quite understand, how gold may be discovered in a rock made up of granitic material, whether under the ternary, quarternary, or binary form, provided the materials be such as are known to be prevalent in gold bearing rocks elsewhere. It is easy, also, to understand, how porphyry at a later epoch may issue from the same granitic source, and produce mechanical and mineralogical changes in the granite. The main range within the limits assigned in this Report is made up of the rocks I have enumerated; from its base, as before mentioned, true quartzose porphyry has issued, having a north-west and south-east strike, and this, with the overlying derivative, sedimentary, carboniferous formation, forms the outworks of the range to the eastward.

In the manner above described, it is not difficult to explain, how, at a later period, the greenstone dykes may have also issued from the same igneous source, and in their passage upwards have rent and disturbed the formations previously consolidated. It is thus I account for a fact which I have noticed on both sides of the Shoalhaven. Nor does this explanation contradict the fact, that the slates, and, perhaps, some of the quartzites must have been sedimentary in their formation, because all this took place under water, and there is no necessity to imagine that the mode of formation requires a change of material.

Passing to the eastern side of the Shoalhaven Basin, we have the same phenomena developed in the Araluen ranges, only on a wider area. I came to some of the conclusions to which I have alluded above, in the study of the apparent dykes and veins that there occur; and I found that what might have been taken for intrusive dykes of porphyry, for instance, were merely bands of segregation, in which felspar and the finer materials of the other minerals were predominant. It was in endeavouring to comprehend the occurrence of gold in such rocks, that I was led to re-consider a question which had often occupied my thoughts, without reference to that metal; and I am now convinced that there is nothing surprising in the occurrence of gold in such rocks as those which I have described, such as the granitic rocks of the Shoalhaven basin; nor in the deposition of micaceous sandstone, derived from quartz and mica, at an early period, upon the granite of which they came, and which was afterwards to be thrust upwards through such deposits, the latter becoming hardened in the process.

It was with a view to study the point again, that I deemed it advisable to proceed to the Major's Creek, which I yesterday examined.

After leaving the porphyry of the Bendoura range, I came upon a rock which might be called a pegmatitic porphyry, and then to a hornblendic and micaceous variety of it, a passage at last being effected into true hornblendic granite. I have no doubt whatever, that the rocks in this transition were metamorphic or transmuted, a mixture of the granite and the porphyry. But when I advanced into the Creek, to the point beyond which there is no further progress, I found the bar to be formed of a hardened unmicaceous porphyritic rock, which passed like a dyke of intrusion across the valley, and formed the top of a lofty waterfall into the lower part of the creek. The only change which I noticed in the granite near it was, that it was in a state of disintegration; and in this disintegrated soft granitic detritus, or rather granitic materials disintegrated in situ, gold is in great abundance.

Whatever, therefore, may have been the cause, why the granitic materials have undergone this alteration, it is not evident that the more porphyritic unmicaceous rock effected it, for that is not in a condition to disintegrate. The hornblendic rock is that which, when micaceous, readily decays; the hornblendic unmicaceous rock seems less ready to decay; but both are in some degree auriferous,—and I saw no instance of an auriferous rock which was not hornblendic. I, therefore, was led to a further conviction of a view before taken, that the gold hereabouts is connected with the presence of hornblende, and is, therefore, not anomalous as supposed by some persons. The quartz is less developed in many parts of the gold bearing detritus, than in other localities where quartz seems the chief matrix. But in the true quartz porphyry, issuing at the base of the granitic ranges, I can discover no traces of gold; though yesterday I again found it by washing the bed of a creek running over porphyry; and I remark further, that though I have also found gold in the Shoalhaven higher up than here, it seems to me that it is absent where not in the vicinity of granitic rock containing hornblende. Mica, therefore, and felspar are not necessarily connected with gold, but I think hornblende and quartz must be so, either alone or together.

The bearing of this deduction will be evident if we recollect, that granite such as that described is not confined in this colony to Araluen; and I, therefore, should expect to find gold in localities where such a rock exists, bearing in mind other physical conditions, though at a distance.*

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* [Some opinions expressed by me, respecting the probable amount of gold in and about Araluen, at the time of my exploration, were called in question by Mr. Hargraves, in his Reports to the Government, as the following correspondence sufficiently proves.

COPY *of a Letter from* E. H. HARGRAVES, ESQ., *to the* COLONIAL SECRETARY.

Camp, Araluen Creek,
29th September, 1851.

SIR—With reference to your letter dated on the 5th instant, transmitting the copy of a letter from Mr. Commissioner Bell, respecting the Araluen Diggings, I have now the honor to report, for the information

Indeed in this district we have seen how one opening has succeeded another, and I now learn, that in Jillimatong Creek

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of His Excellency the Governor-General, that I have been at that place during the past week, exploring the valley and adjacent creeks.

2. There are now about four hundred persons digging in the valley, and a small tributary stream of the Araluen called Bell's, or Dirty Butter Creek, earning on an average five shillings per diem. Some few are making ten shillings, and a solitary case of two of twenty shillings.

3. The inhabitants of this vicinity are very much excited, and are carried away on the wings of their imaginations, and work themselves up into the belief of the existence of a "Mountain of Gold" in the immediate neighbourhood.

4. The water in the Araluen and Bell's, or Dirty Butter Creek, will cease to run in two months, and unless the miners dig out the bed of the creek, and store it up until they get a supply of water, the Araluen diggings *will die a natural death* in *sixty days.*

5. I should think 20s. per diem could be earned by pursuing such a course. *These diggings may be called poor and limited, and the geological structure of the country not favorable for the production of gold in quantity.*

6. The upper part of the valley is composed entirely of granite, and the lower part of compact schistose, with small quantities of quartz, and the bed of the creek very much covered up with sand. The soil the miners are working in is a granitic detritus.

7. I proceed to the Moruya River to-day. My report thereon may be anticipated in a few days; but I feel perfectly satisfied that place *is of no importance whatever,* and the *few small specks or particles of gold found there, have been washed down from Araluen Creek.*

8. A great many persons, I am told, arrived at the lower diggings coastwise from Sydney, last night, who will be miserably disappointed, as 10s. per diem is as much as could be earned by experienced miners in the present state of the waters, and 3s. 6d. by novices.

9. My report of this field will not agree with the newspaper accounts, and private letters; nevertheless, *the correctness of it, and my predictions respecting it,* may be fully relied on in any contemplated arrangements His Excellency the Governor.General may be about to make to secure the rights of the Crown. I have cautioned the miners not to dig or search for gold without a license. Braidwood is my present address.

I have, &c.,

E. H. HARGRAVES.

COPY *of a Letter from* E. H. HARGRAVES, ESQ., *to the* COLONIAL SECRETARY.

Camp, at Jembaicumbene,
near Braidwood, October 7th, 1851.

SIR—With reference to your communications dated 18th, 27th, and 30th August, and 3rd September, numbered as per margin,* respecting the discovery of gold on the Moruya River, I have now the honor to report for the information of His Excellency the Governor-General, that I have traced that river from its source to its confluence with the sea, which

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* 51-7805. 51-7937 51-8335. 51-8540.

gold has been found. Calling to remembrance the phenomena in the vale of Clywdd, I recollect that gold was found by me in 1841, near Hartley, where disintegrated granite of a

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has engrossed my whole time since the 29th of September, the date of my last letter.

2. The Moruya is at present very high, but gold in very minute specks can be found on the banks, even very near the sea. The geological structure of the country is not by any means favourable for the production of gold in quantity, and I do not consider the Moruya to be a workable field or worthy of notice as such, in any way, and the large number of persons who are daily arriving seawards, attracted to the gold-coast by the newspaper advertisements of Shipping Agents, must be disappointed, as there are in reality no gold diggings on the Moruya; and those of Araluen, as I have before reported, are poor and limited.

3. *I have discovered a small creek called the "Major's,"* running into "Araluen," which will pay very well to work, but on enquiry, find it is on the property of the late Mr. Roberts. It is only a quarter of a mile long; about fifty persons immediately flocked to the spot who have just commenced to work

4. I understand the Rev. Mr. Clarke has visited the "Shoalhaven Gullies," and arrived in Araluen the day I broke camp from that place; not having seen him or being aware of the object of his visits, I thought it advisable to address you on the subject of prospecting the Shoalhaven, as I have instruction from you to do so. Please advise me on this point. I intend prospecting this week to the South West, and then proceed to Yass and Gundagai, unless you think it advisable for me to go to Shoalhaven. I shall send to Braidwood, anticipating your reply by return of Post. I thought as Mr. Clarke had been there, it would probably be unnecessary for me to go.

5. Some parties have done well at Araluen last week, but a great many have left it, and the diggers are on the decrease notwithstanding the arrivals. I would here remark, that on my first arrival at Araluen, I saw scarcely any quartz, but on a closer investigation found abundance. *I am told the Rev. Mr. Clarke speaks of the locality in the most glowing terms; nevertheless I venture to assert it to be next to worthless as a "Gold Field."*

I have &c.,
(Signed) E. H. HARGRAVES.

The Honorable
The Colonial Secretary.

COPY *of a Letter from the* COLONIAL SECRETARY *to* E. H. HARGRAVES, ESQ.

Colonial Secretary's Office,
Sydney, 18*th October,* 1851.

SIR—I have the honor, by direction of His Excellency the Governor-General, to acknowledge the receipt of your letter of the 17th instant, reporting on the Gold Fields at the Moruya and Araluen Rivers, respectively; and to inform you with reference to the enquiry therein similar character exists, and that that granite becomes syenitic and porphyritic, and is traversed by trap.

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contained, that it does not appear to be necessary that you should visit the Shoalhaven.

I have, &c.,
(Signed) W. ELYARD, JUN.

E. H. Hargraves, Esq ,
Commissioner of Crown Lands.
Braidwood.

Again, he writes on the 20th October,—"with reference to my report on Araluen, I would here add, that the diggers have, as I predicted, left it within a dozen or so, and are working on Bell's and *my discovery at the Major's Creek.*"*

My object in quoting these papers, is merely to enable me to show, that I did not misrepresent the Araluen country to the Government. The proof of my correctness is this—that from October, 1851, to June, 1860, that district has been steadily supplying an abundance of gold, and that not only on the Moruya, but to the "southward" also, gold has been profitably worked, and that taking into account the proportion of gold to the number of diggers, no gold field in this colony has maintained so regular and plentiful a supply as that field which Mr. Gold Commissioner Hargraves, pronounced to be "next to worthless."

The following report of Mr. Commissioner Hardy, which is not inserted in the British Parliamentary Blue Book, has too much bearing on the subject in question, to be omitted.

EXTRACTS *from a Letter from* J. R. HARDY, ESQ., *to* THE COLONIAL SECRETARY.

Goulburn, 19*th October*, 1851.

SIR,—I have the honor to inform you, for the information of His Excellency the Governor-General, that I left Parramatta on the 12th instant, and arrived at Braidwood on the 15th; the next day I proceeded to the Araluen Diggings.

2. You will perceive by the tracing herewith sent, that the diggings of this part of the country are in three localities; namely, on Bell's Creek, on Major's Creek, and on the Araluen River; the latter being a tributary to the Deua River, about twenty miles in length, falling into the Moruya River, which empties itself into the sea, in the neighbourhood of Broulee. Bell's Creek and Major's Creek may be considered the heads of the Araluen River. Braidwood is the table land of the sea coast range; and these two creeks occupy the first portion of the descent from that table land to the sea. The table land of Braidwood, the portion of the descent cut through by the creeks in question, and about five miles of the Araluen below the junction of Bell's Creek, are granite. But below that portion of Araluen, the country

* The discovery here again claimed by Mr. H., was made by Mrs. Bagster, on the fifth of October. I was at Mr. Badgery's station on the night of the fifth, and Mr. Flanagan coming in from Braidwood, told me of it, and asked me to visit the locality the next day. Three days heavy rain succeeding a hot wind on the 5th, rendered the visit impracticable till the 9th; on the 20th, as mentioned in my Third Report, there were more than 400 persons at work. Mr. Hargrave's report is dated 7th October, and states that up to that date he had been employed on the Moruya. He gives 50 as the number of diggers at first.

It is not improbable, therefore, that gold will be found in other localities not now declared; and although I am still of opinion that the extent of ground occupied by gold

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is clay slate, for the distance of twelve miles, which was as much as I had time to explore. I believe the head of Bell's Creek to be 1500 feet above the bed of Araluen River, near its junction with that creek; and as Bell's Creek is not more than four miles long, the descent is remarkably precipitous. [The altitude is more than 2,000 feet. W. B. C.]

3. I found above two hundred persons at work at Bell's Creek. I then went down the Araluen River, where I found not more than thirty persons at work; and the next day I proceeded to Major's Creek, where I issued fifty licenses; and I left Mr. McLean to issue licenses to the remainder of the workers on Major's Creek (about one hundred), and to such as remained on Araluen Creek. [Altitude of head of creek 2275 feet. W. B. C.]

6. With respect to the production of gold in the Araluen Gold Field, I am of opinion, after a very careful inspection, that it is equal in productiveness to any other part of the Colony,—and, but the commencement of a much more extensive digging than any in the Bathurst District. You who have visited the latter district will understand me when I say that Bell's Creek and Major's Creek are similar in position to Louisa Creek, and bear the same relation to the Araluen River as Louisa Creek to the Meroo, and the production of Louisa Creek is not to be compared to these creeks. You are aware that the digging in such tributary creeks is much less certain and constant than in the main waters into which they empty. Yet I am certain that the average earnings of the two hundred men who took out licenses on these creeks, are not less than one pound a day each. One party obtained three pounds weight of gold the day after I gave them the licenses, another obtained eight ounces the same day, and I am aware that several parties have obtained six ounces a day, and several more three and four ounces a day. You will be able to judge as well as myself what is likely to be the production of the main waters, when such is that of the upper tributaries; and when in travelling down the Araluen River, I found the character of the stream to assume precisely the same appearance as the productive portions of the Turon and Meroo—the same height of hill—the same slopes and bluffs—and the same slaty and quartzose nature; and when I found that the only party that had attempted to sink to the bed rock in that lower part of the river, had averaged an ounce and a half to three men for six successive days, I could not avoid the conclusion, that the Araluen was at least equal to the Turon Gold Field.

7. There are many points of great interest in a geological and mineralogical point of view on which I should touch, were it not that a much more competent person, Mr. Clarke, has been, I understand, in this quarter, and will, doubtless, refer to them in his official communications.

8. I may, in conclusion, observe, that if the lower portion of the Araluen River proves to be as largely auriferous as I have above given my reasons for believing it to be, the same may be predicted of the whole of that extensive chain, from which that river rises, and in that case, the Bathurst Gold Field is insignificant, compared with that of the South Country.

J. R. HARDY, C.C.L.]

washers in the Araluen creeks is limited, and must, therefore, produce a limited supply, yet the abundance which I saw myself in most parts of the Major's Creek, has convinced me that for a few months to come the people occupied therein will be well remunerated. I carefully inspected all the operations going on, and saw several persons with considerable gains.

On entering the creek which is in appearance in no way different at its head, and in its lateral branches, from thousands of low valleys in granitic regions all over the Colony, being a mere watercourse draining smooth grassy downs, I saw a spot marked by the presence of ironstone, and on prospecting, gold was readily found. This ironstone is evidently an argillaceous ore, derived probably from the iron in disintegrated hornblende, and through it there run small veins of quartz, which may have resulted from the quartz in the granite in the same way. The presence of ironstone in this way in auriferous localities, is not a local but apparently a widely existing phenomenon. The occurrence of auriferous ironstone in the limestone of the gullies, near Marulan,—in the limestone of Wianbene,—and as I learn from a specimen brought by Mr. Hargraves from the vicinity of limestone near Jingery, is not without its significance. It extends our views of the gold question. As the gold in the Major's Creek was first made known by a prospecting woman, whom I saw there yesterday, on the 5th October, and is now remunerating nearly four hundred persons within the limit of a mile, it is uncertain to what extent the metal may be yet discovered. Nevertheless the view I took of the other "diggings" seems not incorrect.

In order to enable you to realize my reference to the gold bearing rock, I forward by this mail a small packet containing a few particles of gold, which were procured by washing a piece of partly disintegrated rock, the fragments of which are also forwarded, taken from a hole dug in the bed of Major's Creek, by Mr. Royds, of Balalaba. A piece of the same rock in which I recognised gold (not disintegrated) is also enclosed: it is a hornblendic granite.

Besides these, I picked up from a small opening in the bank of the creek, at a cradle which had produced two ounces of gold before noon yesterday, another fragment in which the gold was prominently sticking out from it; and

I found persons carrying the soil from the top of the bank at the lowest accessible point down to the creek to be washed, as it was found to be abundant in gold. The whole bank on the opposite side was said also to be full of it. Forty men are employed below this spot in endeavouring to pump out a deep pool below a waterfall.

Notwithstanding this statement, it is to be borne in mind that the creeks are of limited area, and that very shortly there will be no water in them—still no one can say how many spots on the granite may be found auriferous.

I have not yet mentioned that my impression is, that the limestone of Wianbene, is on the same strike, and on the same parallel as that near Modbury. It is, so far, however, as I could ascertain, unfossiliferous; I have no doubt, nevertheless, as to its age, and that agrees with the age of the more northern bands of the same rock.

My barometer was broken before I could obtain its elevation; but I was fortunate enough to obtain a value for the elevation of the true head of the Shoalhaven River. I make it, under correction of a comparison with Paramatta, not less than *two thousand eight hundred* feet above the sea.

I have visited the lodes of lead (argentiferous galena) on the slope of the Jineroo branch of the Gourock Range, opposite Jungemonia, and to the southward along the same range I came upon traces of copper.

As they have only been opened in the side of the bank in which they occur, and appear to be of inconsiderable extent, it would be premature to pass any opinion upon their value; they occur close to porphyritic bands, running through the hornblendic granite. The lead occurs in combination with quartz, having a dip of 68° to East, on a strike of East 15° North.

This direction is coincident, or very nearly so, with that of the lodes of lead near Modbury, the geological peculiarities of both districts generally agreeing.

Whilst in that part of the country, I obtained gold at Warri, near Manar, on the Shoalhaven, not only from granitic detritus, but also from the pebbly alluvium of the river bank, South of Warri.

It would materially assist me, could I be favored with a tracing of the country in the Maneero District, including the Snowy River, &c.

CHAPTER III.

YALWAL AND CLYDE DISTRICTS.

In the preceding Reports there is only a brief mention of that portion of the basin of the Shoalhaven, which may be called the Yalwal Peninsula. And so early as March, 1852, the Commissioner of Crown Lands, for the County of St. Vincent, publicly noticed the omission, in a letter which I think it right to produce in this place, as an official document.

YALWAL GOLD FIELD.

COPY *of a Letter from the* CHIEF GOLD COMMISSIONER *to the* COLONIAL SECRETARY.

Sydney, 15 March, 1852.

SIR,—I have the honour to forward the enclosed that I have received from Mr. Mackay, C. C. Lands, in the county of St. Vincent, reporting the discovery of gold in Yalwal Creek, a tributary of the Shoalhaven.

I have, &c.,
(Signed) J. R. HARDY.
C. C. Lands.

The Honorable the Colonial Secretary.

[Enclosure referred to]

Comberton Grange, near Jervis Bay,
by Shoalhaven, 6th March, 1852.

SIR,—Presuming you to be the proper party to communicate with respecting any new discovery of gold, I deem it proper to transmit to you the enclosed sample of both Gold, and Platina, being the fruits of twc days prospecting of two parties from the Shoalhaven, whom I induced to engage in that pursuit on Yalwal Creek, in this district, and which is the first tributary to the Shoalhaven on the south, or St. Vincent side, above the head of the navigable part of the river, and which joins it about four miles therefrom, or say four miles above Mrs. Reibey's station, on the Shoalhaven.

Yalwal Creek (as you may find by the St. Vincent map,) consists of three branches, exclusive of Ettrema Creek, (to which my present object does not apply) and which three branches descend from the dividing range between the Shoalhaven and Jervis Bay, &c., and all of which are of considerable extent. As to the auriferous indications of the Yalwal locality, I can only say, from twelve years intimate knowledge of it, that for several years back I considered it to develop more mineral indications than I had seen elsewhere; and that from my first perusal of the descriptions given of the Turon geology, &c., I felt such a strong conviction of its being auriferous, that, during the last six months, I have frequently said to many of the Shoalhaven settlers that, ere long, they should find gold much nearer home than they were aware of, and that as soon as they concluded their harvest, I would direct them where to find it; and accordingly, about three weeks ago I got a gentleman, who had some months' experience at the Turon, to accompany me to Yalwal, and who, at one part of the locality said that, had I brought him there blindfolded, he would have declared he was on the Turon ranges. But from all I can learn, I have reason to conclude that most of the Yalwal geology and auriferous indications, are more assimilated to those of the Braidwood diggings than any other, as most of its rocks consist of coarse red granite, with a good deal of the "conglomerate" in some parts, and interspersed with ranges of red earth, trap rock, and schist, without much quartz, except in one of the creeks, where there are considerable rocks of rather a bastard kind. I have often regretted that Mr. Clarke, in his survey of the Shoalhaven, had not his attention directed to Yalwal; and should these particulars, and the enclosed samples, induce you to think it worthy of a visit, I beg to add that should you, or any other official or scientific gentlemen, be pleased to give me a call, I shall be glad to afford any advantage my knowledge of the place may afford. I have just returned from seeing the prospectors; they have found less or more in every place they tried, except one, and rather more of what I conceive to be platina than of gold, but some of which they cast away before I arrived there. I attributed their want of better success to their inexperience and injudicious selection of the spots they tried.

Before I left I directed their attention to places I conceived more eligible, but the weather had now suddenly changed to rain, with appearance of some continuance, and which I have no doubt will discourage and prevent further operations for a time.

I have, &c.,
(Signed) A. K. MACKAY,
Commissioner of Crown Lands.

P.S.—As it may require a number of prospecting and experienced parties to make a proper search and discovery at Yalwal, it might do well to communicate the matter as it is to some of the Sydney Press.

J. R. Hardy, Esq.

I have also seen at a later period another similar notice. But my inattention to Yalwal did not arise from want of inducement. The first geological exploration which I made of any extent to the southward was in 1840, and the districts then examined, were the Illawarra, and the portion of the country between the Kangaroo and Shoalhaven Rivers. In 1841 I had an opportunity of examining the country about Jervis Bay and the south side of the Shoalhaven. In 1842 I carefully explored the country between Mittagong and Marulan, embracing the Wollondilly, and the plateau along the Shoalhaven, from Marulan to Meryla, Caraloo and to Yarimga Creek. In 1850 I was again on the Shoalhaven, and completed to a considerable extent my knowledge of the country between it and Jervis Bay, and Ulladulla. In 1851, as may be seen in the preceding report, I carried my explorations to the head of the river. In 1855 I obtained by the theodolite and barometer, numerous elevations in the country as far as Diddel or the Pigeon House of Captain Cook; and in 1860 I completed my examination of the country, from the mouth of the Shoalhaven to the head of the navigation. Since then I have been engaged in an examination of very considerable collections from the Peninsula, including Dangera Creek, Talwal, Miluagy, and the districts between Ettrema and the Endrick, which have been supplied to me by the zeal and energy of Mr. Moss, who is engaged in a survey of the district, and these collections, in addition to my own previous collections and observations, have made me sufficiently conversant with that portion of country referred to in Mr. Mackay's letter, to enable me to give all the necessary details for the geological description. But my more recent researches have not added any new feature to what I had been so early as 1851 acquainted with. I was then aware that the auriferous indications were not of such striking characters as to induce me to change my route, which I had planned from design, after careful consideration of my previously acquired knowledge, viz., to reach the Snowy River (as will be apparent from my numerous allusions to it in the preceding documents) by way of the head of the Shoalhaven and the north-east corner of Maneero.

It may be, therefore, sufficient on this occasion, to point out that there is, as I have known for many years, a small auriferous region in the deep creeks around the plateau on which the Pigeon House is placed, as an outlier of the Hawkesbury sandstones; but the value of the area, in a commercial point of view, is problematical.

That country exhibits conditions which remind me exceedingly of Tasmania; and these conditions will always reduce the hope of any extensive gold field in the latter country. Having, in 1856, examined the auriferous localities about Fingal, and again in 1860, explored the country under the western Tiers and along the north side of the island to the river Don, and having examined when there all the specimens of gold and rocks collected by the expeditions sent out to examine the country further west for gold, I consider that I am enabled to say, that though these expeditions have confirmed all I stated as to the existence of gold along a certain meridian in Tasmania, and have proved very clearly that true gold rocks do exist where I had indicated them to the Tasmanian Government; yet, the condition of the country there is so similar to the district in question, that the gold may be assumed to be very difficult to obtain, and, therefore, comparatively insignificant in amount, defying such labour and appliances as chiefly belong to the class of "diggers" of alluvial gold.

In that part of Tasmania, and in the country along Yalwal and the Clyde, Silurian slates bearing auriferous quartz veins undoubtedly occur; and I have also detected abundance of auriferous pyrites, not only in the ferruginous schist, but in the quartzose rocks, and even in the granite of Yalwal, and from the decomposition of these auriferous rocks, some gold has been set free in the alluvia. But the mass of the country consists of the rocks of the Carboniferous formation, all the members of which may be distinguished, from the lower fossiliferous beds between the coast and Yerrirong Creek, and sigillaria shales (in the Dangera Creek gullies) to the coal beds of Meryla, (mentioned in my evidence before the Coal Committee, in 1847, which evidence, by the way, Mr. H. T. Plews, in 1858, used as his own, in a paper "on the Coal Field of New South Wales," read at Newcastle-on-Tyne,) and the upper sandstones, (as along Wombellaway, Talaterang, and Diddel.) And, whilst porphyries underlie the fossiliferous beds below the coal and overlie the gold bearing rocks, the more recent igneous rocks have broken through the carboniferous formation, transmuted and covered it in various parts of the district, appearing in dykes (along the coast region,) and in overlying and prismatic masses, (as at Cambewarra, Sassafras, &c.) This is precisely the structure of the country in Tasmania; where the Silurian slates, as I saw them at the eastern and northern base of the western Tiers, (at Pockthorpe, and near Deloraine, &c.,) are smothered by highly altered carboniferous rocks, and by an enormous development of greenstones and basalts. I do not doubt, therefore, that there is some gold to be yet found in the ravines, and all along the broken country between the mouth of Yalwal Creek and the head of Mongarlow River, and also along the Clyde; but it occurs in iron pyrites mechanically united, and in thin quartz veins, which will require the processes of science for the extraction of the metal. The bearing of these remarks on the general capabilities of the Shoalhaven basin, will be seen by reference to the Araluen district, which is separated from the Shoalhaven by less than two miles, and from the Clyde by not more than five miles; the Moruya having been found, contrary to certain assertions made in 1851, to be an auriferous district. Looking to the Narriga district, and the continuation of it towards the head of the Mongarlow, with all the evidence produced, since 1851, by the gold diggers, who have worked successfully between the Currockbilly Range and the Shoalhaven, and bearing in mind what has just been stated respecting the country west of the Clyde; from the knowledge I possess of the structure of the ranges dividing the Clyde from the upper Shoalhaven, I should not feel any surprise, if, between Cooyouya and Buckenbowra, occasional gold localities should be developed; but, knowing how necessary is the existence of *uncovered* auriferous rocks, or if covered, covered only by drift of a certain epoch, I could not, even in 1851, have searched the Yalwal country with any respect for my own opinion of it, though, of course, I have desired, if possible, to relieve the anticipations of land-holders in that region.

The country on the south and east of the Shoalhaven, as far as Murrengenberg Creek, can only be searched for gold successfully, where the carboniferous formation, which gradually dies out as we advance to the Moruya, is denuded; and although near Shelly's flat, which may be said to partly belong to the Shoalhaven basin, I found in a ferruginous quartz conglomerate, (identical with the ferruginous "cement," overlying the auriferous lower Silurian slates of Bendigo and other parts of Victoria, the epoch of which is probably tertiary) gold in the quartz pebbles and ferruginous matter cementing them, as well as in the drift of Bundanoon Creek, where again it has lately been reported as occurring; and in the conglomerate at Wingello, where the lower carboniferous beds abut upon the porphyries and granites over the Silurian formation; and although I have found on the North Shore of Sydney Harbour, in the quartz pebbles of the Hawkesbury sandstones similar existence, here and there, of gold, I still incline to think, that the drift, and the ferruginous *schists*, and quartzose rocks of the Yalwal Peninsula, will not be found very rich in gold. Not till we have got well up on the table land of Argyle and Murray, have we any reason to conclude that an extensive gold field can exist. No doubt in my mind remains, that though in Tasmania and in the Yalwal Peninsula, the true auriferous slates, with the granites of a more recent date, occur beneath the overlying formations, yet in both regions, alluvial gold can only be expected in small quantity. Nevertheless, I am of opinion, that between the Sassafras Range, and the eastern course of the Shoalhaven, an independent auriferous region does exist, but the value of it can only be determined by long and persevering researches. No sooner, however, do we reach the area of the grey hornblendic or syenitic granites, which are so well developed about Araluen, than gold becomes abundant, diminishing in quantity, as we enter the quartziferous schists surrounding it, and becoming very scanty so soon as we come into contact, as in Yalwal Peninsula, with the covering sedimentary deposits of the carboniferous epoch. It has been before stated, that the granite of Yalwal is not of that kind: it is rather a coarse pale pinkish rock of loose texture, and having little or no hornblende, with a small amount of mica, and bi-hexahedral crystals of quartz.

That particles of gold may be found in alluvium, or fragments of gold-bearing quartz, in various parts of the region under review, even to the coast, I would not deny; but having examined that coast, I do not think better indications than those named, will be found on that line between Jervis Bay aud Bateman's Bay, although further to the south there are traces of gold in some localities, even down to the sea, as for instance on the Moruya and other rivers, between it and Mount Dromedary, about the base of which considerable gold exists.

It does not enter into my present purpose to give a detailed account of the geology of the coast, or even of the basins of the Clyde and Yalwal, beyond what has been stated above; but it may be mentioned, that on Talwal Creek, which is a Yalwal water, a lode of argentiferous galena was found in 1849, of which an analysis appeared in the Sydney *Herald*, on 5th June of that year. The result gave a very high *per centage* of silver, but the analyst did not consider it likely to be payable. Since then several claims have been asserted of the discovery of lead, as in the Good Dog or Cambewarra Range, on the Shoalhaven, and near Jervis Bay, but I know not with what justice. The search now undertaken by Mr. Moss in that region for gold will, probably, test the statements made; and lead and copper will, probably, be hereafter found, in some parts of the ranges. The latter exists near Narriga, in the vicinity of gold, which very frequently occurs visibly in the ores of copper (as near Buninyong in Victoria) and more frequently invisibly. Narriga is, therefore, a likely district to produce gold beyond what has been found; and the neighbourhood of the mouth of the Endrick River, is a place in which to look for it.

In the year 1822, my respected friend, the Honorable A. Berry, Esq., read a very interesting paper, on the geology of the Clyde River, before the Philosophical Society of Australia, and it is published in the Geographical Memoirs, edited by Barron Field, Esq., F.L.S., late Judge of the Supreme Court.

At that early period, Mr. Berry had successfully made out all the prominent features of the district, as well as along the coast, and has pointed out the vertical strata of schist, the quartz, the trap, and the sandstone, with their order of succession. It gives me great satisfaction to mention this. It did not occur to Mr. Berry, that the country was likely to be metalliferous.

CHAPTER IV.

GOLD IN GRANITE.

The occurrence of gold in a granitic matrix is demonstrated in the preceding reports; but that demonstration having been misunderstood or misinterpreted, I have been compelled at different times, to make my views respecting the occurrence of gold in granite, the subject of independent remark.

As it may be useful in the present state of affairs, to afford as much information as possible, it is considered advisable to append in this place the following documents, as rendering a fresh discussion of the question unnecessary.

To the Editors of the Sydney Morning Herald.

Gentlemen—During the four months over which the survey in which I am still engaged has extended, I have occasionally seen, or have been informed respecting, various opinions, conclusions and dogmas fathered upon me by writers on the gold question in the local and metropolitan papers. I have never till now broken silence on the subject, because, though many of the opinions alleged to be mine have been so alleged without authority, I have not thought necessary to controvert what has been intended kindly or by way of compliment, when no one but myself has been concerned. But I cannot treat one observation recently made in your columns as the mere soliloquy of some gold-seeking Mrs. Caudle, because the interests of others are involved in the conclusion drawn by the writer from what he partly attributes to me. I allude to a passage in a letter signed *Publicus*, in your journal of the 8th January, and headed "Gold in Granite." This number I have accidentally met with to-day. The writer says—"What I want is to endeavour to show by *common reasoning*" [the italics are mine] "that through the granite, *veins of gold* are formed equally with the quartz. Brongniart, a modern writer on European geology, states the fact in a *recent* work; Mount Alexander, Major's and Bell's Creeks at the Braidwood, appear to be fully confirming it. Theory is falling to pieces before the iron hand of practice: with only a Ural, science had but one gold field; she may now turn to innumerable ones, each in detail perhaps of varying character."

"If I have been rightly informed, both Mr. Hargraves and Mr. Clarke expressed surprise at gold being found in Major's Creek. If gold is to be found in situations to create surprise, what ought the yield to be in situations where the formations tell indubitably of its deposits?"

The writer then goes on to infer, as I read his letter, that because gold exists in granite in the Araluen country, therefore it may exist in granite (generally) throughout the colony.

It cannot be expected of me, that with the many claims upon my time and attention in the field, I am to find leisure for entering upon discussions respecting theories or facts of this kind; especially as having made my reports to Government, those reports are the only documents by which I wish to be held accountable to the public as to what I have thought, or imagined, or discovered. But I cannot refrain from a few words in reply to the passage quoted above. Nor would I now do this were it not evident that "Publicus" thinks well on many points of his argument, and has the interest of the colony at heart.

He has, in my humble judgment, ventured too far, in holding out views of gold veins in granite, for "common reasoning" cannot show the truth of those views from the facts known of "gold in granite," at least in this colony. I do not know to what work of M. Brongniart allusion is made, but that author is scarcely modern in relation to the present state of geology, for he is one of the fathers of the science. But I think I may venture upon the assertion, that at least the Major's and Bell's Creeks do not "fully confirm" the statement said to be Brongniart's. On my second visit to Araluen, I made it my special business to study the mode in which the gold occurs in the Major's Creek. I found no instance, nor did I hear of one, in which a gold vein had been discovered in the granite. And I believe it to be very unlikely that such gold as is found in that locality could occur in a vein. Having, in October, broken up and washed the granite, and by that means, extracted gold from the rock, I can testify that the metal does not occur in veins, but in grains disseminated amidst the granitic constituents. The allusion to "theory falling to pieces," &c., and "only the Ural," &c., is not justified by facts. The Ural was never the only gold field, indeed it is a recent example of a gold field. Fact, not "theory," had, long before the Ural became so noticeable, shown, that on the Oronoco, in America, and in other regions, gold has been known to occur in granite, and all over the world that peculiar granite called *talcose rock* has been proved to be a common auriferous matrix.

California and other countries have also shown that quartziferous schists are gold-producing rocks; but the one fact does not necessarily contradict the other. It will be seen, in one of my reports, that I have endeavoured to show that gold in granite is not an anomaly, and I have also shown, that because it does occur in certain quartzites and schists, it ought, under peculiar conditions, to be found also in certain granitic rocks.

"Publicus" is, therefore, not rightly informed, that I expressed surprise that gold should be found in Major's Creek. All that I have ever said was, that there is nothing in the appearance of Major's Creek to justify the expectation of gold there, more than in a thousand other similar valleys in any other granitic region. I had, when there, actually found gold in a part of that creek in which the matrix is ironstone, and not granite. I had also, more than ten years since, found gold in granite, not five miles from Hartley. But, believing that the region of the Macquarie basin is chiefly auriferous in the quartz of the schistose formations, it was useless to say anything about granite in comparison with them. And chiefly so, because (and this is the very reason why I notice the remarks of "Publicus") I know that it is not all granites, but only peculiar granites, which are auriferous, such as have a trappean character. I take the liberty of making mention of my own experience, because for some time past, I have been working out this very point over a region which covers many thousand square miles of country, and during a journey which, either in direct distance or traverses, has extended to upwards of 1,600 miles. For hundreds of miles I have examined quartz veins, schists, and granites, without finding a trace of gold; but in more than twenty different localities, between Araluen and the ranges beyond Mitta Mitta, (including the waters of the Upper Murrumbidgee and the Murray, the highest part of the Australian Alps, the sources of the Gipps' Land rivers, and portions of the sister colony of Victoria), I have found gold in granites of peculiar character—but in them only.

It is, therefore, with a view not of finding unnecessary fault with "Publicus," who is quite right to stand upon his own experience, and to detail his own opinions, that I presume to mention his letter, but to check the probable impulse which his too broad an inference is likely to produce, being assured that those who cannot, from want of previous knowledge, discriminate amongst the varieties of granite, may run the risk of grievous disappointment. At the same time, it is but just to declare my confirmed opinion that some of our granite rocks are richer than is supposed; and the only fear is, that persons of covetous dispositions or impatient tempers will turn with contempt from granite gold, because it does *not* present itself in veins or in lumps or in hundredweights, but only as "dust in the balance." To extract it requires patience, perseverance, and diligence, and these are qualities in which all gold diggers do not abound.

"Publicus" must, however, hold me excused if I do not adopt his statement as it stands near the end of his letter, respecting the "rivalry of granite over the quartz formation." But having *seen* gold in certain granites, on ranges near Araluen not yet worked—having washed it out of granites from Major's Creek—having found it in granites in the counties of St. Vincent, Argyle, Murray, Dampier, Wallace, Wellesley, and beyond the boundary of New South Wales—in the basins of the Shoalhaven, the Murrumbidgee, the Hume and the Snowy River—albeit in minute quantities in some instances—I fully concur with "Publicus" in thinking it worth while that the question should be set at rest. But I, nevertheless, warn the indolent or easily dissatisfied, not to come flocking to a granite region upon the strength of such advertisements as figure in the first column of your journal of the date to which reference is made above.—I remain, &c.,

W. B. CLARKE.

Camp at Coocoocmanulla, Jan. 15th, 1852.

THE GRANITE GOLD OF NEW ENGLAND.

To the Editor of the Empire

SIR—It will, I submit to you, be rendering a public service at the present time to re-publish for general information the following several passages from the Rev. W. B. Clarke's geological surveys, relating to the gold diggings now opening up on the Rocky River.

None will deny that the recent exposure of these hill-covered gold deposits is entirely due to a movement among the gold diggers themselves unprompted, unstimulated, and unencouraged to exertion and discovery by any of those artificial means which in former times may have been found useful in awakening an apathetic multitude to a just sense of the treasure-strewn path upon which their daily footsteps were planted; yet it is gratifying to turn from contemplating the mere showman's arts, to examine in this instance the cautiously expressed predications of the scientific authority I am about to quote, and to find the previsions of science becoming verified after years of arbitrary and unmerited depreciation.

"There can be no doubt, at least," observes the Rev. Mr. Clarke, in the public document to which I refer—(the seventh Report, dated Armidale, February 14th, 1853),—"that gold, in this part of New England, is most abundantly found where granite has been disturbed and overflowed by hornblendic trap. This deduction has been confirmed by the testimony of the most intelligent of the observers amongst the gold washers along the Uralla (Rocky River), with whom I have conversed."

"That quartz veins, bearing gold, do exist, there is, nevertheless, reason to believe even as respects the granite itself; but, as about Major's Creek, in the Araluen field, so along the Rocky River (Uralla) field, these veins are generally small. More to the westward there are auriferous quartz veins in schistose beds, in the neighbourhood of the present Bingera gold fields; but I am led by a multiplicity of facts, all bearing one way, to conclude," says the scientific reporter, "that, in New South Wales there is no anomaly in the association of gold with granite, which, under certain conditions, is always found to be somewhat auriferous, and generally more so than the schists."

"Should it be argued," continues the Rev. Mr. Clarke, "that the Gold which is so universally distributed over tracts of granite, circumstanced as I have described, was originally derived from quartz-bearing schists, which have been denuded altogether, with the exception of the fragments yet remaining, in which cases the higher tracts of these fragmentary schists ought to be auriferous if any are so, it must be left to the assertors of that doctrine to show by indubitable proof that such must have been the case. For myself I can only say, that having sought for such instances of auriferous schists I have never found any immediately over auriferous granite at high elevations; and I have, over and over again, found granite at nearly all elevations, parallel with those of existing unauriferous schists, to be auriferous. In the character of the gold itself there is also a clear proof that it has not always had the same origin in time nor the same matrix. Whilst gold derived from veins of quartz in schist puts on divers distinct and remarkable forms, gold found over granite bears a kind of universal character; being granular, fine, and of uniform purity, such as well could be supposed to have been once entangled amidst the granular elements of granitic rock. There is little difference in these respects between the gold of the Uralla (Rocky River), of the Araluen, or of the Ovens gold field. It is immediately recognised by its features."

"Probably the point may be conceded that the gold as well as the gems in the granite country had its matrix on the outer portions of the granite at the junction of other rocks. Some of these having been denuded, as we have seen already, much disintegrated and decayed, the heavy gems and the heavier gold have been left in the granite and on the scaly soft surfaces of still decomposing drifted blocks of granite now filling the creeks and river beds and which once belonged to the upper and outer portion of the granite masses."

"Being under this impression and seeing how completely a wide region in New England, both on the western and eastern falls, is occupied by granite either partly destroyed or still attaining a considerable elevation, and knowing that much of this granite is still covered up by partial relics of younger formations, or by universal gem-and-gold-bearing drifts; seeing also how thoroughly this region has been pierced and overflowed by igneous rocks of various kinds, I cannot but conclude, that there is a vast amount of gold scattered over this portion of New South Wales, and along both falls from the table land; and so far as experience goes, this geological inference is borne out by facts. For, whether in small quantity or in abundance, every creek and river, and the deposits of drifts upon the surfaces of the country are found to contain gold and gems. And yet, in consequence of its depth and from want of water much of this gold can never be obtained."

"This difference between an auriferous country of granite and one in which the gold is found in veins is as much marked by this universal distribution of gold as by its occurrence in nearly equal sized particles; and a little reflection will show why this equality in size and distribution is to be anticipated."

It affords me much pleasure, Sir, to express an acquiescence in those views. I have, as you know, opposed with all my force, at every opportunity, the metaphysical myth inculcated by one or more European geologists, that gold is equally disseminated in grains through the mass in granites, yet there cannot be a doubt but that upon the surface and outer portions of granite the precious metal can often have had its matrix. The fine character of the metal itself undeniably indicates when the gold granules have had a granitic source and origin and invariably distinguishes such gold from that which has been in any possible way derived from quartz veins in schists, and if (which is my view of the matter) gold of the latter kind can have been brought visibly and abundantly into presence towards the surface only, and deposited upon the fixed rocks in horizontally disposed beds or free or easily released grains, so likewise, according to my thinking, has the precious metal been brought to the surface upon granites. "I can see no other conclusion," says the Rev. Mr. Clarke himself, "than that to which I have come, it is local gold" (in New England.) Such appears to me to be the universal condition of eminently rich gold deposits. Pebble-covered local gold in evenly-spread beds or linear troughs of leads or gutters, but very partially disturbed by existing drainage streams, characterizes most of the notably rich mining centres which I have witnessed. The granite-produced gold of the Ovens gold fields, of Major's Creek, and of Braidwood generally, (which have all been first class diggings, if, indeed, they be not so yet,) may perhaps be some test of the value of such deposits as remain in concealment upon the granites of New England, yet it seems to me not improbable that the former are but as surface scatterings in comparison with such as may be revealed by the deep sinking commencing near Armidale.

Gold diggers may be experienced either by having had a long acquaintance with one or a few localities, or by being conversant with a great number of gold mines. Among the crowd of men proceeding towards New England, there are, no doubt, many whose experience in gold mining embraces all its varieties, yet, taking the Victorian gold diggers in the mass, they really have had no great experience at working in gold on granite, for except on the Ovens and some other streams on the northern borders of Victoria, the auriferous granites do not elsewhere exist in that colony. The experience of the Victorian diggers generally is confined to working for gold on fields where quartz and slates are the constants. The rich patches of gold grains in that description of digging were unquestionably, when first opened in Victoria, of greater extent than the hardly less rich, though smaller, numerous patches in this colony, and the larger sort of gold which the quartz and slate fields produce dazzles the eyes of strangers more completely than small granite gold will do; yet it needs no logic to prove that a pound of fine gold is of equal value with a lump of the same weight. The working for gold on soft granite has many advantages, of which the Victorian diggers are not all fully aware. Easy driving under a solid ironstone roof is the *beau ideal* of a gold mine, and that is the sort of mining on the Rocky River. It is not necessary that such gold deposits should be enormously rich to make them attractive.

"When, however," to quote again from the Rev. Mr. Clarke's seventh Report, "as in the case of the New England districts, there are both vein-gold and granite-gold, and all the rocks over a vast area to the westward appear to have been more or less affected by gold-producing phenomena, we may safely anticipate that there is much gold yet to be discovered in the alluvia around the detached ranges, between the table-land and the flat interior, and that hereafter, as the seasons may suit and diligence be called into requisition, not only the Hanging Rock, and the Peel, and Bingera, and the Uralla (Rocky River) but divers other localities will supply, if not to a multitude greedy of great gain, yet to men contented with moderate gains, gold through many years to come."

"In the preceding details, I have," continues the authority in quotation, "stated fully what are my views, and though I have therein pointed out, that a granite gold field is not always likely to be of very long continuance, in consequence of the facility of obtaining its alluvial gold, and on former occasions have shown that difficulties of other kinds exist, likely to aid the prejudices of gold diggers in general, against such fine metal as such a field alone supplies, I think, that as the researches of those employed are extended, other spots than those now worked will be found along this river, and on other streams belonging to the same system of waters. At present, only two or three parties have employed any engineering skill; nor have the boulders been removed from the bed of the river in more than one or two claims. I do not doubt that under these there is much gold."

"I have," adds the scientific author, "already expressed my opinion as to the probable future importance of the country between this (Armidale,) and the junction of the Namoi and Gwydir, over which, I am thoroughly persuaded, gold is to be found in numerous localities. To test this experimentally, and as it ought to be tested, is not in my power, nor in that of any single individual; it is the work of a multitude. Yet, though caution is necessary in deducing extensive conclusions from the limited data supplied by what one set of gold washing implements can supply, and in the excitement of the public mind, it may require extreme caution when dealing with the commercial value of a country as a gold region, I think sufficient has been advanced by me in this Report, and in those which precede it, which may be considered satisfactory as to the inference that the Hanging Rock and Peel River Gold Fields, are the 'outskirts of one of wider extent.' "

To enlarge upon these extracts would be to mar them. They are the work of a solitary scientific explorer, written three years ago, when pseudo-scientific fallacies perplexed, and garbled accounts from California were scarcely less bewildering. Yet, are not all these previsions of true science about to be realized? To say now that the beds of existing streams will afford no certain criterion of the value of neighbouring gold deposits is to repeat a truism better understood at this time than formerly. The apprehended impossibility of obtaining the gold of New England in consequence of its depth in the drift upon the surface of the country is but a groundless fear, and its expression supplies information which in reality is the most alluring invitation that could be sent to a body of energetic gold miners. It is surely to be regretted that the plan of collecting and distributing authentic and reliable information which began auspiciously should have ended so abruptly, and have been rewarded in that particular case so inadequately, when the magnitude of the subject is considered and the sums since expended in searching less favourable fields is remembered.

I am, Sir, your obedient servant,
SIMPSON DAVISON.

Sydney, 13th August, 1856.

GOLD IN GRANITE.

To the Editor of the Sydney Morning Herald.

SIR,—It is a very long time since I have written anything on the subject of gold in Australia, but I have received a refresher and must awake. In your impression of the 7th instant, is a letter from Mr. Simpson Davison, on the subject of Gold in granite, accompanied by a letter to him from Mr. Potts, late of California, and now of the Rocky River.

In Mr. Davison's letter I find the following passages:—

The Rocky River is one of those localities where alluvial gold is most abundantly found upon a granite bedding rock, and in which an obviously existing connection of the precious metal with the granite masses beneath has afforded much matter for philosophical speculation in the official reports of the Rev. W. B. Clarke.

The readers of your journal are aware that a few years ago Sir Roderick Impey Murchison, upon the alleged authority of the Rev. Mr. Clarke, solemnly informed the several learned bodies of which he is so distinguished a member, and the public generally, that in Australia gold was found equally diffused in visible grains through the granite itself."

By "granite," I find Mr. D. means "solid granite," "hard granite," and granite in "mass." It is therefore said by Mr. Davison, that Sir Roderick Murchison solemnly informed the world that I had authorised him to state that "in Australia gold was found equally diffused in visible grains through the granite itself."

On looking over what Sir Roderick has really said respecting me, in print, I can find only this passage, which seems to bear upon Mr. Davison's reference. It is in "Siluria," p. 452.

"Whilst the most prolific sources seem to have been the quartzose veinstones which traverse the older slates, we are further instructed, that in Australia, *as in the Ural Mountains* there are *tracts wherein* gold is diffused in *small* and *almost invisible* particles through the body of *certain granitic rocks*, especially those (according to Mr. Clarke) which are hornblendic or syenitic."

This is all, so far as I know, to which I am pledged.

Now, when Sir Roderick wrote this passage, he had read only those of my reports which relate to the country south of Sydney, in which the Gold-Fields of Araluen, Mitta Mitta, Snowy River, and other Alpine regions are described. I have, therefore, carefully searched those reports, to see if, by any chance, I had left unguarded by what is said any opinion on the question mooted by Mr. Davison.

I can now confidently challenge any individual to point out a single statement which affirms that "in solid granite," "hard granite," or the "mass in granite," gold is "equally diffused," as Mr. Davison has it, "in visible grains."

The trouble I took to ascertain the real facts of the case led me to a conclusion not of that kind, but of another kind, viz., that it is in "decomposed," "disintegrated," "transmuted," "hornblendic granite," alone, that gold does so occur in Australia. And I stated clearly enough, that such granite is nearly allied to *talcose rock*, which all through the United States is a matrix of granite, wherever gold occurs.

The absence of such granite, so far as I believe, is one reason why in Tasmania the supplies of gold must be limited; the granites which I saw there, being of a different character from that of the grey hornblendic and syenitic granites of the Rocky River, Araluen, &c.

If you will be so good as to reprint the following remarks on this subject from my Report of the 21st October, 1851, your readers will perceive, that I have only stated in other words, what both Mr. Davison and Mr. Potts confirm, that gold is found in "rotten granite," in "soft granite," or what I call "disintegrated" granite, as well as "modified" and "transmuted" granite.

[The passages alluded to are at pages 29—32 of this work.]

I have mentioned, moreover, gold in "*granitic detritus*" at Warri, on the Shoalhaven, in my Report of 10th November, 1851; and in my Report of 24th December, 1851, I say,—"Near Mitta Mitta, and creeks on the left bank, gold is very abundant in the *decomposed* and *decomposing granitic detritus*." I mention, also, that in the Alps, I found gold generally "*connected with* granite of some kind," and "its occurrence in *granitic rocks* of a *certain* class." Further, I explained that the "*habitat* of the gold was a *peculiar species* of granite *approaching the talcose rock of America*."

At Mount Elrington, I produced a lump of similar granite, which was taken from a hole dug in Major's Creek; and Mr. Hargraves, who was there at the time, doubting my statement that it was auriferous, broke up the lump by my desire, over a prospecting pan, with a hammer, and the gold fell out, as I had seen before. So was it on the banks of the Mitta Mitta; the gold fell out of the soft granite when struck by a hammer. I sent a specimen of this to the Government at the time. I found it lying unnoticed in 1853, and the same specimen was exhibited in my collection in Paris in 1855.

There were a few other remarks, in subsequent reports, in which I have spoken of gold as directly traceable to the existence of granite as lying upon it, and mixed with fragments of the detritus of granite.

It is from these statements, and no other, that Sir Roderick Murchison compared what I described here, and what he had found in the Ural; and, therefore, as what I stated is confirmed by Mr. Davison and by Mr. Potts, I do not see what end is to be gained by calling in question the statements against which Mr. D. excepts.

But as Mr. D.'s *venue* is the Rocky River, it will be well to see whether I am in fault in my subsequent reports on the Northern Gold Fields.

In my report of 14th February, 1853, I said—"Gold in this part of New England is most abundantly found where granite has been *disturbed* and *overflowed* by *hornblendic trap*." (Surely this is well established by the late researches about the Rocky River.) I speak, therein, of gold and granite, "*under certain conditions*," as more general than any other association, instancing Mitta Mitta, the Ovens, Moamba, &c. But, as if shutting out "*all controversy*," I have defined my opinion in these words, words confirmed by what Mr. Potts himself says, of gold on the "*surface of granite*;"—"I think in that portion of the granite which was once, or is now, in contact with trap of some kind, that is to say, on the *surfaces* of the granite, or at the *outer portions* of the formation, in contact with some other formation."

The whole of my speculations come to this; and the whole of my attempts to explain gold in granite, are resolved into the deduction, that whatever gold may have been elaborated in granite must have been in the *superficial portion* at the *outside* of the original masses.

These are my words—"Now, what has occurred in the Araluen gold field and on the Mitta Mitta, (in both of which localities, I separated gold from granite by the blow of a hammer), has occurred on the Rocky River.

"In one of the workings, I pointed out to the gold-washers, a *decomposing flaky covering* from a large *drifted* mass of granite, with particles of gold visibly apparent to the naked eye, and this could not have been washed into it. It was there, because the granite in which it was found contained it before the boulder had been rolled down from above. It belonged to a mass, which, in all probability, had been at the *outside* of the granite formation.. . . .

"Some of these having been *denuded*, as we have seen already, and *much disintegrated and decayed*, the heavy gems and the heavier gold have been left in the granitic sand, and in the scaly *soft surfaces* of still *decomposing drifted* blocks of granite, now filling the creeks and river beds, and which *once* belonged to the *upper* and *outer portion* of the granite masses."

After this, I have gone on to speculate as to the probable abundance of gold in the other similar granite tracts of New England, and may I not venture to ask—was I deceived? Have not all my indications been proved true to the letter? Does not the Uralla itself—does not the Glen Elgin gold field—does not even Boonoo Boonoo show that my views were correct?

It is certainly some satisfaction to me, that not one statement I have made to the Government has been proved fallacious *thus far*; and that day by day, and by the strongest concurrences, there has been, during five or six years, a continuous verification of my reports. I take Mr. Davison's and Mr. Potts' letters as confirmatory of what I have deduced, not alone from observation, but by induction from acknowledged principles.

And I now repeat that the future of this colony, as relates to its production of gold from tracts of granitic formation, will be infinitely expanded; and that, wherever a soft *surface* of *hornblendic granite* can be found, or where such surface can be worked, gold will and must be obtained.

Having said this, I will explain how gold has been held in such outer surfaces of granite originally, not as Mr. Davison puts it, "*equally diffused*, in *visible grains*," but held in sulphuret of iron—in iron pyrites—from which the whole of the gold in some countries is procured. The decomposed granite, holding gold, is generally *ferruginous*. This is occasioned by the decomposition of the iron; and, I will add here, with a celebrated geologist, that there is a question of infinitely more difficulty, and equally striking with that of the association of gold and granite, viz., the association of sulphur with granites and connected metamorphic formations.

I will go further, and say, that before any person denies the possibility of gold in portions of granite below even the present surfaces, he should ascertain by distinct examination whether it may not exist. Gold has been proved recently to exist in all metals; and we know it is universally found not only in such portions of granite as we have considered, but in other formations, and, to use Sir Charles Lyell's words, in *all*. It is elaborated by vegetable growth in soils where there are no pretended geological indications: it is found occasionally in rain water; it may, for anything I know to the contrary, exist in the air, vaporised and afloat, as reguline.

My view of its occurrence even in *quartz*, which is allowed by your correspondent to be a matrix (and what is quartz but a constituent of granite?—and what are the threads Mr. Potts speaks of but segregations of silica?) owing to the action of steam, is confirmed by a recent determination of Mr. Sorby, (which you have published an account of in Monday's *Herald*,) who says, that all crystals of *quartz* and *granite* contain innumerable cells, charged with *water*—and that, therefore, hypogene rocks are not simply igneous but *aqueo igneous*, and formed by *pressure* under the ocean. This he has determined by the microscope.

With revelations of this kind coming to light, it is wasting time to dogmatise on the observations of those who can scarcely know what they see with the natural eye alone, or on speculations which, however honored to-day, may to-morrow be consigned to eternal oblivion.

I cannot resist quoting here a passage from a work published in Petersburg and Paris in 1856, by a member of several Imperial societies, which will show that my views respecting the formation of gold in veins by the aid of vapour or steam are commending themselves to others, and it is with this object only that I quote it:—

"Gold and silver were formed by the action of fire, or, as it is called, by the igneous way."

"Gold and silver penetrated to the surface of the earth, traversing cracks and crevices, under the form of vapours. . . . If, then, the formation of gold and silver was accomplished by subterranean ignition, it is evident that the two bodies passed through *all the beds* by the cracks and crevices resulting from the action of igneous substances darted from the bowels of the earth, and, moreover, that the metals presented themselves originally under the form of vapours or gas, or in general in the liquid state. It is easily comprehended from this, that those auriferous and argentiferous vapours rising through these fissures ought to be deposited in crystals. It is thus that these vapours, in traversing the rocks or minerals, which they meet in their passage, and in union with them, formed the ores and veins which we now see. It is for the same reason that gold and silver cannot form enormous masses like granite and other metals."—*Translated from a work "On Gold and Silver," by Narcès Tarassensko Otreschkoff.—Petersburg.*

Let all gold-seekers bear in mind that *no portion of the original surface of any exposed formation is now in existence.* They will then see, that, though gold is not *now* traceable in any but the *superficial decomposing ferruginous portions of granite*, ages ago, what is now considered alluvial, when formed on granite, may once have been formed in the still higher but now totally disintegrated or destroyed surfaces of granite; and therefore, "gold in granite"—or gold from granite, is not a misnomer, nor a mere formula of speculative theory. The Rocky River (Uralla) has proved this viz., that the gold, however it got thither, lying on the top of the granite, and (Mr. Potts admits, as in California) in the superficial portion, is now covered not only by deposits of other matter, but again by an overflow of hard basaltic lava, as in Victoria, in some cases one hundred feet thick, through which the gold is reached. Such gold is venerable from age: for, if alluvial, it belongs not to the alluvia of this epoch.

Hereafter, perhaps, we may find gold still lower, though not perhaps equally diffused in granitic rocks; but except in sulphuret of iron I have not found it in hard granitic rocks. Yet I consider it would be rash to conclude hastily that, because a thing has not been seen to exist, it will never be seen; and if the statements of Hopkins are correct, what is to prevent such discovery being yet made?

It may serve as an amusing pendant to this long discussion, if I mention that from the *facts* I have stated in my reports, a gentleman who read them in the British Museum, giving me more credit than some of my friends, has, on the strength of my description of *gunpowder gold*, (the gold which is nearly universally found when in connection with granite, and is different to all other gold), invented a peculiar machine for the washing and separation of such gold; and he proposes shortly to set it in action in this colony. It is not impossible, therefore, that we may know more hereafter than we do now respecting the possible and probable alliance of gold and granite.

In the meantime it may be well for those who deny the existence of "gold in granite" in Australia, to weigh well the following examples of such an existence in other countries, as related by other observers and geologists. But I again remark, that *all granites* are not in the category: it is only in decomposed hornblendic, syenitic, trappean granite, that it has thus been found at present in Australia.

(1.) "In my own experience on the Tuolumne, in California," says Mr. Potts "I have known *one foot of rotten granite* pay well for washing, but, at the same time it was soft and greasy, and could be spitted out."—(Letter in *Herald*, June 7, 1858.)

(2) "The rocks *in which* the gold of the Ural Mountains and Siberia

is found are very variable in their nature, including *granites*, metamorphosed schist, and other igneous and altered rocks."—(*Ansted, Gold-Seekers' Manual*, p. 9.)

(3.) In Brazil, "the rock, where exposed, appears to be primitive *granite* inclining to gneiss, *with a portion of hornblende*, and frequently mica. The soil is red, and *remarkably ferruginous*, in many places, apparently of great depth. The gold lies, for the most part, in a stratum of rounded pebbles and gravel called *cascalhao*, immediately incumbent on the solid rock."—(*Id.* p. 11.)

(4.) "It is, however, derived from the *granitic* and gneissic rocks, and particularly from those veins of quartz which run through them."—(*Id.* p. 59.)

(5.) "The gold of commerce is obtained chiefly from sands and gravel, produced from *disintegration of the parent rock on the spot*, or transported by water from districts where much gold is disseminated."—(*Id.* p. 51.)

(6.) The *Caldeiraos*, or those parts in the body of the mountains, where the metal exists in large masses, and almost pure, are of two kinds; those in *solid granite rock* seem to be chambers, whither the menstruum which held in solution the precious ore has tended,—where it has rested, and deposited the metal, with which it was saturated."—(*Luccock on Brazil*, 1808-1818.)

(7.) "In the well-known and important mines of Berezovsk, near Ekaterinburg, *granite* dykes or bands of talcose schists and clay slates contain the gold particles."—(*Ansted*, p. 53.)

(8.) "These mines (Berezovsk) are interesting, as offering the only subterranean shafts, by which gold is extracted from the parent rock. The chief fundamental rocks are *talcose*, chloritic schists, and clay slates, like those which prevail around Ekaterinburg, and these have been cut through by parallel bands of a felspathic rock, called '*beresite*,' which M. Rose considers to be a *decomposed granite, a continuation in fact, of the granites* of the Shartash Lake and Ekaterinburg. The band of beresite, which bears, in truth, the aspect of a metalliferous lode, trends from north to south, and contains within it many veins of quartz, in which the gold occurs."—(*Murchison's Russia and the Ural*, p. 477.)

[This is a similar case to that mentioned by Mr. Potts, of quartz threads intersecting granite.]

(9.) "I know of no primary rocks of the above composition of quartz and felspar, and the *friable, ferruginous granites, with bright yellow mica, but what contain gold*."—(*Evan Hopkins' Geology and Terrestrial Magnetism*, p. 55.)

(10.) "This metal is never found mineralised in nature, but *enclosed commonly in iron pyrites*, and frequently alloyed with other *metals*. . All the *ferruginous and friable granites*, containing yellow mica and pale yellow quartz, which are subject to *disintegrate into spherical masses, produce gold in grains* during the change. The *auriferous granites* bordering the Pacific Ocean, as well as those situate in the interior of the Americas, *which I have minutely examined*, show this effect in a striking manner. The internal crystalline character of the *auriferous granite* changes *as it approaches the surface* by an almost imperceptible gradation into a *kind of globular structure, like a coarse conglomerate*."—(*Id.* p. 53.)

(11.) "By bruising and washing the most compact quartz in the auriferous granites and porphyries, we detect gold in an impalpable state of dissemination, forming, in fact, a portion of the compound, like the salt of the sea; but it is in the small fissures only, or in the vacuities of the oxidating crusts that we find the granular or massive gold formed, by the process of crystallisation, which is constantly going on in the moist rocks."—(*Id.* p. 52.)

(12.) "Gold is sometimes found in gneiss, granite, and porphyry. It is often contained in pyrites. By decomposition it stains the rock with iron rust."—(*Vide Article Gold and Mineralogy*, p. 549.)

(13.) "Mr. Clarke leaves no doubt that we may find gold in different *granitic* rocks, which in Australia, as well as in other regions, present extremely various mineralogical characters. He has recognized, for example, on the banks of the River Mitta Mitta, that the gold is disseminated in a variety of *decomposed granite*, which approaches nearly the auriferous talcose rocks of California."

"It would be easy to cite other numerous examples of the position of gold, either in *granite* or in *schists, crystallised with orthose, which are decompositions of granitic rocks*. I will content myself with mentioning here the deposits of gold which are known in the Alps of France and Piedmont.* I will remark, moreover, that even in Brazil, *granite* is often the rock which holds the gold."—*Translated from Delesse, Gisement et Exploration de l' Or en Australie. Paris*, 1853.

I have now, I hope, said and quoted enough to save me from any charge of misleading Sir Roderick Murchison, or of inducing him to "solemnly inform the several learned bodies of which he is so distinguished a member, and the public generally," by proving that I have said no more than, and not so much as, some others, geologists, mineralogists, chemists, and physiologists, have confirmed—and what even, when regarded with strictness, both Mr. Potts and Mr. Davison also confirm.

The subject is one of so much interest, that I have entered more fully into it than either my leisure or your space would otherwise justify; but, in hope that good may accrue to some from such an illustration, not, perhaps, fully considered before, I have intruded to this extent on your forbearance.

Believe me, Sir, your obedient servant,

W. B. CLARKE.

June, 15*th* 1858.

SUBLIMATION OF GOLD.

To the Editor of the Sydney Morning Herald.

SIR,—When "Jupiter" condescends to seek for information from lowly mortals, it would be wrong to refuse what one has to offer, and, therefore, called on by name, I take the liberty of making a few remarks on your correspondent's letter in this morning's *Herald*. The question mooted is, whether there is reliance to be placed on the assertion made in an article in yesterday's *Herald*, copied from a Californian paper respecting the loss of gold by vaporisation at the San Francisco Mint. Unfortunately for myself, "Jupiter" has not put me in the way of

* I have mentioned the gold from the granite of Mont Blanc, in a paper on the strata of that district. M.N.H. vii., p. 647.—W. B. C.

answering the question by the means of instituting experiments on my own account, as he has not done to me as he did to Danae of old, showered in my lap his golden treasures. I must leave, therefore, to the officers of H. M. Mint, the special duty of reporting whether a like accident ever attends the operations of gold-refining in Australia.

But it may be interesting if I show, by the similar occurrences in melting and refining other metals, that all *primâ facie* objection is removed from the *possibility* of the case.

1. The vaporisation of *Mercury* needs little illustration. All amalgamators know that it is in this way gold and silver are procured free from alloy. The great merit of the recently-established machinery at Clunes and other places in Victoria is that the mercury thus vaporised is recoverable. In Saxony, the loss of mercury by this process used to be a sixth of a kilogramme for every kilogramme of silver, whilst in Mexico and Peru the loss was in the proportion of from 1 4-10 to 1 7-10 kilogramme of mercury to 1 kilogramme of silver.

2. With respect to *Tin*, it is recorded that in the old *blowing-houses* of Cornwall, where the tin was melted with charcoal, the fire being *blown* by bellows worked by water, (whence the name), the process was so conducted, that particles of tin were driven up on the thatched roof, in such quantities, that the owners of these blowing houses used to burn them once in seven or eight years, and they then found (says Carew, in his *Survey of Cornwall*,) as much tin in the ashes, as paid for a new building, with "a gainefull overplus."

3. *Iron* is also capable of being volatilised. In the trachyte lava of the Puy de Sarcoui, in the volcanic region of Auvergne, large crystals of specular iron ore are found inserted in such a manner amidst the particles of the rock, that there is no way of accounting for their occurrence, but by supposing sublimation: the iron must have been volatilised in the first instance.

4. As to *Copper*, the effects of its fumes upon vegetation and animal life, are sufficient to demonstate the possibility of some portion of the metal at least undergoing the process in question.

5. But the present mode of reduction of *Lead*, shows the way in which that metal is capable of suffering loss by vaporisation. In Durham and Northumberland, horizontal chimneys or galleries miles in length, with recesses, to collect the smoke, are in use for the express purpose of saving the lead, which, otherwise is deposited on the land or carried away in the atmosphere. The value of the lead thus collected from the *chimney scrapings*, at Mr. Beaumont's works alone, *considerably exceeds ten thousand pounds sterling*. My authority for this, is Mr. J. B. Jukes, who received the information direct from Mr. Sopwith, the well known manager of the mines. This last fact is quite sufficient to meet the arguments of those who deny the possibility of the vaporisation of metals. For my own part, I admit it even as respects gold, the only condition being the application of heat sufficient to cause it to boil. A considerable access to the arguments in favour of an igneous origin for the first arrival of metals in veins is, no doubt, involved in this question. But there is nothing, so far as is known, to disprove the possibility, if we admit the amount of heat which must sometimes have been necessary in natural operations.

I have quoted above the instance of iron in Auvergne, because it is well known to myself. Now, according to the tables in use, mercury boils at from 600 to 672 degrees of Fahrenheit's scale; whereas gold only melts at 5237 degrees. Of course, therefore, the mercury might be all evaporated before the gold would melt. Lead, however, melts at but little below the point of boiling mercury; and tin melts at a still lower temperature. Both may be vaporised, as we have seen already. According to the Auvergne example, iron, which does not melt except at a heat of 21637 degrees, may be vaporised. Copper also seems to undergo the same process, though its melting point is 4587 degrees. What, then, should hinder gold, which melts at 5237 degrees, from evaporating if sufficient heat be applied? The only question, therefore, really seems to be this—was the heat in the Californian furnace sufficient to boil the gold? Perhaps such a heat may be questionable, and allusion may be made to the heat of a volcano as not in fair comparison with that of a smelting furnace. Nevertheless, the heat of a plate glass furnace is upwards of 16800 degrees, whereas a coin of copper, which melts at a little more than a quarter of that heat, will float unmelted in lava in a melted state, at some distance from the point of eruption; though silver, which melts at 2283 degrees, disappears; and yet, Sir H. Davy states that a copper wire 1-20th inch in diameter, and a silver wire one 1-30th, introduced into lava at its source on Vesuvius, were instantly fused; and an iron rod 1-5th inch, and iron wire 1-30th inch, were kept five minutes in the eddy of the stream of lava, unfused. Our earthly furnaces are, therefore, much more intense than even some volcanic sources of heat. Any experiments, therefore, at the Mint which do not actually boil the gold will not satisfy the problem, or disprove the statements respecting the sublimation of gold in California. But, nevertheless, it will be seen from the above, that the heat employed there must have been greater than that which is usually employed in smelting furnaces of gold.

I do not venture to give any decided opinion on this subject, because, I have never seen any experiments directly bearing upon it. But, I may remark that, if flint glass requires a temperature of nearly 16000 degrees, and gold requires only little more than 5000 degrees to melt them, it is very improbable that quartz veins containing gold, (contemporaneous with them) can have been produced by the action of dry heat.

W. B. CLARKE.

22nd July, 1858.

[P.S.—I have since requested a friend at the Mint to have the roof swept and the soot collected, in order to discover whether any gold was thus diffused. The experiment was made and gold was found! It could only have been collected in the soot, by vaporisation. May not this account for a small portion of the waste in melting gold?

W. B. C.]

Mr. Selwyn, the accomplished Government Geologist of Victoria, has very ably pointed out in his first Report, &c., 1853, (Q.J.G.S., x., p. 299,) on the Mount Alexander Gold Fields, that the granite of that region cuts the quartziferous Lower Silurian slates of the Bendigo and Barker's Creek Districts across their strike, thus proving, that the quartz reefs are cut off by the granite; a fact which, I myself verified in February last, when with that gentleman, I examined the junction of the slates and granite on the southern flank of Mount Alexander, where transmutations of a kind well known to me in the southern districts of New South Wales, and at the back of Mount Kosciusco, are well exhibited.

Under the present condition of the surface, in the vicinity of Mount Alexander, there is nothing, however, to disprove the position I have maintained in my letters and reports; for, as in all probability, the gold-bearing rocks, before the intrusion of the Mount Alexander granite, extended over the whole area now occupied by granite, the old sedimentary deposits, having been carried off by denudation, it is possible, that some portions of the now destroyed granitic surfaces were in the exact conditions of the granite quoted by me; and it is equally possible, that a critical research would produce proofs of it, from patches yet in existence. But, whether this conjecture be reasonable or not, there is nothing in the facts established by Mr. Selwyn, to set aside conclusions drawn from different data, especially where the granite itself is of a different constitution. These remarks are to be borne in mind by gold-seekers in the Maneero and Alpine regions, where granites of different compositions are found in different relations to the associated rocks. Mr. Selwyn remarks, that there are no metalliferous veins in the Mount Alexander granites; there are, however, a few traces of lead and copper in the surrounding transmuted rocks, and probably from the granite, have been derived some occasional minerals in the detritus; but mention is made of Galena, Blende, Arsenical, and White Pyrites, in the quartz veins of the slates. On the Peel River, N. S. W., the granite does bear veins of lead and copper, but in that locality also, the gold-bearing quartz veins occur in diorite. So various are the conditions of the gold-bearing rocks. It may be added, that in N. S. W., we have nothing on the large scale exactly similar to the wide spread formation of *soft* quartziferous slates as they occur in the north-western gold fields of Victoria; for, in the highlands of Maneero, and all along the summits of the main chains of mountains, the formations have been more intensely transmuted.

Whilst referring to my friend Mr. Selwyn, I cannot refrain from bearing testimony to the skill, diligence, and judgment with which he is carrying on his laborious and interesting survey of Victoria. Would that our own Colony had equal advantage in that respect with her sister, and that a staff of equally enterprising and intelligent geologists were now mapping down New South Wales as Victoria is mapped! The map of Ballaarat, and that which is forthcoming of the Castlemaine district will, probably, give new ideas of the value of this survey not only in Australia but in Europe; and whatever may be the cost of production, it is sound discretion on the part of the Government and Legislature of Victoria to supply the means of such permanent and valuable contributions to the knowledge of this part of the earth. It is but feeble praise, to say that Mr. Selwyn, Mr. Aplin and the other officers of the geological staff are doing for Victoria, that which the leader has already so ably performed for British North Wales. It affords me great satisfaction to recollect the agreeable and instructive intercourse I have had, during two visits to the sister colony, with the geological surveyors both in the field and in the office; nor ought I to forget the other labourers in a similar sphere of duty, my friend Mr. Brough Smyth and his coadjutors in the Mining Surveyor's department. It will be long before so much good work in such a way will be done in this Colony. In looking through the "Mining Surveyor's Reports" published by the Board of Science, I find the clearest confirmation of Mr. Selwyn's opinions, as to the connection of the gold in the Castlemaine district with quartz alone: e. g. "where a gully continues above such out-crop of quartz, little, if any gold is found, and neighbouring gullies running parallel and precisely similar in geological formation, but not having quartz reefs, are also non-auriferous." (May 1859.) On the other hand, those who have read carefully the very able reports on the Ovens and other gold fields by the "Special Reporter of the *Sydney Morning Herald*", will be convinced that the opinions expressed by me on the subject of Gold in Granite are amply sustained by facts, and even Mr. Davison, who has theories of his own, has admitted the truth of my deductions.

In conclusion, I think it is well to call attention to the following remarks by Mr. Ansted, ("Scenery, Science, and Art") on the gold-fields of North America, in which he produces a fresh illustration of the occurrence of gold in decomposed rocks.

" The facts established with regard to the auriferous accumulations in this and others of the gold mines of Virginia, have a bearing not only on

the practice of gold mining, but also on the general theory of metallic deposits. For the practice of gold mining in any systematic way, it is clearly important that the geology of the subject should be known, for there is hardly any department of mining in which the usual mode of estimating value, finding the yield of a sample by panning or assay, is more deceptive. As indicators of gold, sulphuret of iron and quartz have been long known to possess singular value. Two or three kinds of slate or talcose schist, and a peculiar form of chlorite, are also found to be favourable generally. Here, also as elsewhere, garnets are remarkably constant; and some other conditions, such as the vicinity of chlorite and hornblendic rocks, and a peculiar state of the quartz, are worthy of notice. With regard to the theory of metalliferous deposits, the results are, I think, not less important. We have here one of the most extensive gold regions at present known, reaching from Georgia into Canada, and including, in the part I have examined, two belts of auriferous rocks separated by syenite. The gold occurs in the rock beyond all question; and although occasionally to be obtained from placers or diggings, where it has been transported by water, this is an exception to the usual condition in this part of the country. The rock within 20 or 30 feet of the surface is in a state singularly different from that presented at the depth of 40 feet and more, and this difference does not admit of being explained by any ordinary or extraordinary kind of decomposition. The enclosing slates and schists are indeed rotten and disintegrated, the quartz broken and weathered, the iron highly oxidized, and the whole band or vein readily reduced to mud. This, too, is especially the case within a small depth from the surface. But decomposition will hardly account for a change in thick, well-defined quartz bands, to small but distinct threads from an inch or two to a foot thick, perfectly detached from each other, and imbedded in innumerable thin flakes of coloured schists. It is another point of importance that the appearance presented by the quartz, when forming veins sufficiently well marked to pass current on a cursory observation, is not the condition found to prevail generally, when the whole system of rocks is examined."

It is very certain, that whatever opinions may be entertained by Australian gold diggers as to the improbability of gold having been diffused, occasionally, through the body of certain rocks, Mr. Ansted does not take part in those opinions; his statements are clear enough as to the fact, that in Eastern Virginia at least, gold is diffused not only in quartz but in other rocks, and in this he agrees with numerous other authors in Europe and America.

Space cannot be afforded for further extracts from Mr. Ansted's work, but it may be stated, that he confirms another of my views relating to the coincidence of hornblendic rocks with gold, and pointedly mentions that in America sulphuret of iron is very common in association with gold; that it is so in Australia I am able to demonstrate by my collections made from the granites and vicinal rocks at Araluen and other parts of New South Wales, and from the schists of Tasmania and Bendigo.

CHAPTER V.

GEOLOGY OF THE COUNTRY BETWEEN THE SHOALHAVEN & THE MURRUMBIDGEE.

REPORT No. IV.

THE GOUROCK RANGE, AND SOUTHERN DIVISION OF THE COUNTY OF MURRAY.

Camp, at Bullanamang,
10th November, 1851.

I have the honor of reporting to you, for the information of His Excellency the Governor-General, that since my last communication, dated Jineroo, I have made an examination of the country between that place and this, by way of Bombay, Manar, Lake George, Gidleigh, Queanbeyan, Micaligo, and the Berudba or Bredbo. I camped two days under the Tindery Brothers, in order to ascertain the character of the formations there, and have made other *détours* from the route above named. Having experienced very bad weather, and having been subjected to considerable inconvenience by a most extraordinary tempest on Friday last,* I have not yet completed my investigation of

[* As this storm was of a very unusual character as to its violence, it deserves more especial mention. The day had been very hot, and, as I had been on horseback since 7 a.m., I was anxious to come to an early camp. But as we were approaching the Berudba River, which one of my attendants spoke of as being very difficult to cross in time of flood, and as we saw ahead of us a very threatening sky, as if a furious tempest was brewing to the south-westward, I was induced to go forwards, in the hope of crossing the river before the storm broke. We had, however, scarcely gained the left bank, and set foot on the Maneero territory when we were met by a furious whirlwind of dust, hail, rain, and thunder, accompanied by vivid flashes of lightning dashing along the ground. As I crossed the river, I saw for a moment, up the valley, patches of what appeared to be snow; but these were nothing but vapour, suddenly condensed close to the earth by the sudden change of the atmosphere. In an instant, all objects were completely obscured, except within a yard or two. The horses, two of which were drawing the cart, and the other ridden by myself, immediately turned round to avoid the blinding gusts of dust, rain, and thunder. The dust came on at first exactly like a this neighbourhood; but I trust that it will be satisfactory to His Excellency, that I have been able to carry my researches on the western side of the Main Coast Ranges to the same parallel, 36° S., whither they extended on the eastern side, being now somewhat south of the mountains at the head of the Berudba River, whence I returned to Jineroo and Araluen.

With His Excellency's permission, I will reserve, till a future opportunity, my details of the geological phenomena in the districts lately examined, and confine myself to an enumeration of the localities in which I have ascertained the existence of gold since I left Jineroo.

I did not obtain any satisfactory evidence respecting it in the creeks falling from the Bombay Ranges, in the Maloon, Butmaro, and Turallo Creeks; nor in the creeks falling eastwardly into Lake George, on the parallel of Ellendon: there was gold in all, but it was not readily procurable. On searching the Molonglo River, below the crossing place from Turallo Creek, I found gold readily in the detritus of the river bed. I also ascertained its existence in the Queanbeyan River, though it is not abundant there.

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large wall, and with the hail frightened the horses, In about three minutes, we were all drenched to the skin, and there was not time to put on extra covering, though it became very cold. We, therefore, remained as we were, during the fall of the aerial torrent, till it grew nearly dark. Soon, we heard the roar of waters, and a furious flood came rushing along our track, roaring and hissing, and reminding one of a cascade. The whole country appeared to have been deluged, and I am satisfied, from what I saw next day, that a waterspout had burst over a limited space not far beyond us. The masses of rock and earth that had been washed down to the river, and also a mile or two to the southwards, especially about Cosgrove's, where the torrent had sought a way to the Murrumbidgee were perfectly astonishing.

The roar of the waters beginning to subside, but the low grounds being still very deep under water, we contrived with much difficulty to get the cart up a height to the left of the road, and when the moon broke out from the clouds about midnight, we saw that we were on a nearly bare porphyry hill without any neighbouring wood save a few dead trees, and we had first to cut down one of them before we could make a fire. At last we did so, and by the morning we had dried our clothes; but, as it was impossible to put up any canvas for a covering, we had to pass the night the best way we could. The morning was fine, and we made a start about nine; having no tent to dry, we were able to get under way without inconvenience. On passing to the Umaralla that day, Mr. Brodribb very kindly sent a man on horseback after me some distance on the road to Cooma, and invited me to rest at his place, which enabled me to anticipate some explorations on the west side of the Murrumbidgee.

It occurs also in a tributary to Smith's Creek, between Queanbeyan and Micaligo [at a point N. W. from Yarrow Pic, where the slates have a distinct cleavage.]

On the right bank of the Murrumbidgee, below Micaligo Creek, I also very readily obtained gold in every pan of earth which was washed; and also above that creek, as at Yangielera Creek and at the Berudba River, I have ascertained its existence. I have also to report, that along Cowara Creek, and in parts of the Berudba, it occurs distributed in small particles. I have also detected its existence on the Murrumbidgee, and some of the western creeks near this place; but the river and creeks being in flood, I do not consider my present examination satisfactory; the state of the approaches to the alluvial deposits being almost unsuitable to prospecting purposes. From what I have seen, I am, however, under the impression, that though large tracts of slate and quartz have proved to be not auriferous, yet where hornblendic granite occurs, there gold is found. And I think the banks of the Murrumbidgee will, ere long, be

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As conveniently suiting this reference to the tempest of 7th November, 1851, I may mention that so violent are the floods on that part of the Murrumbidgee, which there makes a sweep through the mountains, that I saw in the sitting room of Mr. Brodribb's house, which is some feet above the river, a brown mark only a foot or two from the ceiling, and which indicated the height of the last flood! On the 11th Nov. I measured excavations at the Stockyard behind the house, which had been formed by the rain that fell from 6 to 8 P.M. on the 2nd January, 1851, and by which blocks of granite and porphyry, some two cubic feet in contents, with earth and pebbles were removed, leaving a hollow in one place 12 feet deep, 8 to 30 feet wide, and 272 feet long; and in another 2 to 3 feet deep, 17 wide and 282 feet long; with minor excavations, I calculated that nearly 200,000 cubic feet had been thus removed in the little Stockyard Creek.

But this was nothing to the devastation at Bullanamang, during the flood that destroyed Gundagai, in June, 1851, the atmospherical warnings of which, apparent for three weeks previously, caused me to close my researches in the Snowy Plains, beyond the Eucumbene. I have been told that on that occasion Mr. Brodribb's house was under water altogether. I have often thought that my attempt to open up Maneero was as significantly welcomed by the tempest, of 7th November, 1851, as my last attempt to disclose the gold fields of the Snowy River, was significantly closed by the warning I received at "Bothered Jack's," (on the Gungarlin River) by the stormy wind and tempest of 13th May, 1852.

Nevertheless, in spite of these things, and in spite of the 87 days of rain, that I had to contend with, in a journey extending through 265, or *one in three*, I shall always look back upon the time spent in Maneero, as not the least useful, nor the least agreeable, that I have worked through, in spite of difficulties, during a long and varied career.—27th June, 1860.]

wrought. Two persons have already been at work at Cowara Creek, and have produced a very fair sample, which I have examined.

The gold appears to me to be all from a granitic matrix, being in character like that of Araluen.

In the creek falling from the Tindery Brothers, I found decomposed slightly hornblendic granite, and washing some of it, I detected the existence of gold therein. Should the present unpleasant weather subside, I propose running up the Berudba River to its junction with Cowara, and also examining the Murrumbidgee further, as well as Umaralla Creek, on my way to Cooma and more distant parts of Maneero. The Snowy River, I am informed, is now quite impracticable; but I hear there are indications of gold in the branches of that river, and in others falling from the Peaks of the Alps, of which I hope to report hereafter.

[As the future opportunity spoken of in the second paragraph of Report No. 4 has only now arrived, it may be useful to append here a few memoranda from my field books, in illustration of the geology of the districts passed over. This might briefly be described, as comprehending the phenomena of the Silurian formation, embracing slate and limestone, conglomerate and grit, intruded into by granite and porphyry, and resting on older granitic rocks carrying elvan dykes and other felspathic bands, with occasional lodes of lead and copper, that seem to occur where the rocks have been much transmuted by metamorphic agencies. In some instances the intrusive granite and porphyry following the strike of the beds, partakes of an apparent sequence of formation.

Near Gidleigh, on Turallo Creek, the slates have assumed the character of micaceous and chloritic schists, which is a common feature of Lower Silurian rocks in many parts of the world, owing to the highly metamorphic agency to which they have been subjected. Similarly, not far from Kurradocbidgee, and near the junction of Reedy Creek with the Shoalhaven, and at Manar, and near Modbury, the schists put on the character of chiastolite slate, which is a common phenomenon in some parts of Maneero, as at Jejedzeric Hill; and in England, as on Mount Skiddaw in Cumberland. In all these localities I have seen similar examples of this mineral change in the rocks. The limestones also pass in some instances into granular marble, the fossils disappearing, almost without a trace of them, and the colour also departing, so that the rock becomes of snowy whiteness. As the strike of the older sedimentary formations in this colony, as well as in Victoria, is generally along the meridian, or nearly so, the occurrence of the same rocks may be traced to the southward at wide intervals, even where they have been much interrupted; and where they come in contact with granite, they appear to have been folded up and over the granite in the original structure of the country, so that the same north and south lines of alternating rocks occur eastward and westward.

Subsequent intrusion of porphyritic or other igneous rocks has broken up as well as transmuted the sedimentary formations; and denudation has carried away vast areas of the original summit masses, leaving a broken, dislocated, and irregular surface to be still later, in geological time, affected by more recent igneous forces; so that as in Maneero, in the country now in question, there occur intrusive trappean summits, or wide trappean plains in which the trap has flowed over or around the insulated fragments of the quartziferous schists or other deposits of the same age.

As we depart further from the coast, these features become common, and thus, between the Shoalhaven and Yass, for instance, as the sandstones and conglomerates of the Carboniferous formation become reduced to mere outlying patches, the underlying formations, whether Devonian or Silurian, in the latter of which the lower deposits are the chief auriferous rocks, become more and more prominent; and where they remain uncovered by the more recent igneous rocks, there we see the phenomena alluded to above, viz., recurring alternations of rocks of the same mutual characters and features, along the same general strike. When the older members of the Silurian formation occur, or certain granites, such as have been described in the preceding chapters, are discovered, there gold may be looked for with a reasonable chance of success, especially, if alluvial deposits of detrital matter derived from the older rocks occur in exposed surfaces, or can be traced by the exposed edges at the line of contact of the granite and overlying sedimentary rocks.

Keeping this in mind, as we cross the country represented in the above Reports, or continue our journey to the southward along the line of meridional strike, we shall understand what is the use of geological indications in looking for gold; and shall come to comprehend, how river channels that cut across the line of strike, or run parallel with it, in the region of the older sedimentary rocks, where quartz veins are common, are the likeliest places to find the object of search.

Now, the alternation, or recurring of beds becomes very prominent on the upper part of the Shoalhaven, and in that country which was traversed by me between Jineroo, or Arnprior, and Micaligo and the Berudba; and similar recurrence or alternation marks the country, not only between Shoalhaven and the Murrumbidgee, but also between the latter river and the Coodradigbee; the effects of dynamical action, in upheaval and dislocation of the lower formations, becoming more prominent and distinct as we approach the axis of disturbance in the various parallel chains, and especially in those, which are the highest and probable central masses of all, the Snowy Ranges, nearly along the 149th meridian.

The Gourock Range is the nearest of these masses to the Shoalhaven, and in traversing the line of country named in the 4th Report, especially between Kurradocbidgee and Turallo Creek, we cross the northern spurs of the Gourock, the waters of which, instead of flowing to the sea are compelled by the character of the elevated plateau to flow into Lake George, which occurs on the broad summit of the table land of the county of Murray; and into which drain waters which can neither, owing to a parallel ridge on the western side from Cullarin to Molonglo, find their way to the Murrumbidgee, which is their natural outlet, by the Yass basin; nor by the more circuitous valleys running to the Lachlan.

Under these circumstances it is, therefore, probable, as will be insisted on hereafter, that some of the gold, now found along the western bank of the Shoalhaven, and what will, some day, be found in more abundance than at present at the heads of rivers running to the right bank of the Murrumbidgee, such as the Gundaroo, the Yass, the Molonglo and the Queanbeyan, has been derived from the disintegration of rocks which belonged to that elevated area of which the Gourock and its continuation to the north and south between 35° and 36° S. mark the eastern border.

In crossing, then, from Jineroo by Manar and Gidleigh, I had an opportunity of inspecting the structure of the Great Coast Range at its culminating eastern portion, and of tracing the alternations of the formations on its flanks. On the west side of the Gourock range, which I explored from Jineroo, tracing its continuation to the Tumatbulla ranges, between Jineroo and Jerrabat, we find a micaceous slate abutting upon the granitic spurs which fall from the range about Talerang Pic. Connected with these occurs a mass of protogenic granite, composed of red felspar, white quartz, greenish chlorite and a very minute portion of mica, passing on the west side into pegmatite. The whole of this tract in the vicinity of the Long Swamp of Gubededrac is metalliferous, with some gold at the head. On the east side of the meridian of Modbury, the granite is in immediate contact with a whitish felspathic schistose rock, having quartz disseminated between the laminæ, and this is interposed between the granite and the pegmatite. A coarse red conglomerate, or quartziferous sandstone and grit, overlies the latter in both localities. To the west and east of the pegmatite, the ranges are composed of a greenish talcose and saponaceous slate, passing into coarse bluish slate, which might be employed for slabs or roofing, and which in places is filled with andalusite or chiastolite, exhibiting on the transverse section all the peculiarities of the Skiddaw mineral, though in minute crystals, which are deposited along a hollow axis in a pyramidal form. The decomposition of these crystals leaves some of the surfaces of the schist studded with minute hollows. And, probably, some of the slates in Tasmania, as well as in this colony, are studded with small holes from a similar decomposition. The slate to the west dips 45° W., that to the east has a similar dip to the east. Bands of crystalline, grey siliceous, and apparently dolomitized marble traverse the chloritic schist, and separate it from the chiastolite slate on the one side, and from a laminated felspathic quartziferous rock on the other, and this extends to Queanbeyan. The bands of limestone may be traced northwards to the vicinity of Goulburn. These rocks taken as a whole are a complete representation of those on the Murrumbidgee.

Nothing can more clearly illustrate the way in which the country is built up of alternating parallels of the formations which belong generally to the lower Palæozoic epoch, than the transverse section just described, since it crosses the meridional strike.

Again, we have a regular passage from the schists to sandstone exhibited in the felspathic quartziferous rock and beds, jointed so as to produce polygonal and rhomboidal figures, having opposite angles of 52° and 128°, whilst beds of fine sandstone derived from the former rock occasionally interpolate the schists.

Occasionally the schists are traversed by dykes of porphyritic granite, which seem connected with porphyry, and in the dykes are entangled fragments of slate which are transmuted.

The limestone beds on the west side of the traverse were found to contain masses of fibrous brown hematitic ore. Dykes, also, of decomposing trachytic rock occur in the pegmatite, and dykes of grey metalliferous protegenic rock occur in the protegenic granite, all ranging across the meridian, about N.W. and S.E.

South of Reedy Creek a dyke composed of quartz, felspar, mica, and chlorite (a variety of granite) traverses the pegmatite and the neighbouring granite in an east and west course. The pegmatite which may be the representative of a porphyritic elvan (for such elvans also occur) contains veins of galena ranging N. and S. together with lodes of copper, chiefly green carbonate. But sulphuret of copper also occurs in quartz and in a chloritic gangue with fluate of lime and soap-stone; the lodes running N.W. and S.E.

In the whiter schists galena also occurs in veins associated with quartziferous conglomerates and sandstones, about Modbury, ranging N. and S. But what brings this locality into association with a gold field, is the abundance of fluted iron pyrites, and of micaceous, arsenical, and massive black as well as auriferous pyrites; some of which are met with in quartz veins passing through the porphyry, the ore occurring at the planes of contact.

In this small tract described, we have, then, some striking phenomena.

1. Alternations which we shall find repeated along the Murrumbidgee.

2. A passage from the granitic and slate rocks into conglomerate and sandstone.

3. The occurrence of silica with carbonate of lime in the composition of marble, a fact of which I laid an example some years ago before the Geological Society of London.*

4. The association of porphyritic rocks with metals.

5. The passage of granitic dykes through older rocks of the same mineral character.

6. The general tendency of the older sedimentary formations to take a meridional strike.

7. The tendency of felspathic dykes to a N.W. and S.E. strike.

8. The direction of lead veins along the strike of the older formations.

9. The direction of copper lodes to points either N. W. or intermediate between N. and W., establishing, almost, the conclusion, that the lead is older than the copper, inasmuch as the rocks that carry them are in that relation.

10. The occurrence of gold, either mechanically held in sulphuret of iron, which is a common phenomenon, and is known at Araluen to the eastward; or independently of it.

11. The probability that the trends of Modbury Creek are due to the same forces, which have impressed upon the metalliferous phenomena their various directions.

This tract on the north end of the Gourock has been chosen to illustrate the occurrence of similar ranges; and there can be no doubt, that the phenomena are repeated over and over again, in the extension of the Range into Maneero.

The same kind of succession takes place on the way to Gidleigh, where occur some singular instances of stratified, or bedded porphyritic granite, almost schistose, projected in huge masses, which have a dip of 60° to E.N.E., a phenomenon which will be seen to occur in the granite of the Murrumbidgee Ranges, at the back of Bullanamang, and which did not appear to me to be more auriferous than the granite now mentioned, as it occurs opposite Kugarloa, near Gidleigh. The ranges on Maloon Creek exhibit the alternating rocks before described; but on Turallo Creek which lies W. of Gidleigh, and runs into Lake George, quartz reefs of considerable thickness and great extent, occur in the brown Silurian slates.

*See Quarterly Journal of the Geological Society, vol. 1, p. 342. Feb. 1845.

At the time of my visit I found but little gold in this part of the country, as stated in my Report; but I was unable to obtain sufficient assistance to dig through the flat, the men whom I employed deserting the holes, after water came in at about 10 feet down. My own people consisting of but two persons who had charge of the horses, I was compelled to leave the fact unproved; but I have always considered, with my late lamented friend Rear Admiral King, who held the estate at the time, that gold does exist not far from that locality; indeed, it was found on Maloon Creek between the time of my visit to it and May 1852.

Quartziferous slate ridges occur between Gidleigh and Queanbeyan, the country descending gradually, but in places steeply, along promising looking patches of country till the Molonglo, Isabella, and Limestone plains are reached, in which the Silurian formation is distinctly marked by alternations of beds such as have been already described, and by abundance of fossils that leave no doubt as to the geological epoch; and where, again, we are upon a tract which contains lead, copper, iron and gold. In subsequent Reports, this subject will be more fully discussed.

Passing southwards from the Plains we find the same succession and alternation of rocks, and these, in fact, continue right through Maneero to the heights above Gipps' Land, so that the above description applies generally to the districts between the Queanbeyan River and the Murrumbidgee.

The parallelism of the ranges and rivers, including the Shoalhaven, the Queanbeyan, the Murrumbidgee, the Coodradigbee and the Tumut, all of which have a general trend from S. to N., between the parallels of 35° and 36° S., is not without a significant cause. That cause has been partially illustrated in the account of what occurs in the disposition of the rocks along the Gourock. And it is because of the importance of having this striking feature of the country well impressed upon the minds of the gold explorers, that I dwell so much upon it. If they can master the geological phenomena in one portion of the country, and perceive the consistent characters and structural identity of the alternations of any two portions of the same, they will be more easily led to inferences favorable or unfavorable to their search for gold; and if by examination of the limestones and slates, and associated deposits, they can discriminate very nearly the relative age of the formation, which the general character of the fossils will determine, if not scientifically, yet enough at least for their present purpose, they will know within a little, whether they are in a region which holds out any inducement for their pursuit. And, unless I have studied all this in vain, the occurrence of certain granites, such as were previously described in the chapter on "Gold in Granite," will, with the other indications be to them instead of a perpetual monitor. Without this acquaintance with geological *constants*, (as Sir R. I. Murchison has called the invariable relations of rocks,) gold finding will ever be a matter of accident, and not the result of knowledge.

It is not, therefore, the general outlines of any region and vague notions of certain fanciful resemblances which are just as likely to be wrong as right, and, probably, more so, that will enable a person wandering about the country to hit upon a locality; but it is the sufficiency of observation of the peculiarities I have now pointed out, which a careful, though not strictly scientific, person may attain to, that will stand instead of actual knowledge of geology; because such observation, though limited, may lead to a spot where a few particles of gold may be found and, after that, the matter, so far as the gold digger is concerned, passes out of the province of comparative investigation. If it had not been for geological principles thus applied, my own exploration of the Colony for gold would have been nearly useless: for, having but two persons with me, who had very little time and less inclination to do as thousands do, who work by the pick and spade without using their brains as well, and so become disappointed, such manual operations were of less avail to me in prospecting large areas than they are after the gold in any locality has been indicated to the professional gold digger. It is not to decry what is called the "practical man," whose value all appreciate, that these remarks are made; it is rather to assist others in becoming really "practical men": and if we needed any example to make this practical to men, we might refer to such as coming from California, for instance, to look for gold here, found it when the locality where it was known to be, had been pointed out to them, but afterwards left to themselves to roam at will over the whole territory have never been known, since the first adventure, to *discover gold* in any untried locality whatever. A lucky guess and an accidental circumstance may lead to a fortunate find; but the reveries of the fancy, not seeing general resemblances where they are to be seen, pass over the advantage when it is most needed, because knowledge is not imagination and fancy is not certainty.

I think, however, else it would be wasting time to enter into details of this kind, that the inexperienced traveller between Queanbeyan and Maneero can take a very good lesson, if he will only carefully study what he may see on the way.

The parallelism so much insisted on, and alternations of rocks are seen in the Burra and along Smith's Creek, and at Micaligo. In that line which follows in some measure the strike of the formations which are only occasionally crossed in the windings of the route, examples are abundant of what occurs near Modbury and at the north end of the Gourock Range.

The strike of the sedimentary beds, whether slates, limestone (which occurs at Micaligo and in the Burra), or quartzite, is generally N. and S., or varying from the meridian not more than 20° to W. having an easterly dip on the east side, or that nearest the granite of the Tynderies; whilst on the west side, on the left bank of the Murrumbidgee, the dip is west, on the side nearest the granite of Mount Tennant. So that the intermediate country between these ranges is, as it were, laid in a large trough, through which the Murrumbidgee pursues its way along the western edge, ranges of different rocks succeeding each other, and exhibiting all the phenomena, which varying structures and broken and contorted masses, into which porphyries have intruded and through which trap has burst, may be supposed to display.

The grey ferruginous quartz-bearing slates at Micaligo are probably the remnant of a once more lofty range, the softer portions having been carried off by denudation and elemental decay, the harder masses of porphyry remaining. A most instructive section is presented on the left bank of the Murrumbidgee, in the folded, outcropping curvilinear strata presented by the mountain on that side which forms the eastern boundary of Naas Valley, stretching for 40 miles S. and N. from the Berudba to Mount Tennant, just as the Tindery range bounds the Micaligo country to the east.

At the mouth of Micaligo Creek, the river is bordered by beds of limestone bearing various fossils, as *fragments* of *Crinoids*, *Cyathophyllidæ* and other corals; and the fluviatile drift upon them is partly composed of a beautiful hard grey porphyry, having plentifully distributed through the base rich salmon-coloured crystals of felspar. It was amongst this drift in the crevices of the limestone and slates that I found gold. The course of the river here is from the south, and is evidently due to the wearing out of the softer rocks, on the line of strike. As on the east of Gourock, so in this neighbourhood, the porphyry intrudes between granite and slate, and becomes a prominent member, in some of its varieties, of the formations that occur westward between the Murrumbidgee and Coodradigbee. This arrangement is well marked all the way to the Berudba and about Bullanamang. The quartz porphyry, which forms a very considerable portion of the Murrumbidgee rocks, even lower down the river, where well exposed, takes some peculiar forms. Near Yangielera the hills put on the shape of a cocked hat, and round their bases there is a considerable outburst of trap. The porphyry passes occasionally into a bastard granite; and also into bare hills of felspar and cornean. On the Berudba, dykes of hard grey hornblendic porphyry intrude among the slates. In the south, all the formations, as the country rises into the Maneero table land, become more important, forming distinct and lofty hills; the basalts and other trappean rocks also occupy more imposing positions, and every geological feature attains a dignity commensurate with the expanding width and height of the Cordillera.]

REPORT NO. V.

Bullanamang, 15*th November*, 1851.

In my last communication respecting the existence ot Gold at Molonglo River, &c., I mentioned that the slates and quartzites of the Merriwa and Lake George Ranges did not appear to be auriferous.

I have now the honor of stating for the information of His Excellency the Governor-General, that although when subjected to chemical analysis the quartz running through the slates yielded no gold, yet the ironstone intimately associated with that quartz (the specimens were taken from the summit of the range a little south of the Stony Creek) is auriferous, half a grain of gold having been produced, by amalgamation and the retort, from about four ounces of the ironstone.

I am able to confirm the report of the existence of gold in the Cowara Creek, and to state that it occurs in Bircher's Creek and Frog Hollow, where, as I have every reason to believe, it has been found in some abundance by a person living in the neighbourhood. The Berudba River is called the "Good Good River" in a part of its course between Cowara and the junction with Bircher's Creek; and in the "Good Good," at a locality where it takes a remarkable bend in the midst of highly inclined beds of schist and quartzite, I found no difficulty in obtaining several particles of gold in each pan of earth, collected by clearing out the interstices of the laminæ of the slate. No suspicion had existed of the auriferous nature of the alluvia of this river before I examined it, though gold had been found in the Cowara.

[Mr. S. Davison, who formerly held the station at Good Good, has made statements in the public prints respecting the occurrence of gold on that run. In a letter written to him by his brother 1st March, 1855, dated Burlington, the writer says: "I have seen a large number of your old letters, but do not find that you ever hinted at the existence of gold at Good Good or elsewhere until your arrival in California. Mr. Hargraves, in his letter to you, dated 14th December, 1851, (which I have here) says: 'Good Good will not produce gold in quantity to pay for working. I have visited it recently.'"

I am quite sure, however, from the tenor of the correspondence I have read, that Mr. D. held a very favorable opinion of Good Good. My own researches in that district incline me to think somewhat favorably of gold in the ranges to the eastward. I can only report what I myself saw of the country, in traverses across it from the Murrumbidgee and in a careful investigation of its structure. But, taking into account the fact, that the creeks and rivers mentioned rise from the very range, of which I have traced the continuation in my third Report to Uranbeen and Bigbadja, from which the heads of the waters are but three or four miles, and that gold exists, as we know, on the east side of that range in the Araluen country, and, as I afterwards found, in the whole of the country drained by the waters on the western side forming the Umaralla River, the junction of which with the Murrumbidgee is but seven miles to the south; I am still inclined to look upon Good Good as belonging to a gold country of rather better promise than is allowed in the opinions cited above. The geological structure of the district in question is a continuation of that already described to the northwards, and the counterpart of that on the eastern side of the range to the head of the Shoalhaven. The principal hills are of massive quartz porphyry, having on its flank grey slates with felspathic quartzose schists all dipping about 48° W., and which to the eastward are succeeded by granitic slate and hard bands of limestone and quartz, and which pass into ferruginous porphyritic flagstones. The limestones and slates contain *Rhynconella*; *Crinoidal remains; Petraia bina; Favosites; Orthis* and other Silurian genera, probably of about the age of the Llandovery beds of Wales. The succession of the different members of the formation is well marked by the outlines of the hills, which are distinct, rounded, and waterworn, the fossiliferous beds exhibiting the same kind of fluted and excavated surfaces which are presented by the limestones at Wianbene, and near Inverary on the Shoalhaven. At Good Good the quartz rock comes down in a broken mass striking N. 10° E. so closely imitating the *Stiper stones*, of which excellent figures are given by Sir R. I. Murchison in Siluria, (3rd ed., p. 13,) that, at the time, I said to the persons who were with me, I could fancy myself again in Shropshire. The resemblance is, perhaps, not distinct in all mineralogical features, but similar agencies are apparent in the contour and general appearance of the country. The age of the Stiper stones is perhaps older. That important physical changes have taken place at Good Good is also clear; for the rocks are broken and contorted, the strike changing across the river, being S. 28° E. on the west side, and N. 28° E. on the east. The limestones especially have been much transmuted and hardened, and the fossils are partly obliterated.

On the slates, &c., rests unconformably a deposit of ferruginous conglomerate of quartz pebbles and fragments of slate.

In completing my section along this parallel on the other side of the Murrumbidgee, I had an opportunity of overlooking the whole country on the east side, including, of course, the Berudba district; and I then saw, that whilst the mountain masses appeared to have a kind of general level, as if the whole of the ranges had been cut off by a vast denudation, yet it was possible to distinguish the separate divisions of the strata as the synclinal and anticlinal folds exhibited alternations of valley and ridge, and I could thus also distinguish the various differences of the component rocks by the outlines they have attained by the long processes of change to which they have been subjected in time.]

LEFT BANK OF THE UPPER MURRUMBIDGEE.

REPORT No. VI.

Cooma, 17*th November*, 1851.

I have the honor of reporting for the information of His Excellency the Governor-General, that having examined the Berudba River in the direction of the southern branches, the Cowara Creek, &c., I proceeded to the westward across the Murrumbidgee Ranges, to the waters falling into the Murrumbidgee through Alum Creek, &c., returning to Bullanamang by way of the Dry Plain, Black Springs, and Murrumbucca; these traverses complete my inspection of an area of about four hundred square miles along the Murrumbidgee since I left Micaligo.

[This journey enabled me to complete my traverse from the ranges at the head of the Shoalhaven to those at the head of the Murrumbidgee. The eastern portion of this traverse is described in the last Report. The porphyry, which forms the nearest principal rock on the Berudba side, appears again on the west, the Murrumbidgee here sweeping through a gorge in that rock at this place. The porphyry is succeeded for a little space by slates, and they by granite which forms the head of Naas Valley, and extends on the west side of it from the Gap for nearly forty miles. The granite in Reedy Creek which lies at the back of Bullanamang puts on a schistose structure and is slightly hornblendic, having frequently distinct aggregations of quartz and felspar with segregation of mica. The mass that extends to

Naas Valley runs nearly N. and S., bearing veins of schorlaceous quartz as in that valley. The same rock also occurs further south, as near Cooma. Near the river, the granite passes into mica slate, or gneiss, a nodular as well as schistose rock. Patches of segregated hornblendic elements and veins of porphyry also occur. The general outline of the hornblendic and schorlaceous portion of the granite in this region is that of the Araluen ranges, a round, rolling wave-like outline. This generally predicts an auriferous granite.

The slates are limited to patches only, but may be seen more fully expanded towards Murrumbucca. From the Murrumbidgee the ranges at the back of Bullanamang rise gradually to elevations of 171, 354, and 389 feet, at which latter height a creek runs down below the base of Robinson's Mountain, which consists of the *schistose granite* that occurs at Gidleigh, and which, as before said, I do not regard as very auriferous. The extreme edge of this mass has an elevation of 960 feet above the Murrumbidgee, and from it there is an extensive view over Maneero, and to the northwards; this summit, which I afterwards intersected from the head of the Bargo River, bears from Tyndery (A) S. 18° W., and from the Maneero Peak mountain N. 20° W. At this summit and at the western side of the granite, the rock is schistose and has a clear and decided easterly dip, assuming the planes of division to divide the rock into stratiform masses. In the middle region the granite attains an elevation of 1663 feet above the river, or of 4182 feet above the sea: it is there nodular on the large scale.

It is covered by timber, which exhibited the appearance of having been injured by snowstorms, and I was informed that in the preceding winter (that of 1850), vast masses of snow had accumulated in that range, as is probably always the case in winter. The surface of the ground after passing the granite led me to a similar conclusion. It is strewn with innumerable fragments of quartzite, and grey, black, and yellow highly silicified slate, betokening the presence of such beds at that elevation, 1239 feet above the river, on the western slope of the granite. The ground again rises to the height of the summit, 1673 feet, so that there is an undulation.

From this exposed *western* edge, I had a view over all the country to the heads of the Murrumbidgee and Tumut, Big Bogong and Table Top appearing in the distance. The whole of these ranges were deeply clad in snow; and the sleet and cold west wind I experienced on the summit, showed me how late in the year (12th November, 1851) the winter maintains its influence in this region.

At 1420 feet above the river, or 253 feet below the summit, the hardened schists ceased, and were succeeded by grey and brown *soft* slates, striking N. and S., and dipping 68° E., the reverse of that on the Berudba side.

The review of all these facts shows, that the Murrumbidgee runs in the straight course it pursues from above Bullanamang to below Micaligo in a *synclinal* depression, and it is precisely in it, about Yangielera, that basalt breaks out.

The slates continue from the mountain all along what is called Horse Gully, through which the descent is made to a swamp near Mondegong. At this place we meet with vertical slates, bearing quartz veins, and interrupted by basalt, which has burst through, hardened the slates and overflowed them, forming a hill 746 feet above Mondegong, which is itself 781 feet above the Murrumbidgee at Bullanamang, or 3023 feet above the sea.

Alum Creek flows to the westward at the foot of the hill. It passes there through the slates and the granite, which again appears, consisting of large grained elements of greenish mica, white felspar, and translucent quartz. Veins of quartz traverse the slate, and veins of pegmatite and leptenite occur in the granite. The basalt is inconsiderable in width; but it has a drift on its flanks of baked quartzite, jaspery slate, and ferruginous conglomerate. These rocks on the east side of the basalt assume so much the character of some of the Hawkesbury conglomerates of the carboniferous period, that, at the time of my first visit, I considered them as such. But, further acquaintance with the ferruginous quartz conglomerate, or "cement," which overlies the Silurian gold rocks round Mount Alexander and elsewhere in Victoria, leads me now to believe that they are of the same epoch as the "Cement," and if so, we have all the conditions at Mondegong of a gold field. Next the granite, at the bottom of the creek, is a greenish grey fine grained grit which belongs to the quartziferous slates. The creek itself rises in the high granitic and basaltic ranges that form the spurs from the peaks at the head of the Murrumbidgee, and which in the group of mountains about Mount Clear, the Centry Box, and Murragurall or Mount Murray, become prominent masses whence the tributaries of the great river and the Coodradigbee collect the melted snows into their basins.

The whole of this group and the base of the intermediate country, to Yayouk and Gungangara to the head of the Eucumbene and the Tumut, and round by Jones' Plains to Bolaro, is composed of the same general formations, granite, quartziferous slates, with the intermediate changes already described; but, in addition, there are vast outbreaks and overflows of basalt in the great plains that occur amongst the ranges, and these bring to mind the enormous basaltic plains of Victoria, spreading over many square miles of auriferous rocks, which, I do not doubt, is the case also along the upper parts of the Murrumbidgee. No one who has seen the Dry Plain, or others of the kind in that region, as well as those of Victoria, but will recognise the similarity of features; only these features are as respects this part of Maneero wonderfully contrasted in point of grandeur, with the tamer plateaux of the sister Colony. Nothing can be much finer than the contrast between the horizontal sweep of the basaltic plain beyond the river and the deep gorge amidst the thick ribbed cliffs of slate, in which the river flows, as seen from what I call Basalt Point, south of Bolaro. Clear beyond the basaltic horizon, I could distinguish the summit of Table Top white as a sheet, and the Snowy ridges to the south of it.

That gold exists in various places in the country thus occupied, there can be no doubt, and looking at the character of the rocks, such places will be discovered in due time. The long ridges of white quartz; the prevalent alluvium, not very deep and easily worked, where the slates approach the granite; and the whole of the deeply fissured and scarred surface of this upland country, induce the belief that, as population collects, it will gradually spread more to the eastward than the summit of the Alps, and will find as there, not only generally diffused particles of gold, but occasional pockets, as they may be called, of considerable extent. My impression of the country which I saw along the upper Murrumbidgee, and all the information I collected from those whose residence there has made them familiar with the country, led me to the same conclusion, that gold abounds in it. I merely record here, the views I took in 1851, but which were only briefly and hastily alluded to in the Reports which I was compelled to make as short as possible, owing to my constant occupation in the field. It was in this way that the Report I have thus interpolated continues.]

Alum Creek rises in the neighbourhood of granitic and basaltic ranges, and in that part of its course which passes through granite and receives some supply from the slopes of the basaltic spur at the back of Mondegong, I found readily particles of gold in the alluvium of the flat which is watered by the Creek; a little below this locality, slates traversed by quartzites, and having through them veins of white quartz, are much disturbed and confused by the mechanical effects of the intrusive agents; the gold appears to me to be derivable from a granitic matrix. This granite is *only slightly hornblendic;* and, like the higher ranges to the eastward, which I traversed at a height of four thousand feet above the sea, is schistose. It is generally very unlike an auriferous granite, but I think the gold may be locally distributed where it becomes hornblendic.

On my return from Mondegong to Bullanamang, having followed Alum Creek to within a short distance of its junction with the Murrumbidgee, I next day travelled along the "Back Creek" (as it is called,) where basalt has much disturbed the slates, and rendered it somewhat difficult to pass, without finding more than one minute particle. This was discovered at the confluence of a branch creek rising near the "Black Springs," and falling over a bar of basalt into the "Back Creek."

I do not venture upon any opinion as to the commercial value of these localities as respects gold, but it is very probable that when the shearing time shall have passed, there will be numerous prospectors, now the existence of gold is established, and then the metal may be found in abundance as well as in other neighbouring localities.

I am not, however, favorable to the idea of the existence of much gold in the *schistose* granite of the Murrumbidgee Ranges, having, besides those mentioned above, "prospected" in Creeks falling through that formation to the river, south of Bullanamang, and knowing that not much has been discovered in Naas Valley, which traverses the same formation running for about forty miles to the back of Mount Tennant.

[In the slates there will be more chance of success. I had no difficulty in obtaining the gold in the flats about Alum Creek. The soil was removed by a *trowel* only, and yet each panful of earth produced several particles. Below Mondegong, the creek trends to S. W., passing through a series of gullies of slate and quartz, in which the rocks are full of undulations. The river and creek run in lines of dislocation, which have fractured the strata, so that they are cut up into ravines. I saw in them much of what the gold diggers call "pipe clay," and great accumulations of fluviatile drift. Alum effloresces in the crevices of the blue slates, giving the name to the Creek.

The detritus over the granite to the east is chiefly quartz in pebbles, or not much rounded fragments of broken veins and reefs. At the junction with the basalt the slates are jasperised, or hardened; and here the detritus is larger. At Murrumbucca, where the basalt comes into contact with granite, the water-channels are filled with ferruginous balls, like grape-shot; this I believe to be a tertiary or modern product, resulting from the decomposition of basalt.

The occurrence of ferruginous conglomerates and deposits of iron, probably the bed stuff of ancient swamps, is very common in the vicinity of trap and granite. It is common in Maneero and New England under these circumstances; and appears to me to be akin to the tertiary cement of the gold-fields. It often holds gold.

As on other basaltic plateaux, the occurrence of lakes or huge ponds of rain water may be noticed in this district; "Mud Lake," for instance, occurs in a N. and S. hollow between amygdaloidal trap and quartz, not far from Murrumbucca. The granite at that place reposes on its edge, and becomes schistose, dipping 30° E.; its range is about N. and S., so that it is a continuation of the Robinson's Mountain rock. It contains segregated quartzose veins, and veins of steatite, in this respeet resembling the granite of Byron Creek, in New England, which occurs in the neighbourhood of the basalt and basaltic plains of the MacIntyre river, and is not far from the Bingera gold field.

The elements of the granite north of Murrumbucca are grey felspar, black mica, white quartz, and little hornblende, and it bears veins of leptenite. For a wide extent to the westward, the plains or upland tracts may be concisely said to be formed of islands of granite and slate, in the midst of a sea of basaltic rock or mud. There is much open forest but often a want of trees, which on the highest points disappear or become dwindled.]

CHAPTER VI.

GENERAL REMARKS ON THE GEOLOGICAL STRUCTURE AND AURIFEROUS CHARACTER OF THE

COUNTIES OF COWLEY, BUCCLEUCH, SELWYN, WYNYARD, AND GOULBURN.

These counties were not especially reported on by me in 1851-2 ; it may be well, therefore, in this place, to collect from chapters which I had prepared in 1848, for an intended Report on Australia,* some useful particulars, which will, I trust, not only serve to furnish an idea of the general geological details of the southern districts, but enable me to direct further attention to certain principles

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* Mr. Berry obtained a vote on 28th August, 1849, from the former Legislative Council, of £210, for the purpose of aiding in the publication of my Report. But, although this vote was afterwards frequently alluded to in the Council, and not always kindly, I never received any official intimation of it from any quarter ; and, consequently, I never received the money. The subsequent events of 1851 set aside any immediate further desire to move respecting it; and in that year, by undertaking a journey which the Reports now published describe, I was compelled to abandon, at that time, all idea of independent publication. But had I obtained the grant alluded to, probably the question of the first "gold discovery," as the affair of 1851 is commonly called, would have been settled in a very different way to that in which contending claims have been officially disposed of. It is quite clear, that the present chapter, if nothing else, proves what advances had been made by me in the geology of the southern districts long previous to 1851. It is not, however, to be understood that the present work is intended to supersede the larger Report, which I hope hereafter to prepare.

in the structure of Australia, which may be capable of application in other portions of territory not yet proved to be auriferous.

I will first consider the country immediately north of Limestone Plains and west of Micaligo, extending across the Coodradigbee and Tumut Rivers; and then offer some remarks on the other south-western Counties along the north-western frontier of Victoria, between the Murrumbidgee and Murray.

1. Counties of *Cowley*, *Buccleuch*, and *Selwyn*.

The whole of this region is occupied by very lofty and rugged groups of mountains, consisting chiefly of granitic, schistose, and quartziferous rocks, with porphyries and some trap, which latter have left evidences of transmuting agency of a later period than the intrusion of the granites amidst the slates, flags, and limestones of the Silurian epoch. Into such a broken region, where mechanical forces have extensively operated, geological phenomena of striking kinds might be naturally expected. And, therefore, amidst fractured strata, which culminate in mountains above 6000 feet in elevation above the sea, as around the sources of the four great rivers Tumut, Eucumbene (Snowy River), Coodradigbee and Murrumbidgee, which undulate to verticality, wild glens, upland plains, and deep valleys, assisted in their formation by denudation and erosion, partly the result of heavy rains and melted snow, are general features. Nor, regarding the meteorological or geological influences, is it strange that one of those rivers should rise in swampy plains, or, as in the case of the Coodradigbee, should issue after the first collection of waters, through a cavernous underground channel, or under a natural bridge of excavated rock, as on Coolalamine plain; where partly as well as from Garrangranmara Plain, the Murrumbidgee issues on the other side of the ridges, on each side of the "Gulf." In a somewhat similar way, first collecting in swampy ground at the foot of dividing ranges, the waters of the Tumut, and of the Eucumbene, as well as the other sources of the Snowy River, form in mossy flats in the recesses of the mountain summits. With such sources, it would be a fair deduction from physical premises, that where the ranges above these fountain-heads consist of slates traversed by auriferous quartz, there alluvial gold, of a coarse kind, will be found in what may be called extensive "pockets," because the lower grounds in which the rivers rise have been themselves formed, in the course of ages, by constantly acting degradation, even if no paroxysmal catastrophe had commenced the wearing down of the summits, which once extended over the valleys. Where, then, such localities occur in connection with auriferous strata, the normal strike of which is in the same direction as the courses of the rivers themselves, it will be apparent on reflection, that there are, probably, other localities in which gold may be found, that lie apart from the head channels of drainage, in what are called "Dry Diggings," and in the, at present, undisturbed veins below. But, as in those lofty elevations, erosion has had, generally, less extensive action, than in lower regions, of course, especially where the auriferous region culminates in one superficially narrow range, as along the Muniong, which supplies the chief upper sources of the Tumut and Snowy River basins, or the dividing chain between the Tumut and Coodradigbee, it will be advisable to search the flanks of those mountains, particularly in localities where the changing courses of the rivers intersect, on the one side or the other, the meridional strata.

In cases where rivers cut across the strike of the strata there is a somewhat different plan to be pursued in looking for accumulated deposits, which are found at points of obstruction, or in gold-digger's phraseology, where "bars" occur. The above remarks will justify what is said in a subsequent Report as to the reduced value of expectation of extensive and deep deposits of gold beyond a certain level above the sea. But it must, at the same time, be borne in mind, that if the area of such deposits diminish in width, it is likely to increase by frequency along the line of bearing, and by repetition on its parallels. It may be of use to the gold seeker to keep these deductions from the physical facts in view, and to follow out along the line of bearing, or on its parallels, such strata, as he has found to be auriferous by accumulations, where portions of the strata have been destroyed and gold has collected, if his researches lie in such regions as those at the heads or along the courses of the rivers under consideration. And where basalt, or other trap, overlies any portion of the auriferous strata, it may be well to examine the lines of junction; for there, as experience has shown along the Uralla, in New England, and at Taradale, in Victoria, the old alluvia have been preserved by the later igneous covering, and can be reached by tunnelling. As along the chain of the Alps, above the Long Plain, and beyond Giandarra, on Gibson's Plain, the Dog Plain, and Dry Plain, such trappean summits occur, there may be room for the exercise of discretion in this respect. And where, also, as will be found in abundant examples, granite of a certain class exists, and of the epoch of which, in comparison with the slates, there can be little doubt, it may be of service to consider how far the statements made by me in Reports Nos. II. and III., and in Chapter IV., are applicable.

It would carry me too far beyond my, at present, intended limits, were I to point out to what extent the parallelism of alternating strata, which I dwelt on in the case of the Gourock range, is evidenced in the loftier regions of the Alps and Maneero. It may suffice to say, that this is the great phenomenon of the whole of the higher portions of our Cordillera. It is the main cause, why gold fields in Australia are so widely extended in geographical longitude, as well as in latitude. The succession of alternations in this way, is a kind of "recurring series," which the mathematician finds sometimes useful to employ. The first point is, to find out the terms of the series, that is the rocks of which it is made up; and then to bear in mind, that in the lower portions of the Silurian series, the greatest amount of gold is likeliest to be discovered; for that has been determined by undoubted facts, and we need no better illustration than we have at Bendigo.

The least observant person sees, how frequently, in such a region, bands or "reefs" of quartz recur amidst slates.

But there are many component parts in the Silurian series, and at a great distance from the axis of disturbance the lowest members are not generally found, or if they are found, they are often too much altered in aspect to be recognized, except by their quartz reefs.

As an example of the way in which certain members of this series extend in Australia, it may be mentioned, that there is a band of cavernous fossiliferous limestone striking for full 200 miles at intervals, along the meridian of the head of the Coodradigbee; and that limestone of Silurian age has many parallels in meridional direction, in the Alpine and Maneero country. And what is remarkable as respects the cavernous limestone, is that it contains bones of extinct animals, whose destruction was, probably, at the epoch of one of the gold drifts, since bones of the same animals are found in the gold drift of the Turon country, and in other places. The same phenomenon is equally striking in California and Russia.* In this country, it is probably due to some connection with the ancient western boundaries of the raised land; for it is at these boundaries that the great Carboniferous formation begins to occupy a prominent position.

Again, ranges lying between the rivers in our present area, present alternations of slate, and quartzite, with granite masses, occurring also in similar recurring patches of country. To prove this fully would require an extension of observation south through Maneroo, and north all through New England. For this we have not room on the present occasion. But it would not be difficult to point out, how the same principle of structure seems to have operated, in continuing the same formations, as the bottom of Bass' Strait would teach us, if we could search it, into Tasmania; and in giving the peculiar character to the headlands and bays, in a regular order of succession, all along the North coast of Australia up to Cape York and into New Guinea. The flats and bays sheltered by high cliffs and precipitous bluffs, are in close analogy with the swampy flats and sheltered coves of the interior, lying among the mountains, and which now give passage to rivers and creeks.

In the county of Cowley, it appears that the most probably auriferous rocks occupy the western and middle region, while the eastern is occupied by the granites, that, as we have already seen, form the great boundary masses of Naas Valley, on the left bank of the Murrumbidgee and of the back of the river to Mount Tennant.

Amid the slopes of the granite and abutting upon it, lie the mudstones full of Silurian fossils, the limestones and flagstones, &c., of the plains along the Queanbeyan, Molonglo, and Yass Rivers. Of this area, which is intersected by the Murrumbidgee, I shall have something more to say

* "On the occurrence of fossil bones in the auriferous alluvia of Australia." By Rev. W. B. Clarke, M.A., F.G.S., in Quarterly Journal of the Geological Society. Vol. XI., page 405.

hereafter; here it will be sufficient to point out, that, as the same formations occur on both sides of the river, the same metalliferous products were expected. And as it has been found that gold exists on one side, so in the same way it exists on the other. But, at present, there has been an incomplete search for it in the Yass, and in the Coodradigbee district; the probability is, however, that the whole country is full of patches in which small supplies of gold have been accumulated. Regarding the serpentine of Jugion as an indication, it is likely, that all the varieties of gold fields, though on a small scale, will be hereafter discovered in the region between 148° and 149° E. and between 35° and 36° S. In 1852, as will be seen in a subsequent Report, I mentioned gold at Brindabella, and there are, no doubt, other auriferous localities in Cowley and Buccleuch, such as that on the Shaking Bog, which was proved in April 1855.

There are some general geological observations, which I wish to introduce here, because they bear on the principles which I would enforce, in relation to the gold-bearing rocks, and especially to granites, such as have been described in chapter IV.

It has long been the opinion of some geologists of eminence, that the distinction between granitic and schistose rocks associated together, is an unreal and unnecessary distinction. Dr. Boase, whose chief endeavour is to destroy the opinion of the igneous character of any portion of this system, offers, notwithstanding, very evident reasons for concluding, that in certain cases granites and schistose rocks found together are apparently contemporaneous; and that the phenomena considered due to after intrusion of the former among the latter are, in part, wrongly interpreted.* He thus disputes the received explanation of the Glen Tilt metamorphoses, and those of the Pyrenees, as described by Dufrénoy; and argues, that, "it appears less objectionable to regard these limestones, with their granite beds, and the main mass of granite, as members of the same primary formation, and connected with the fossiliferous limestones by mechanical transitions; and, although the line of union may be at present obscure, it may be hereafter detected by more minute observations and nicer discriminations."†

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* Primary Geology, p. 329. † (id. p. 331.)

Elsewhere, that author endeavours to prove, that the slate rocks are felspathic compounds of like materials with the granites*; and subsequently,† to show this, by examples from Cornwall, Norway, Saxony, Mont Blanc, Corsica, France, and other countries.

It is no part of the present purpose to fully justify this theory. But it is quite certain that all the passages from one rock to another, indicated by Dr. Boase in the work just cited, are found to exist on the Murrumbidgee, as in Cornwall and in the Cotentin, in which latter region, as described by de Caumont,‡ Brongniart,|| and myself,§ these passages have been detected. Having very carefully examined the alternations of granite and slate and quartz rocks in the Cotentin, and having stated some curious facts observed in that district, I ventured, with confidence, to examine the relations of the Murrumbidgee rocks, as I may concisely call those now under review, and to institue a comparison between them and similar rocks in Europe. It is, then, on ample evidence, that I pronounce, that the Australian system in some of the localities indicated is precisely that of the neighbourhood of Cherbourg.

In order to show this, it will be necessary, first, to state what are the changes noticed in the latter, to which I confine the comparison as more satisfactory than one instituted between Australia and any region in Europe, not so completely known to me as that is.

In the memoir in question, the results are thus summed up: "The argillaceous and talcose schists, where they are in contact with the quartz rock, partake of a gradual intermixture of the components of that formation, and the same slates in contact with granitic rocks become charged with particles of felspar." It must be understood, that the lower Silurian schists often take the transmuted character of chlorite slate.

Near Cherbourg, the green schists and quartzites have been subjected to similar crystalline changes, as fragments

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* id. chapter IV. † id. chapter V. and VII.

‡ *Bulletin de la Soc. Geolog. de France.*

|| *Journal des Mines*, tom. XXXV.

§ Trans. Geol. Soc., vol. VI., p. 563. "*On the Geological Structure and Phenomena of the Northern part of the Cotentin, and particularly in the immediate vicinity of Cherbourg. By Rev. W. B. Clarke, A.M., F.G.S., (Read Feb. 1, 1837.)*"

detached from each formation are found to be intersected by similar joints, causing the fragments to present the same angles of intersection. The angles are constant, viz. 108°, 64°, and 83°.†

The impression left upon my mind was, that the slates were Silurian and that some of the granite was subsequent to their deposit. The eurites which accompany the schists and quartz rock pass into greenstone and granite. The variety of the schists, called by Brongniart, *stéaschiste noduleux*, consists of nodules of quartz, entangled in greenish glossy slate, which passes into talcose schist with nodules of felspar and quartz. This occurs in the county of Cowley.

Humboldt thus speaks of the alternations of the various rocks composing the groups of the transition (Silurian) formations. "Almost every group is composed of alternating rocks, and many of these rocks, which may be considered as little partial formations, are common to all the groups. It is this community, this alternation and periodical return of the same masses, which constitute the apparent unity of the great family of the transition formations."‡

Speaking of the intimate relationship of felspar with the rocks in question, the same author alludes to its occurrence in limestone, and adds :—"We may consider it true, that in passing from granite to clay slate, through gneiss and mica schists, this substance (felspar) remains hidden in the paste, which is only appaıently homogeneous; for we see the transition clay slate sometimes becomes porphyry; as by other interior developments, by accumulations of silica, and carbon, and by the aggregation of the elements of hornblende, it becomes flinty slate, anthracite, greenstone, and syenite."§ He, moreover, points out the frequent geological relations of magnetic iron with all the substances in which magnesia prevails,* a fact well illustrated in New South Wales, at Bingera; and in New Caledonia, near Porte de France.

Again, M. de Bonnard† says, the granitic formation of La Manche, which contains syenites and protogenes, is contemporaneous with the quartz rocks and schists of the Cotentin and Brittany, some of which con-

† W. B. Clarke in G.T., VI., p. 565.

‡ Gisement des Roches dans les deux hémisphères, p. 104.

§ id. p. 106. * id, p. 105. † Annales des Mines, 1822.

tain organic remains. In the Hartz, also, he describes the association of cavernous limestones with porphyry and slates. Moreover, M. Geronar is quoted as to the direction of the granites and hornfels of the Hartz, as ranging N. and S. transverse to the greywacke beds.

Now, in one respect, we have on the Murrumbidgee, and elsewhere, just such alternations (already mentioned), as have been described by Humboldt, and just such relatious of rocks as are mentioned by him, and by de Bonnard, and myself.

In support of these conjectures M. Brochant de Villiers may be quoted, for he tells us,‡ that in the Alps, talcose felspathic schists; serpentine, with or without limestone; fine grained hornblendic rocks; more or less crystalline limestones; and chloritic schists, with magnetic iron, are united by insensible gradations.

Such phenomena, as we are treating of, are, therefore, very common. In the European Alps, however, the association of quartz with these rocks is very rare.

Without, then, offering an opinion here as to the actual age of all the ancient formations on the Murrumbidgee, and the Australian Alps, we may proceed to the evidences offered in the localities selected.

Between the Tinderies and Mount Tennant to the south and west, the country is occupied by a series of primary, transition, metamorphic and felspathic rocks, which may be comprised under the general heads of—

1. Granite.
2. Pegmatite.
3. Protogene.
4. Gneiss.
5. Quartz Rock.
6. Mica Slate.
7. Limestone.
8. Chlorite Slate.
9. " Schiste noduleux."
10. Clay Slate.
11. Eurite.
12. Leptenite.
13. Petrosilex.
14. Ophite.
15. Trachyte.

Some basalts, though very sparingly, occur in this particular district.

A little east of the 149th meridian, about seven miles from Mount Tennant, lies Gudgenby. Near this spot rises a small stream which runs parallel with the

‡ Ann. des Mines, 1819.

Murrumbidgee, till it is met by Ororal creek, which rises W. by S. of Mount Tennant; the united channel enters the river south of that mountain. Between Gudgenby creek and the river lies Naas Valley; S.W. of the former is Boboyan. The Gudgenby creek flows between hills of schist and granite.

The summit of Mount Tennant consists of blocks of grey felspathic granite, passing about 30 feet below, into a parti-coloured rock very like Cornish granite and also into a laminated black granite. The surface is often fragmentary, the fragments fresh broken and cleanfaced. Fine granite also occurs in ledges, passing through which are veins of manganesiferous quartz. On the N. side a spur runs to the west, consisting, about 200 feet from the summit, of laminated gneissiform granite, in which occur nodular mica schist and talc schist and steaschist, with leptenite and protogene, passing back on the descent of the mountain into protogene and true granite. On the south side gneissiform dykes contain emeralds.

On the slopes of this mountain is exhibited a phenomenon which induces the idea, that at some former period, either by the action of ice or of violently agitated waters, destruction of the surface has been in extensive operation.

Numerous hollowed blocks of recomposed granite, bearing attrited pebbles of quartz, lie in detached heaps, much water or air-worn. The ledges of the rock appear like sea-cliffs, the surfaces presenting the likeness of beaches. On these the granite is broken up into small clean fragments as if it had been struck by the hammer. Now, as snow generally lies a very long time upon this mountain and is perennial in some parts of the Australian Alps, it is not unlikely, that if these ranges ever stood at a higher level than now, the agency of ice may have produced these phenomena. Much of the granite is in a decomposing state. On my journey up to Maneero, I examined the mountain on the south and east sides.

We may now consider *Ororal*. This range is composed of large grained variegated granite, consisting of greenish mica, blue hyaline quartz, and white felspar. The mass called Ororal Rock is of that variety which occurs in the Vale of Clwydd; the quartz being generally blue and hyaline, with pinkish, pale or brownish white felspar, and black or greenish mica. The quartz is always splintery, and the whole mass has a metamorphic appearance, passing occasionally into a protogene.

The surface of the range is covered by large blocks; but at Ororal Rock is a low peak of deeply rifted and jointed masses rising nearly 80 feet above the general mass, and, consequently, seen at a considerable distance, the joints dipping 80° to S. or vertically. The edges of the joint planes are much worn, either by ice, water, or atmospheric agents.

It has the character of an elevated mass, and has, probably, been pushed up through the schists.

Three miles from Ororal, on Cotter's River, the granite becomes porphyritic containing metalliferous bands of a rock like leptenite, and is in contact with mica slate, which passes into a schistose quartz rock, and is overlaid by a hard ferruginous granitic sandstone, evidently of local origin. At the junction of the river with the Murrumbidgee occur limestone and arragonite, and on Limestone Plains jaspery quartz and eisenkeisel occur in the limestone.

The constituents of the granite change into black mica, pale felspar, and white quartz, between Naas and Gudgenby, occasionally becoming large grained and spreading out in extensive flows. The granite flows exhibit veins of quartz, leptenite, quartz rock, and gneissoidal granite, in which quartzose particles are embedded in thin layers of the gneissiform rock.

About four miles S.E. of Ororal the granite passes into pegmatite and schist rock, the same as occurs at the back of Bullanamang. South of this, a junction takes place between granite and slates, the latter occupying low hummocky barren hills, with withered trees, amidst the luxuriantly clothed granitic ranges, which run parallel with the slate, in a direction due N. and S., and retaining for several miles a mean breadth of from two to three miles. The state of the vegetation is very different on the two formations. The schists are frequently nearly bare.

The slate itself is chloritic, with minute crystals of (apparently) hornblende, arranged in parallel lines, similar to what I saw at the base of Mount Alexander, passing into an arenaceous gritty schistose rock, which, near the granite becomes hardened and like a crystalline quartzite; and veins of quartz also pass from the granite to the slate. Masses of the latter, much hardened, as well as quartz rock, both having a wedge-formed shape and insulated, also occur. The surface of the hills is covered with broken fragments of these, and of hardened sandstone. These, probably, have been derived from the protruding portions of the hardened slates, which attain a width of from four to six inches, and continually crop out. A black slate, very rough and full of thin seams of quartzose matter, and which appears to be the base of the lighter coloured schists, makes its appearance in the vicinity. Its strike in one place is an exception to the general N. and S. trend. It ranges N. by E. This black slate has with trap supplied a considerable portion of the local drift; the smooth hills of slate are covered by small fragments abraded *in situ* from the ends of the out-cropping laminæ. The arenaceous schistose beds, sometimes, also, pass into flagstones or a true fine-grained micaceous sandstone, overlying the schists at the junction of the granite.

To the westward of the schists, on the south and west of Gudgenby, it becomes changed into a mottled red and white quartzite, and also into a rock closely resembling the "Lickey" rock, of Bromesgrove, in Worcestershire. Very clean joint planes intersect these rocks and produce angular and semi-columnar forms, presenting the identical appearances common in many parts of Europe.

Near Boboyan the granite is seen to be overlaid and surrounded by schists and sandstone, into which it has protruded in a broad base, hardening and breaking up the latter rock into fragmentary lumps.

In some of the veins and dykes of quartz, particles of schist are entangled, and are much hardened; these veins run N. E. by E. from the granite towards the schist, but occasionally stop without intruding into that rock. Veins of white quartz also pass through the hardened sandstone and quartz rock. This phenomenon I also observed close to Table Bay, near Cape Town, in Africa.

There are also many similarities between these Murrumbidgee schists and those of Pembrokeshire; and between the quartz rock, and that of La Roule near Cherbourg: also between the felspathic veins and the elvans of Cornwall.

The above was written in 1848; it is highly satisfactory to find in Murchison's "Siluria" (3rd ed., 1859), a complete confirmation of my views, deduced from fossiliferous evidence, as to the Silurian age of the Cherbourg rocks. Sir Roderick states, (p. 437), that *Calymene Tristani*, a Caradoc sandstone trilobite, "has been found in the hill of La Roule, near Cherbourg, in slates which underlie the hard siliceous sandstones, so largely employed in the construction of the great breakwater of that port; rocks which, according to de Verneuil, are the exact equivalents, in age, as well as in lithological structure, of the Caradoc sandstone."

Whilst alluding to this determination, I would further remark, that the doctrine of recurring beds in the Silurian system of rocks, which I have so much dwelt on in this work, is also most thoroughly confirmed by the distinguished author of "Siluria," who shows (p. 87), how the lower Silurian rocks of the British islands assume the characters of an alternating series. It is really curious to observe the exactness with which these lower Palæozoic formations maintain at the Antipodes the distinct features which they assume in Europe.

The cleavage, bedding and joints of the slate, quartz rock and sandstone are consistent, affecting all alike and producing regular rhomboidal and other figures, in some instances with angles 60° and 120°, and in others, with angles of 125°, 55°, and 104°.

The angles and planes of a hard crystalline mass of quartz rock from the junction of granite and schist about a mile from Gudgenby furnished identically the same measurement by the goniometer, as the micaceous sandstone between Gudgenby and Naas Valley, where the latter passes into schist: and also as the hardened schist itself. This is precisely an analogical case of what has been mentioned as occurring also with slate and quartz rocks, near Cherbourg in France, although the angles are not the same.

In the altered rocks the laminæ of the sandstone are distinctly traceable, but the cleavage planes are not so well defined as the joints.

Some of the black slates are also divided into regular rhomboidal tables, having opposite angles of 66° and 114°: others are irregular, the angles being 158°, 158°, 24°, and 20°, thus completing the four right angles.

In the Ranges between Gudgenby River and Naas Valley, from the junction of the slate and granite to the Murrumbidgee, the granite occurs in large blocks, with abundance of micaceous leptenite. Protogene, occasionally assuming mica in laminæ, and of a fibrous structure, occurs in the low grounds; small veins of large-grained granite, of eurite and of pegmatite from 18 in. to 2 feet wide, passing through the fibrous protogene. These veins appear to come from the talc schist which lies about, in large separate blocks, and is traversed also by veins of quartz rock which run to the south into the valley. The schist contains six-sided tables of talc.

On the tops of the ranges the granite contains black six-sided *rumpled mica*, white adularia and blue quartz. A gneissiform granite with blue quartz, black mica and with very little felspar of a glossy appearance, comes into contact with the schist in some places, where a greenish schistose rock allied to compact felspar, either a cornean or a petrosilex, is also found, quartz veins passing through the schist.

On the east side of the valley, at the base of the bounding range, occur very finely composed pegmatite and dykes of a greenish, very closely grained and jointed, aggregate of felspathic particles, containing a green mineral; a laminated gneissiform granite forming small mound-like elevations, which appear mere accidents in the coarser and softer granite, which has been worn away. The occurrence of a very fine-grained granite in patches, in the coarser varieties, is a common phenomenon, and not only marks the granite of Green Point, near Cape Town,* (which is apparently of the same age as that in question), but also has been observed on the Glenelg,† where the finer portion is soft, and of the character of mica-schist. We see here a remarkable illustration of the connection of these formations. On the sides of this range occurs abundance of schorl. The principal variety is a blackish laminated vertically-jointed rock, not rounded, as to the westward, but lying in slabs. In this is a succession of veins of fine-grained granite, approaching protogene; quartz rock and leptenite with topaz or ruby, semi-stratified schorlaceous granite, greyish yellow nodular gneiss, and coarse pegmatite, are also present.

* Rev. W. B. Clarke, Geology of Cape Town, G. P. III., 408.
† Mitchell's Eastern Australia, vol. II., 200.

The whole of the ranges between the Murrumbidgee and the valley, on both sides, show the same cleavage and jointed structure.

Within less than a mile of the river, and all along the base of Mount Tennant, to the other side of the Murrumbidgee, we find a formation of gneissiform granite, with occasional veins of jointed and prismatic protogene; pale schist, with grass-green crystals of epidote; bands of quartz rock, studded by crystals of sulphuret of iron; and grey eurite, also in bands. These are flanked by greenish grey talc-schist, full of veins and bands of quartz rock, which trend N. by W., and which are auriferous in places.

To some of these rocks are attached masses of grey tufa, which occupy many square yards in the beds of creeks. In contact with these bands, to the southwards, along the Murrumbidgee, bands of white and grey crystalline marble expand into a considerable mass, which, in one spot, is washed by the river.

In the range running eastwards to the Murrumbidgee, from the north end of the range near Mount Tennant, gneissiform and large grained black granite, with disseminated uncrystallised mica, underlie schistose micaceous quartz rock, passing into mica slate, and containing veins of granular quartzite, and flesh-coloured eurite; and again into protogene, and pegmatite. In one of the creeks in the vicinity there is a recent conglomerate of granitic detritus and water-worn fragments of schist.

We come now to Naas Valley, of which the eastern boundary is the Murrumbidgee range. The latter extends for about forty miles to the south, and, as before mentioned, meets the river near Bullanamang. The valley itself is not much more than three miles in length, but the mountains at the head form a great group, which gradually rise into the high peaks at the head of the Murrumbidgee. The little river which runs through the valley is subject to heavy floods, which have not only materially raised the bed of the valley, but have also excavated in places deep hollows. In one place, during the flood of September, 1843, a hole 10 feet deep and 50 feet wide was excavated.* The low hills are partly steep: one of them has an abrupt face for 60 feet, and a capping of 30 feet of inclined rock.

* On the authority of Mr. H. W. Nichols.

The direction is N. to S.; and the summit is 200 paces over. The laminæ of the schists are vertical.

The granite of this valley contains great crystals of white mica, quartz and felspar, which sometimes assume a *graphic* character, and at others become mingled with crystals of hornblende and schorl, in this respect rivalling the granite of Norway.

Another variety of granite with black laminated mica, white felspar and quartz passes to protogene like that of Mount Blanc; with dykes, of eurite; leptenite; vakite; and quartz.

The eurite passes into steatitic mica slate containing glossy fibrous mica or chlorite, in the latter case becoming chloritic schist; and also changing to greenish grey "*steachiste noduleux*" like that of Cherbourg. Other spots near Naas exhibit a passage into gneiss, which occupies the higher part of the rock, the granitic portion being marked by an undulating yellowish border containing detached large nodules of bluish hyaline and chalcedonic quartz, a character which distinguishes all the granites of that quarter. The quartz is occasionally iridescent by refraction; even in the slate the veins are hard and shining, like the fragments embedded in the great sandstone of the carboniferous formation, which, no doubt, derived its contents from rocks of this epoch. There is also a development of rocks with a cornean base, containing crystals of glossy and glassy felspar and augite, with iron pyrites, and little threads of blue quartz also studded with pyrites; and also of rock of compact hornblendic or augitic cornean; and grey and white quartzite. A blue and white compact quartzite also inclines against the slate. Compact felspar also occurs; this seems a metamorphic or instrusive rock, for the granitic rock which surrounds it changes insensibly to it, i.e., the felspar and chlorite of the protogene and the mica of the granite become laminated before they disappear. In one spot the granite is penetrated by a dyke of greenstone. Here, then, we have the features, which are common at Adelong, where gold abounds.

At Pialgo in the Limestone Plains to the north of Lanyon occurs a greyish steatite, with much iron pyrites, underlying limestone, also pyritous; and at Lanyon on the Murrumbidgee to the north of Mount Tennant, greenstone occurs about 40 feet above the river and 180 yards from it; and dioritic trap with crystals of a light coloured decomposing mineral, glossy felspar, and quartz; and also clear whitish emeralds. Besides this dioritic trap, there occur a homogeneous quartzite very translucent, apparently an altered sandstone, in relation with the greenstone, and a rock with a yellowish hard granular felspathic base, with rounded crystals of clear quartz, glossy pale salmon coloured felspar and hornblende. Other porphyritic rocks also occur. 1. A base of splintery grey and brownish yellow cornean with crystals of salmon-coloured felspar; cubic pyrites; and traces of augite or hornblende. 2. Bluish grey and yellowish brown cornean base, with thin threads of quartz, rosy felspar, and many points of pyrites. 3. Greenish grey hornstone with crystals of clear quartz, felspar, and pyrites coated by black oxide. Below Lanyon, the river bed contains numerous pebbles of diorite.

From a careful comparison of the whole of the series, I incline to the opinion that the more quartzose granite in the region described is the older. The veins of compact felspar become a steatitic schist in one place, and elsewhere pass into hornblendic and true granite; as do the veins of quartz, which in that case are segregations. The binary compounds are quartz with felspar, quartz with schist, quartz with mica; which all occur in separate patches. The protogene is most frequent between the Murrumbidgee and Yass. Where limestone occurs in connection with slates, quartz veins also traverse it, and there is a passage observed into mica slate. The leptenite and cornean may be traced to the second dyke, at Duntroon.

Ten miles south of Gudgenby, at Boboyan, the slates and granite wedge into each other, in low ranges, clear of trees, in the schistose localities, ranging north and south. And in one spot in the Gudgenby range, not previously mentioned, the schist is intruded into by veins of granite.

I have been thus precise in detailing the phenomena of the granitic and schistose systems, and their mineral changes, in order to afford a type of the way in which these systems are united and affected over various portions of the wide area occupied by the Silurian formations in New South Wales. Nothing can more clearly establish the similarity of these phenomena with those of Europe; and undoubted evidence has been offered to show, that, at least one class of the granites is younger than some of the metamorphosed sedimentary deposits overlying the schists, intruded into by the granite. If this could be received as sufficient proof, we might thence assume that the oldest rocks are the schists, the direction and uniformity of which, over a most extensive region is so striking as to excite the attention of the most ordinary observer; they are constantly associated, not only with granite, but with quartz-rock and limestone, distinct transmutations from one to the other being traceable. There is every reason to conclude that these Murrumbidgee rocks are in close analogy with similar formations in La Manche, Cornwall, Germany, and the older portions of the region of Mont Blanc; in all which localities I have observed phenomena of joints, cleavages, stratification, and metamorphism, strictly in unison with these. In all the districts under examination, there is no slate rock at all comparable with those of the Lake region of Cumbria; though there are instances where the granite, without a break, assumes nearly as distinct a gneissiform character as it does in the heart of Skiddaw. There are, however, some greenish felspathic rocks, which resemble some of the third class of schistose rocks in the vicinity of Wastwater and Borrodale.

I would not hesitate, even without fossiliferous evidence, to class the Murrumbidgee schists as Silurian; a conclusion justified by their positive passage through sandstone into fossiliferous limestone, containing undoubted corals of species described by Sir R. I. Murchison.* It may also be observed, that whatever opinion may be expressed respecting the various modes of accounting for the phenomena in question, it is highly probable, that many of the binary products are strictly metamorphic, and that these combinations, so closely uniting igneous with sedimentary rocks, and forming a link between them, may be as satisfactorily explained by the theory of transmutation as by an admission of the theory insisted on by Boase, that all the formations are contemporaneous and of one character.

The facts here stated agree so closely with some of the doctrines laid down by M. Durocher,† that I cannot doubt,

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* See a Letter of his in Appendix, dated 10th February, 1851.

† *Etudes sur le métamorphisme des roches, par M. J. Durocher. Bulletin de la Soc. Geol. de France.* (*2e. ser. III.*, 546—647. 1846). My friend M. Delesse has lately published a very valuable work on the same subject; but I have not yet seen it. The *Bulletin*, however, con-

that we have in this part of New South Wales, one of the most satisfactory fields for the study of transmutation of rocks; all the phenomena described come under one or other of M. Durocher's propositions. He has illustrated some of his views by reference to Norway. Never having been in that country, I have not named it, but it furnishes numerous grounds for comparison.

Under any view of the question, it cannot be denied, that even if granite forms the base of the whole of the formations,* granites and porphyries of a later epoch have intruded into the superimposed masses.

So far, also, as the evidence can be collected from the present state of our knowledge, the intrusion of these more recent granitic rocks has been attended and followed by metamorphic phenomena, as well as by mechanical effects, which latter have, with the aid of chemical and other physical forces, produced a derivative series of carboniferous deposits, such as conglomerates, limestones, grits, and sandstones. The passage of these may be traced downwards into the older formations, which appear to have furnished their materials, in local supplies, to the general mass, and this has, subsequently, been affected by a third or fourth inroad of igneous matter, which, in its turn, has also produced corresponding transmutations at the points of contact.

It has been mentioned, that bands of limestone occur amidst the schists. These are, generally, unfossiliferous, and mostly white. Examples, also, of the passage of slate into sandstone have been adduced. And at Good Hope, on the Murrumbidgee, about 52 miles N. 20° W. from Mount Tennant, there occurs an arenaceous limestone, passing into a true sandstone and grit, charged with innumerable spirifers, the relations of which to some of the rocks already

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tains numerous papers of his upon the subject. Those entitled "*Sur les variations des granites*" (*Tom. IX., p.* 474. 1852), and "*Sur la Protogine des Alpes*" (*Tom. VI., p.* 230. 1849), furnish me abundant proofs, that the views I have so long held, respecting the transmutations referred to in the text, are generally correct.

* "In no part of the world can any granitic mass be proved to be of great antiquity,—an ancient fundamental rock; the masses which are now in contact with any of the palæozoic strata are all intrusive." "Important changes have resulted in Devonshire from the intrusion of so many heated masses among sedimentary rocks." Austen, on the Geology of S.E. Devonshire; G. T. VI., p. 479.

described cannot be disputed. Again, on the Tumut and Coodradigbee, as well as on Yass Plains, these bedded limestones and sandstones occur, under very obscure circumstances, presenting fossils, apparently identical with species well known in the Devonian or Upper Silurian limestones, to which the rock itself has a remarkable similarity.

At the junction of the Cotter with the Murrumbidgee, the rocks exhibited at Gudgenby, due south, again present themselves. The whole of Cowley in this direction is composed of the same drab and grey slates, with interspersed quartz veins, rising in Pabral Peak into lofty eminence; the quartz chiefly brown, but on the slopes of Brindabella Mountain, descending to the Coodradigbee, the quartz becomes white. The latter is not so auriferous generally as the darker varieties.

Grey limestone and white crystalline fossiliferous marble, charged with encrinites, occur in the river, and form the drift in its bed.

I did not ascend it, but the view from Brindabella mountain, as described to me, is very striking; the whole valley of the Coodradigbee being composed of undulating hills of slate, flanked by occasional loftier ranges, like those of Gudgenby.

The same formation continues, with slight interruptions of granite, and quartziferous porphyry—the former, doubtless, connected with Bogong Mountain—to the Coolalamine Plain. I am indebted to the Honorable T. A. Murray, Esq., Speaker of the Legislative Assembly, for a collection of rocks and fossils from this upland region, for a plan of the source of the Coodradigbee, and for some interesting information respecting the state of the country there in January, 1851. In his journey Mr. Murray was accompanied by Mr. H. W. Nichols, who had undertaken the solution of some inquiries I had requested him to make. At the head of the plains occurs a rock of a similar character to one at Yarralumla, being an aggregation of crystals of white felspar (albite), quartz, and chlorite, and green mica in a grey felspathic paste, looking very like a porphyritic protogene. Another granitic rock, very ferruginous, and in consequence surface-worn and cellular, from decomposition, with abundance of felspar, also occurs in the same locality. The protogenic rock, and a grey leptenite, with indications of pyritous iron, are in contact with limestone, and doubtless is a dyke or elvan. Coolalamine has many features of great interest.

The extent of limestone covers from 30 to 40 square miles, being at a great height and, generally in winter, covered by snow. It forms extensive cliffs vertically stratified and abounding in caverns. The perpendicular cliffs are from 80 to 100 feet in height; sometimes perfectly smooth, sometimes fissured in every possible direction. It is through these lofty and pinnacled cliffs, that the Coodradigbee passes, having a breadth of not more than 30 feet in places, and over-hanging cliffs of at least 100 feet. A small river here passes under a natural arch of granitic porphyry, and after a junction with a second at a small basin of about 18 yards in circumference, descends into the earth through a very small orifice.

One of the caverns in this vicinity was entered by Mr. Murray, who found it filled with brilliant stalactites for more than a quarter of a mile; the cavern exhibited abundant evidence of large bodies of water having passed through it, and the floor was strewn with water-worn pebbles.

In a mass of stalactite from this spot I found a bat's head in perfect preservation.

The other branch of the Coodradgibee also issues from the bottom of a limestone cliff, passing into a pool.

East of this pool the rock is composed of highly crystalline white marble, a connected mass of crystals of carbonate of lime, many of them extremely well developed and striated on their planes. The crystals are white, and their external surfaces worn, so as to exhibit the striation on the rock; originally these were due perhaps to fossils. This kind of rock continues for about two miles; westward it gradually changes to a grey and light-grey limestone, with occasional veins of calcspar, and containing corals and bivalves, of the former of which *Favosites Gothlandica* is most prominent.

The crystalline character and arrangement of the limestone on the east side of the plain, and its nearly total want of fossils (for I have only detected a slight appearance of some crinoid) points to metamorphic agency, the origin of which may be found in the porphyritic rocks with which the marble is in contact, and which are the same as those in similar position at Molonglo.

Yet these crystalline masses look in part as if the original rock had been decomposed, and in form of stalactite re-deposited and crystallised by the gradual agency of slow acting forces. In the grey limestone to the west, amidst the encrinital stems with which it abounds, are traces of similar striated crystals of carbonate of lime.

The other fossils which I have examined consist of a fragment of a large shell, apparently a Pachydomus, and the posterior end of another species of the same genus, together with *Pentamerus australis; Calymene* (near *Blumenbachii)* an *Encrinurus* and other well known Silurian genera. The rock, which passes from a compact grey limestone to a white crystalline marble, is, in places, as full of the fossils as are some of the limestones in Shropshire. The dip of all these beds, as well as of most of the calcareous strata on the west of the Murrumbidgee range, and of the Yarralumla beds to the northward, is from 20° to 30° and 40° to west; they produce undulations parallel with those east of the Murrumbidgee, on the Berudba.

About 10 miles S. by E. of Bogong Mountain is the valley of Arranarrang, at the head of Mungola Creek, and on the west side of Coolalamine, surrounded by lofty mountains nearly bare of timber. The Creek is a tributary of the Tumut.

Cliffs of water-worn marble abound here also, being a western parallel of the Coolalamine cliffs, with schists and quartziferous porphyry between. The position of Arranarrang is assumed to be 200 to 300 feet below Coolalamine.

The marble here is either white or red, but there are stalactitic caverns in it of great beauty. The floor of one of these is strewn with calcareous nodules of all sizes. Such nodules are very common in Australia. I have seen them in localities at great distances from each other. They frequently occur in clay soils near trap rocks; and are abundant in the Hunter Valleys, and on the Murrumbidgee, near Lanyon and Limestone Plains. In the present case, there is no doubt, they are the result of the action of water.

West of Arranarrang, occurs the mudstone of Yarralumla, dipping from 20° to 30° W. interstratified with beds of blue and yellow porphyritic grit, like that upon the flanks of Bowning; and of the harder varieties of which, the shearers and artizans make whet-stones, which they consider superior to the English rag-stones.

The fossiliferous limestone is in connection with a greenish calcareous grit and sandstone extremely fine and compact. Adjacent to these is a conglomerate, composed of small pebbles and worn fragments of quartz rock, schist, porphyry, clear quartz, felspar, chloritic slate, green flinty slate, &c., containing entangled fragments of corals, and traces of lime. It is, evidently, a rock derived from local materials, which have been hardened either by chemical or thermal agency; many of the pebbles and fragments are crusted with manganese or black oxide ofiron.

The rock, in some places, is a perfect mass of corals and encrinites. Large loose blocks of this lie dispersed on the surface of the Plains, as similar blocks do over Yass Plains, Coolalamine Plains, and Limestone Plains—the result of disintegration, and, perhaps, denudation.

Over some of the hills and ranges in the district now described, conglomerates of the carboniferous formation are also found, the relics of larger masses similarly degraded at a later period.

We have now marked out the principal features and phenomena of the country around Mount Tennant, and on the northern flanks of the Australian Alps, and have discovered nothing, geologically, to disturb the arrangement of the deposits below the carboniferous beds, which, from other data, we have had reason to determine.

So far as the evidence has gone (but further researches may modify or enlarge it) it appears, that the schistose region of the country, immediately west of the Cordillera, consists of alternations of bands of rock having the same general dip, and consisting of interpolating series of slate, limestone, quartz rock, &c., resting on granite, and protruded into by granites of a more recent period; as well as by porphyry, which either overflowing, or merely intersecting, forms the link between the tilted schistose beds and the overlying carboniferous formation, the base of which is derived from regenerated detrited rocks of that era. Again, more recent igneous rocks have risen and overflowed.

The recapitulation of similar general facts may have been tedious to the reader, but it has been thought necessary to detail much of the evidence at present possessed. And as the intention has been to furnish a type for comparison elsewhere, and to obtain a view of the general phenomena of the class of formations in question, minute descriptions

..rious localities in which they occur have been given, in the hope that successful comparisons may now be made.

It is necessary for all useful purposes to briefly mention, that, as reported by me in 1852, the Tumut, at its head and below, is auriferous; and there can be little doubt that now the crusade of the gold diggers is directed to the region of the sources of this river, other localities as well as those since determined will be disclosed.

It may be also enough to remark, that on the western flanks of the Muniong Range, and in the mountainous regions between Jagungal or Big Bogong and Kiamba, ores of copper abound, sulphurets and carbonates of that metal, promising a profitable field of labour and enterprise. Such have been long known to exist in the great breaks on the right bank of the Tumut, near Lobb's Hole.

In the region westward, still within the boundaries of this Colony, numerous gold-fields have been explored and worked since my declarations respecting them in 1851 and 1852.

Of those which were named by me for Instructions to the first Commissioner to the gold-fields, most of them have realised my expectations, and others have been added, such as Maragle, Tumbarumba, Kiamba, and the Ranges at the back of Albury, completing an area of very much greater extent than the most sanguine expectation would have imagined, unless the geological principles which had been canvassed had stood the test.

It would occupy too much space to minutely describe here all the variations and successions in the formations to the west of the Tumut; suffice it to say the whole of the region, intersected by the creeks and rivers flowing to the Murrumbidgee from the south (see p.p. 7 and 8) partakes of the same character as that to the eastward. Granites interpolating slates, which are transmuted, contorted, and partly silicified and traversed by quartz veins and reefs, and occasionally affected by more recent trappean eruptions, are the prevailing rocks. The decomposition of these, aided, probably, by the snows and rains of ages, has accumulated deposits of auriferous drifts along the deep ravines and their bordering slopes and banks, in which a comparatively large population has been earning for some years past an abundant livelihood.

The centre of this activity is Adelong Creek, where the drifts and auriferous reefs and veins have been most abundantly wrought. And there, too, the fact of the presence of pyritous iron, as an associate and gangue of gold has been demonstrated to excess. In that whole district there are abundant proofs that the granite is younger than the Silurian rocks; that the auriferous portions of the veins in the slates do not pass into the granites; and that it is at the surface, or outside of the granite, that gold is detected, for there the metal is evidently in intimate association with the transmuted surfaces of the slate. Amidst the granite masses, the slates undulate in dip, but they generally preserve their meridional strike.

There are, doubtless, numerous localities not yet searched in that great knot of mountains between Dargal and Albury where alluvial gold and auriferous reefs exist. But Bago, and the country between the head of the Tarcutta and Nangus (as well as Tumberumba and Maragle) will, probably, not yet be fully exhausted. The amount of mineral matters in the drift is so great, that, perhaps, hereafter other products 'besides gold will be found. Copper, for instance, is not confined to the neighbourhood of the Tumut, but also occurs in the gold bearing pyritous reefs of the Adelong: and from Tumberumba, in 1855, I received from one of my American correspondents, a parcel of gems and other rejectamenta of the cradle, in which I found some small particles of oxide of tin, together with ruby, sapphire, corundum, and zircon. Though the gold is patchy, yet some parties have realised as much as 16 oz. per day; and others from £2 to £4 per man, per week, from one or other of the above named Creeks. It is quite certain now, that there was no mistake in recommending, in 1851, that these Creeks should be searched; and, although a noted prospector afterwards declared, that there was too much grass at Adelong for gold, yet that Creek has turned out from quartz reefs alone, in four years' time, gold to the value of nearly £230,000 sterling, to say nothing of the alluvial gold.

2. Counties of *Wynyard* and *Goulburn*.

The County of Clarendon belongs rather to the western than the southern districts; but, hereafter, in that county, and in Wynyard, and especially in Goulburn County, where there are localities in all respects answering to the geological conditions necessary, no doubt much gold will eventually be discovered.

Passing on by the Mitta Mitta country, and the other localities which are mentioned in the following Reports, we have a clear connection of gold localities all over the south-western border of this Colony and Victoria; and believing that, at present, much of the country has never been sufficiently examined by persons qualified for prospecting, and who unite to manual skill intellectual acquirements, I have merely to express a conviction, that, even if some of the anticipations of the results of the coming rush towards the Alps be doomed to disappointment, *as, undoubtedly, some will*, there are yet large regions still lying waste, in respect of their mineral contents, to which inquiry will be, when the time arrives, directed.

It may be broadly stated, that the whole of the formations in the counties indicated above consist of the same alternations of granite, schists, and quartzose rocks which have been already noticed, and that these are interrupted in the same way by various trappean and felspathic eruptions, which have metamorphosed the detached outliers of the younger sedimentary formations.

Between the Murray and Murrumbidgee, within the limits of this area, there are some striking metallurgical as well as geological localities. Thus about Pulletop Creek slates charged with mineral veins occupy an extent of about 150 square miles. A region chiefly of slates, nearly 500 square miles in extent, along Kiamba Creek and on to Yeven Yeven Creek, is bounded on three sides by granite along the Murrumbidgee, Hillas' and Nackie Nackie Creek, and on the north-east side of Pulletop Creek. West of this, granite extends for 80 miles along the Murrumbidgee; and near Wagga Wagga micaceous schists again appear. Again on the east side of Hillas' and Nackie Nackie Creeks, the schists occupy a considerable tract of country. With the schists quartzose rocks also occur. On the west side of this region, vertical beds of slate are met with; altered portions of the formation covered by a conglomerate dipping S. W. occur at Table Top Hill, not far from Albury, and opposite Mount Ochtertyre, which is of granite, the schists have been transmuted.

Between the syenite of One Tree Hill and the more micaceous schists on Tarcutta Creek, slates, quartzite, and granite succeed each other at Maria Galery; granite also occurs west of the syenite, forming a hill north of Mount Trafalgar, which latter consists of gneissiform and micaceous schists dipping 55° to N., and supporting conglomerates, which dip about 35° to S.W. Galore Hill, near Old Man Creek, is of the same formation.

Silicified slate occurs in this region, on the range terminating on Hungry Peak, at an elevation of not more than 1100 feet above the sea, between Pulletop and Bullenbong Creeks, where it trends N.W., parallel with the mineral veins to the S.E. of it.

As a proof of the general resemblance to the phenomena of Europe, may be mentioned, that round the granite to the N.E. of this slate region, springs burst up in considerable volume, offering promise of water, by boring, in the lowlying regions to the westward.

The occurrence of these springs is analogous to what occurs in the eastern European Pyrenees, proving, not only that the granite is intrusive, but that transmuted slates and mineral veins are in the vicinity of fissures of disruption, which throw out springs between granites and schists.

And, if any further proof be needed, it will be found on Nackie Nackie Creek, where the granite entangles fragments of altered slate within itself, at a point where the two formations meet; this is only a similar example of what occurs between Mount Tennant and the Murrumbidgee. Thus we have conditions in Australia like those which obtain in Europe, and which are in accordance with facts which have been described by Professor Forbes in the Trans. Roy. Soc., vol. xxxvi., viz., "the union of hot springs, elevatory or intrusive rocks, transmuted strata, lines of fissure, and elevation, and metalliferous veins," all occurring in the Pyrénées Orientales.

Another instance occurs on Nackie Nackie Creek, where syenite appears between masses of granite on that Creek, and Jilmoul or Gilmore's Creek, which is the west branch of the Tumut. It is there, also, that gold occurs. The temperature of springs near Mount Hugel, as ascertained for me by James Macarthur, Esq., was, on 2nd November, 1850, 59° and 57°.

Again, the relations of limestone to the slates may be seen near the junction of Nangus Creek with the Murrumbidgee. This is, perhaps, the most westerly observed locality of the kind; but the occurrence of tufa about the springs round the granite above mentioned, seems to point out the probable extension of the limestones and slates in the direction of the interior. For, "in a great many cases," says Forbes, "it happens that part of the springs rise from granite and part from the slates or *limestone* in contact with it; and a more striking instance of the immediate connection between thermal springs and disturbed strata could not be desired." (p. 575.)

3. In advancing towards the Billabong country, dry swamps or circular lakes such as Uranna, Broajong, and Doodle Swamp, of similar character to those so frequent in the region in the north-west parts of Victoria, give the idea, that the same forces have acted in both regions. In which case, it becomes natural to conjecture, that possibly, the gold alluvia which have been traced far in the Victoria Mallee scrubs, may hereafter be found in the plains westward of the counties of Wynyard and Goulburn. As in February, 1860, in company with Mr. Selwyn, I saw proof of the extension of the gold-bearing drifts some miles north of Bendigo towards the Murray, at the bottom of a shaft which I descended; so I see no reason to doubt, that the drifts from the auriferous region in our most south-western counties, may, hereafter, be traced into the low western region between the Murray and Murrumbidgee.

Whatever may be the value of this conjecture, this, at least, is certain, that there is, probably, a great amount of gold to be obtained by digging as well as by extraction from quartz in the region just reviewed.

I do not think, that any inference hostile to this view is to be fairly deduced from the fact, that westward of Wagga Wagga, the fluviatile drift is chiefly sand: for, if gold drift occurs in the country named, it will be exceedingly deep, just as in the district approaching the Murray at Echuca, the depth of superficial covering of the auriferous deposits has a considerable increase of thickness, as well as a decrease of elevation above the sea.

I can only find room to quote here the strata from one well on the Billabong, at Gunambil:—

1. Surface soil.
2. Gravel.
3. Light coloured clay.
4. Clay and calcareous concretions.

5. Quartz gravel.
6. Dark brown clay mixed with quartz and ironstone gravel.
7. Red and white clay. (Pipe clay of diggers.)
8. Hard red sand.
9. White sand with decayed ligneous matter.
10. Hard dry red and white clay. (Total depth 165 feet; no water.)

Another well dug at Maiden's ferry near Moama gave the following result, which I introduce merely for comparison:—

1. Yellowish brown clay.
2. Do. quartzose sand.
3. Large grained ditto.
4. Greyish saponaceous marl (with ligneous matter in 3 and 4.)
5. Sandy micaceous marl.
6. White sandy marl.
7. Hard white marl.
8. Fine gritty pulverulent marl.
9. White slightly argillaceous quartzose sand.
10. Hard white clear fine sand.
11. Red and white mottled argillaceous sand.

(Total depth, 30 feet.)

The elevation of this locality I make from 86 sets of contemporaneous barometrical observations by Mr. Townsend and myself, 295 feet above the sea. As the bed No. 1 is 35 feet above the Murray, the river is there 260 feet above the sea.

The distance of these wells being at least 150 miles, they have, of course, no immediate connection: but they serve to illustrate the object I have in view in publishing the account of them. The shaft I descended south of Echuca was 106 feet deep, and the level of the surface there was about 700 feet above the sea, which gives a fall of about *ten feet* per *mile* to the Murray.

CHAPTER VII.

AURIFEROUS LOCALITIES IN THE S. W. OF MANEERO AND ON BOTH FLANKS OF THE ALPS AS FAR AS OMEO.

[The country between Bullanamang and Cooma, and between Cooma and Jejedzeric has not been separately described; but it has been incidentally alluded to in previous Reports. A few sentences may suffice to give a notion of its geological features. Taking, then, the course of the Murrumbidgee, as its limits from Bullanamang round to Basalt Point, mentioned at p. 82, we shall find the whole area made up of quartz-bearing slates, resting on, or supported by quartz porphyry and granite, which is sometimes schorlaceous. Beds of limestone, and fossiliferous flags in the slates (as from Jews' Flat to Rock Flat Creek and Dangelong) occur to the east of Cooma, in the southward extension of the Berudba bands; and lower quartziferous slates, gneiss and quartziferous granite, with elvans of pegmatite and other binary compounds, form the base to the westward, with occasional beds of quartz conglomerate resting on the granite (as at the Lake N. E. of Jejedzeric, near Wulwya, and near Jillamatong). The whole is overlooked by peaks and lofty masses of basalt (as in the Brothers, &c.) which are outlying portions of a great intrusive overflow, that strikes obliquely across Maneero from the head of the Bemboka to the head of the Murrumbidgee, and has not deranged locally the palæozoic rocks, but has spread around the fragmentary relics of the slate formation, and covered extensive areas on the plains and ancient valleys with decomposing masses, or with black pasty mud. There are portions of the Silurian slates also, as in Blue Peak, on Rock Flat Creek, which culminate in insulated summits, apparently detached, and put on the character of basaltic peaks.

Again, on Cooma Creek there occur masses of basalt and other trappean rocks, which do not assume a pyramidal form, but rather that of low bosses of some breadth. These seem to have flowed from fissures in the granite, as near Cooma Parsonage, in which neighbourhood they are in connection with dykes and domes of felspathic porphyry and trachytic rock. On the tracks to Jejedzeric the slates which are interpolated with massive quartz reefs (as near Arable), pass on to the coarser granites, in which quartz veins, chiefly of segregation, frequently occur. Such are common between Coolringdon and Jedjedzeric. On the north-east side of Wulwya Creek, at Jejedzeric, granite, traversed by basalt, supports clay slates on Jejedzeric Hill, which are charged with chiastolite, and seem almost identical with the rock of that kind on Skiddaw, in the English lake country—with which there is another resemblance in the occurrence of hypersthenic trap in the vicinity of the same granite a few miles distant. On the west side of the creek, at Jejedzeric, the granite forms the Miach Range, at the back of Jejedzeric Station, where it cccurs in high, massive, well-jointed forms, imitating in decay castellated summits and forming balanced eroded blocks, and carries abundance of elvans of pegmatite, with radiating tourmaline and tremolite, as well as of protogene (some completely graphic), which at the base swell into low hills of porphyry; the quartz conglomerate and basalt before named occurring along the creek, as if the latter had followed, in its eruption, a line of fracture, or one of depression in the ancient granitic valley. It will be seen, that this is the exact counterpart and extension of the country between Bullanamang and Bolaro, (p. 83), and the intermediate track traversed by Ural, Frying Pan, Wambrook, and Buckenderra Creeks, is of the same character. Along the deep fractures, through which these creeks flow, are many interesting sections, in which the quartz reefs and undulating slates are very prominent.

At Kiah Lake and Belawindgee Creek, the slates are much silicified, and undulate in a remarkable manner. Near the granite the slates often pass into gneiss, as at Mittagong on the Murrumbidgee, a few miles from Cooma; and the rock is filled with innumerable veins of quartz. Basalt, charged with olivine, comes down between the masses of gneiss, from Pine Hut Range and the Dry Plain, and extends along the same range between Pinjara and Cooma. In this township, also, are bosses of hornblende rock, with tremolite, which have altered the adjoining masses of quartziferous gneiss, and thrown it up in huge blocks on either side; this trap rock runs into the basalt a mile to the southward.

The Church at Cooma is built of the gneiss; but it is a material which will readily decay. Granite, with emerald, occurs near Cooma.

On the N.E. of Jejedzeric, granite forms huge insulated blocks on the margin, and in the centre of a small lake. The granite is smooth and much water-worn, and a dyke of granular quartz rock, striking S. 15° W., with a partially concretionary structure, is also worn into cavities and hollows, the result, probably, of water occupying a much larger area than the present lake, which appears to be temporary. Either water, or snow, or ice, has operated these changes. Similarly, on the summit of a dome-like hill of porphyry S.E. of Cooma, the surface is worn into potholes, just as on the summit of Gibraltar Bluff, in the Mittagong Range, near Berrima, I found the hard trachyte worn into pools and holes, in which the rain water now accumulates. The height in each case is about 2800 feet.

A similar surface exists, at a lower level, west of Jejedzeric, near a small pool or lake on the way to Colibragong. Lakes of this kind occur very commonly on the Maneero plateaux, chiefly in basaltic areas, as about Bombalo, on the heights above the Maclaughlan river and elsewhere; on the Plains along the Upper Murrumbidgee, &c.

The discharge of water from more extensive lakes of this kind may, of course, have assisted the dispersion of gold in the surface drift. The singular occurrence of islands of slate and quartz, in various parts of the plateaux, points to other agencies beside erosion; and this implied action of surface water is one argument for the expectation of gold in the drift of the upland country.

Between Jejedzeric and the Snowy River, which is usually forded at Jindebein, (above a ledge of rock which crosses the river at the mill), alternations of schist and granite extend down to the river, on the opposite bank of which, a mass of syenite and a low range of porphyry precede the slates and granite about the Moamba, Thredbo, and "Crack-'em-back" ranges.

The whole of the banks along the Snowy River afford fine gold from Jindebein up to the junctions with the "Crack-'em-back" and Eucumbene rivers. At the Waste

Point also, where there is an accumulation of fluviatile drift, gold occurs, disseminated plentifully amidst the detritus; and so it continues, at intervals, all the way up to the head of the Eucumbene.]

REPORT No. VII.

Jindebein, County Wallace,
24th December, 1851.

I have the honor of reporting to you, for the information of His Excellency the Governor-General, the progress I have made in the geological investigation of this part of the country since I had the pleasure of addressing you from Cooma.

The extraordinary wetness of the season, and the frequent impossibility of carrying on any researches in consequence thereof, very much retarded my labours after my arrival in this district; but taking advantage of such intervals of fine weather as occurred, I have been enabled to explore a very considerable portion of the counties of Beresford and Wallace, and to extend my researches to the south-west, as far as to the heads of the Murray, the Tambo, the Mitta Mitta, and the Snowy River, returning from Omeo by a course only traversed hitherto by stockmen, and only capable of being passed by pack horses, which I employed for the purpose, and which were supplied by [the late] Mr. Brooks of Jejedzeric, who was kind enough to accompany me in the journey. I had thus the satisfaction of passing with my whole train of eleven horses and seven attendants over the highest part of the Muniong Range, and of remaining parts of two days and sleeping one night within a few yards of the snow of Mount Kosciusco, first rendered remarkable by the visit of the Count Strzelecki. I then descended along the rough and very difficult slopes on the right bank of the "Crack-em-back," following the actual course of the torrent from its western source, and reached this place with no further accident than can be repaired by the tailor, and without any greater inconvenience than results from an attack of slight swamp fever, occasioned by the intense heat of the river valleys and almost constant thunder rains, and the alternations of cold and damp upon the summits of the mountains, where we occasionally lay at night.*

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* It may prevent any interruption of the Report and save the necessity of re-describing the route pursued, if I make an extract in this place, from an account of my expedition in 1851, drawn up from my letters and journals, and afterwards published by my much lamented friend, the late Rear Admiral P. P. King, to whom I was indebted for the service of correcting my Reports for the press, and whose memory will be ever endeared to me by numerous official and personal services, during a friendship of seventeen years. The letter which he gives as detailing my journeys over the Alps I have somewhat curtailed; and I would not have referred to it at all, had not my friend already given it a kind of *imprimatur.*

"Much reference is made by Mr. Clarke to the chain of mountains which forms so remarkable a feature in the southern portion of the colony—"the Southern Alps." At first he seems to have been rather disappointed in their appearance, for he says, "From this" (Cooma) "a lofty conical mountain, which I afterwards found to be one called Wooiula by the Aborigines, raised its snow-clad peak into the clouds, and is very prominent from various elevated parts of the neighbourhood. After having been on the Swiss Alps and on Mount Blanc these mountains appear comparatively insignificant; they have no grandeur or dignity. One reason is we are so high at the point of observation." Mr. Clarke, however, on a nearer approach to these mountains, seems to have formed a better opinion of them. And it is no detraction to their character to consider them inferior in dignity or grandeur to the Swiss Alps; nor does it lessen in our consideration the toils and dangers which our traveller has to undergo in the exploration of the snowy region in his view, and which he rather disparagingly describes up to this point (Cooma). Mr. Clarke had now travelled in 74 days upwards of 1150 miles, of which period, as has been before said, 34 days were wet and unfavorable; so that a few days' rest was not only desirable, but absolutely necessary for the traveller to take, in order to prepare for a journey which he then decided upon making. But it is time to let Mr. Clarke speak for himself, as he does in the following letter, written after his return from the exploration of the country between Cooma and Lake Omeo, which is situated on the borders of Victoria, between it and Gipps Land; dated from Jejedzeric, a station of Mr. Richard Brooks, in the neighbourhood of the Snowy River, December 27th to 29th, 1851."

"I thank you for the Aneroid barometer which A —— was good enough to bring safe thus far, on his way to Gipps Land. I found it on my return from the Mitta Mitta; my only regret is, that I had it not with me on the Alps, for I could then have completed a section, as I have come right across it up and down from Thalimberamungee to Jindebein, by a track known in parts only to any one stockman, and followed out by the help of two or three guides whom I gathered on the way. So far as I can learn, only one party before has ever travelled the route; at least two persons whom I found squatting on the Indi where it is called Piaderra by the blacks, and with whom I remained on the 21st, in order to have service, told me they had never seen but two persons besides my party since they had been there.

My chief objects in going so far beyond the limits of

One had not seen a minister of the Gospel for eleven, and the other for eighteen years! It was well worth all my fatigue, in a journey of 250 miles over such a country, to have the opportunity of reminding them that Christmas has for the first time been scripturally remembered in that solitary wilderness. I have never felt so much as on late occasions the value of the office of a messenger of grace and salvation. The most gorgeous cathedral, filled with holiday worshippers, is not more pleasing in my recollection than that noble landscape by which we were surrounded, and the company of pilgrims who stood by me under a burning sun on the side of the hill, listening to my homely words of encouragement and exhortation. It is to be hoped that I may never be reproached with forsaking my calling to seek for the gold that perisheth, for the judgments of the Lord, which I proclaimed amidst the mountains, 'are more to be desired than gold, yea, than much fine gold.'

"I have given you my meteorological journal, such as it is. But it requires some explanation in connexion with the mere registration of temperature, which the barometers, had I not so unfortunately broken them at the Shoalhaven, would at once have given. There is little to interest in the first part of it; but I think you will feel interested in the journey to and from Mitta Mitta. My journey was on this wise: the black-fellows had told me that one had found a piece of gold somewhere beyond the boundary line of the colony, and that he had tried to hammer it into a breastplate, and finding he could not, he had thrown it away. I heard also, that the Brassy Mountain of which I made mention before, was in every one's idea a gold mountain. I also heard that some young men had found a few particles of gold in the ranges along the Indi, or Limestone River, and Sir Thomas Mitchell says gold is likely to be found there. I found also a great desire on the part of many persons to know whether the Limestone River is or is not the true head of the Hume, and you will remember that Strzelecki says he was at the head of the Murray at Kosciusco. All these things weighed on my mind, and I determined to go and see for myself. I could not take my cart, it being quite useless for such a journey, and therefore I had to get help. Mr. Richard Brooks, of Jejedzeric, instantly fell into my views, and by his assistance I was enabled to take two pack-horses, carrying provisions, and blankets, tarpaulin, cradle, pan, spade, pick, tin-pots, &c. We left this on Wednesday, December 9th, and went by way of Colibragong, over high ranges of slate and granite to the Snowy River at Jindebein. As the river was high, we crossed ourselves and baggage over in a hollow log, having driven the horses and dogs through. As we did not reach the river until sunset, we were not over until dark, and the consequence was that we got astray; and at eleven P.M., Brooks and I managed to find out a shepherd's hut on Moamba Creek. The next morning at five, we started and reached Wallandaby Creek at Brook's station, Crack-em-back, but being unwell, I did not proceed further that night than the Moamba River. Next day, examining the country as we went along, we proceeded to Tongaro, or Jacob's River, and camped about one mile above the junction with the Snowy River, in a little flat on the bank of the former. The descent from Jacob's Point is a very long and tedious affair, but the view is magnificent; from various points we got sight of the prominent peaks along the high ranges to W.N.W.; one of which, the "Cobberas," bore west by south, and what I supposed

New South Wales as the Mitta Mitta, were, to satisfy myself as to the truth of some reports, derived from the

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to be Mount Kosciusco, bore N. 45 degrees W. Next day, after prospecting, we moved on along the Snowy River, but finding it impracticable to follow the river, owing to the effect of the late floods, we took to the ranges, and after some dangerous sidelings, went right over a granite range about 2000 feet above, and made a descent upon Moyengul River about a mile and a half above the junction with the Snowy River. Next day, 14th, being Sunday, we camped on an uncomfortable slope, and had divine service under a tree just over the river. Here began my late illness. The heat was insufferable owing to the steam, and the flies an almost intolerable nuisance. Next day we ascended that terrible climb "Nine-mile-pinch," an ascent of four miles with only nine breaks. The view from the top reminded me of many mountain scenes in Europe. The hills are very steep, cleft from top to bottom, but being chiefly of slate are well timbered and grassed. Hence, we proceeded to Ingeegoodbee, Berrima Range and River, where we camped at noon to prospect and lunch, and, then, on to the creek along the boundary, and got to Wiendel, or Freestone River, about half past four, where we spent an hour, and then climbing a fearful hill passed under the "Cobberas" and over the swamp of Inaneo (the Playground so called by the first European traveller, because he saw black children at play), and so to "Kurnoolee," the Native Dog River, after dark, just under the Dividing Range, which is here very low. The place was rough and damp, and we lay rather uncomfortably on tussocks of coarse grass. Next day, we ascended a scrubby range between the Gipps Land and Murray waters, and obtained a view of the snowy ranges at the head of the "Ovens," bearing W. 20° N. (true). Then we descended the Indi, where its course is a strong small stream over pebbles, through a swamp; here we rested for lunch, and proceeded over granite ranges to Jugylmungee Swamp, having crossed the heads of the Tambo and Indi under Mount Leinster range, where we slept. The next day we proceeded to Omeo, and thence to the Mitta Mitta, where we came upon a gold field (granite gold) in the river basin, extending for 12 miles above and 8 miles below Crook's station to Mount Gibbo. On Friday, 19th, we proceeded from Jugylmungee over the ranges, N. E. to Widgenderra, Hilamarong, Jelbagong Scrub, and Buumba or Gibbo River, and so up to Jelbagong to a swampy springy mountain about 6000 feet above the sea, above Wadymandouree and Buckwong Creeks, which run into the Indi or Upper Hume. It was difficult to find a spot on which to lay our blankets, on account of the "Bull Dog Ants." But we had scarcely done so when a most furious tempest came on, and we were deluged with rain. Our party had been increased by two guides from Omeo and five horses and two dogs. We were up and on our way at 5 A.M., and wending through dense scrub as we could, we travelled, as on yesterday, along a succession of schistose spurs, strewn with innumerable fallen trees, to a swamp; and then ascending a low range at Wanga came to the Indi at Piaderra, where we crossed it. No sooner had we reached this den of heat, damp, and flies, than another tempest more furious than that of the preceding night pounced upon us. We camped, however, beyond the brush and spent Sunday. Then I became very ill. Next morning we started a little before 5 o'clock, an extra horseman and horse in company, and after some flirtation with

Aborigines, respecting the occurrence of gold somewhere in the mountains about the frontier; to ascertain the probability of its occurrence on the Indi or Limestone River, as stated upon the authority of the Surveyor General*; and to

scrub, low and steep hills, and flats, mounted a nearly vertical wall of slate to Woolayian, and descended instantly, just as steeply, the other side of a knife-edge, to a swiftly flowing, snow-fed, affluent of the Indi at Mow-wat, and again mounted a wall of slate to Jungunora and Doornaman. In this ascent, I fainted twice, and was laid out as if dead or dying, on the first flat, stopping the whole party. I was cold as death, yet burning hot, unable to stand, scarcely able to breathe, and I really thought I was dying—but after a rest of an hour I proceeded, and came with difficulty through a dense scrub, masses of fallen trees, and swampy ground, with blocks of gneissiform and concretionary granite to Burramungee and Narramplat, and then to Theroton, and camped under a peak of Muniong, near Kosciusco, between which and my blankets ran a creek into the Indi. I lay ill for several hours in a hollow—under "the shadow of a great rock in a weary land"—and then proceeded to do what I could. Four thunderstorms passed over us, grand from our position, which commanded the kingdoms of the world, and the glory of them. The night was fine but chilly at dawn; when the loud noise of the snow streams which were rushing along during the heat were hushed in silence by the coldness of dawn; and such a sunrise greeted my eyes as I shall not speedily see rivalled. I lay facing the east, and saw all the processes of dressing the day, and wished I had been a Turner to have transferred the tints of that glorious drapery, in which morning marched along the horizon, to the canvas. Parting with three of our party who proceeded to Moamba, we went on to the Crack-emback, and by dint of scrambling, leaping, and fatiguing clambering along the steep slopes of that defile, came to the Thredbo and Wallandaby, there to sleep. Here Mr. Brooks and our guide left me, and Dick and T. and myself made our way to the Snowy River with five horses. T. did not reach the river till an hour after Dick and me: when we got there we found it in flood, flowing like a stream from the paddles of a steamer. The horse was immediately off his legs, and carried me over without difficulty, and when I landed wet over my saddle, for the horse swam very low, and required my attendant, I found he had remained behind. I stayed awhile at Jindebein with Mr. Ryrie who had come to meet me, and came on to this place in as furious a tempest as was ever known. T. managed to cross in the afternoon, when the water is always lower, the melted snow of any given day coming down in the morning of the next day; and the melting of the snow at night being little."

* [The following is a passage from a Report of Sir Thomas L. Mitchell on the Gold-fields of Bathurst, &c., dated 16th October, 1851, which I had heard of, but had not seen till my return to Sydney, in which he collects the information derived from Mr. Townsend and others, and very properly connects it with the probable occurrence of gold:—"At the upper sources of the Hume, and of the Tumut, the rocks consist of granite, schist, and quartz. The same may be said of the valley of the Tooma, where granite, trap-rock, quartz, and schist are the rocks; stupendous

to study the peculiarities, if any, of its position in that region.

[The geology of the region I traversed is very much that which is described in the note below; only there is a large amount of felspathic and hornblendic rocks of which no notice is there taken. From the Snowy River at Jindebein, where a mass of syenite occurs on the right bank, to the Moamba, a range of porphyry is crossed before coming to the river, under the hornblendic granite mass of Moamba Hill; porphyry again comes in on Grose's Plain: and after leaving Ingebyra (in "The Gullies" near which, I think gold will yet be found) the route followed the rising surface of a vast dyke of porphyry to the summit immediately over the Tongaro River, to which the descent of about 1½ miles is very grand, the higher mountain masses beyond making fine scenery, and the deep, inaccessible defile to the left, between masses of slate and granite, through which the Snowy River rushes along, giving an air of inconceivable wildness to the landscape. Beyond Moamba rises the trap hill of Jillamatong. On the track from Moamba to Ingebyra (about the 252nd mile from Port Albert), there is a fine view of the Snowy Mountains along the Muniong, and the great plains at the northern end of the range are well seen.

One cannot resist the impression, that in that broken upland country there are hidden treasures of vast amount. The ranges to the west of this route appeared to strike north-easterly; they rose behind each other in continuous perspective, the loftier summits covered with snow, which appeared also to lie in patches in the hollows and defiles.

This part of the course of the Snowy River is wild in the extreme, and the ranges about Walgalamarang, and all through to the south-east, towards the Deleget country, is a collection of broken, steep, and almost inaccessible masses. It has never been thoroughly explored, though the most considerable portion of it is north of the boundary. On

gullies and ranges the characteristic features. The 'Indi' or Limestone River is that source of the Murray nearest to Cape Howe and the eastern Coast. It is characterised by the same rocks, at an elevation at which snow covers the country during many months in the year. The whole country abounds with springs and mountain torrents, and I have no doubt that in that most elevated portion of our primary formations the principal mineral riches of Australia will eventually be discovered. It will probably be there that gold and other minerals will be found in such abundance as may well deserve the most careful management."]

another occasion I approached this defile of the Snowy River from the south-eastward; it was there equally inaccessible. The amount of fluviatile and transported surface drifts must be enormous; and doubtless they contain gold.

After leaving the Snowy River and its affluents, the country rises into huge mountains of granite, with slates, as at Ingeegoodbee, resting on them, or with porphyry on their flanks, as at Grose's Plain and under the Pilot, where are some huge masses of granite; the Burremandara or Berrima Range is of the latter rock. It is much worn, as if by snow, and the surface is strewn with drift; thence porphyry comes in, as far as Wiendel or Freestone River, and so continues in the huge boss of Billigetmungee, under the Cobberas (an Aboriginal name for the *heads* or summits of the range). A mass of similar kind to these rises in advance, and is called Aberenark, which is near a head of Kurnoolee, or Native Dog Creek.

On this creek, next to the porphyry, rises a pale, micaceous, singularly-contorted slate, traversed by quartz veins, dipping 77° S.E. on a strike of W. 30° N., the strike of the porphyry being W. 28° N.; unmicaceous slates succeeding to the west. The porphyry is completely *moutonné*, as I presume, by snow. Abundance of drift covers the surface, even right over the Dividing Range. The slate is succeeded by a white limestone on the west side of the Dividing Range, interpolated by bands of blue schist and quartz, having a dip of 58° S. E., becoming cavernous. This is the first rock on the Indi or Limestone River; the whole of the surface is covered by fragments of Silurian sandstone, slates, and red oxide of iron. Following up the Indi to its head, it is found to rise in a swampy spot, amidst blocks of granite. This is the source of the Hume or Upper Murray.

Descending from the Dividing Range at a low gap, strewn with rectilinear and pebbly drift, we pass on, over slate, granite, porphyry and trachyte to Jugylmungee Swamp under the lofty Mount Leinster, where is the source of one branch of the Mitta Mitta, between red porphyritic granite with veins of quartz and ironstone on one side, and trachytic porphyry on the other; the heights of Thalunderamungee or Dulinderamungee rising above all in the direction of Omeo. The Tambo rises in the low valley below the scrubby range after leaving the Indi. Between Mount Leinster and Omeo, there are rolling hills and valleys of hornblendic granite running N.W. and S.E., and passing into slates, which reminded me exceedingly of the country above Araluen, and I doubt not it is of the same age; as the succession of the rocks from Wiendel to Mount Leinster, is precisely that which I have shown is the structure of the Gourock. A comparison of the two statements will prove this. At Omeo, there occurs a mass of slate, traversed by quartz reefs, near the head of the valley; but ridges and hills of porphyry striking, as at Kurnoolee, W. 28° N., in advance of the granite of Mount Tambo, form prominent features around, and these are covered by drift: between Omeo and the Livingstone River, mica slate, slate with quartz veins, and all the usual characteristics of a gold field present themselves, the banks of the river being formed of disintegrated greenish granite with veins of ironstone.

In the Inieemungee Range on the left bank of the river an auriferous granite makes its appearance, and this alternating with slates &c., the country is persistent to the head waters of the Ovens.

Crossing Jugylmungee Swamp we came on porphyry again at Widgenderra; then to altered slate, on the Buumba River and Banambera Swamp, which continues with quartz veins along scrubby ranges up to Jelbagong, which is a high point joining the Gumbagumbagulloc Range, opposite Hilamarong. From Jelbagong the Buckwong River runs to the Indi. Hence, dipping steeply to west, glossy slates (schiste noduleux) and flagstones, identical with those near the head of Specimen Gully (Castlemaine), and which are as low down as the Llandeilo rocks of Siluria, become prominent. Further to the westward, blue slates with quartz form the ranges, from the northern extremity of which the Muniong Range, with the summits of Kosciusco and the granitic spires to the eastward, and a huge dome of snow, were seen as if close at hand. From the mountain on which my last camp was made, to the Indi at Piaderra, the whole of the ranges were slates, cracked and rotten in places, apparently from snow; numerous trees on the higher grounds had been blown down from N. W. and killed in snow storms. The slopes are dangerous from Wombat holes; on approaching the river we found the low ground flooded.

The ranges are, in the middle region, well wooded, but above a certain level, the trees are stunted, gnarled, and dead.

The effect of snow storms on these mountains is very evident. The few persons whom I met as residents on the Upper Indi, told me that the snow falls in paroxysmal storms, and then the gullies are filled from 1 to 300 yards deep, so that it must come in drifts with the wind; one told me, he had walked over the tops of the trees hidden by snow; and others in the Snowy plains say, that in hard winters, straggling cattle have been known to be entangled in the trees and die; certainly bones of cattle may be seen in trees, just as in Gundagai there were recently the head and limbs of a horse high up in the branches of a tree, that had been in the midst of the flood of 1852.

The effect of a thaw in narrow creeks can be easily understood. The present season 1860 seems peculiarly mild. In general, however, I believe, that from May to October, many of the mountains are impassable. In 1851 there was no snow in March, which is the month when the cattle are driven to the low country: but it fell heavily at times from May to October, leaving the summits between the Hume and Maneero practicable in November. It often snows above, when the rain is heavy below, and after this severe frosts set in. The plains in winter are very swampy.

On the right bank of the Indi granite appears, traversed by dykes, one of which crosses the river, forming a cascade. This dyke is of porphyritic trap, charged with pyroxene; its strike is N. 30 E.; the granite is in places amygdaloidal but becomes very quartzose. From this to the summit of the Muniong range the formation is of slate intruded into by porphyry rising steeply scarped and divided by ravines; probably, the porphyry occurs as dykes from the subjacent granite, and as the summit is approached the slate becomes transmuted and at the junction is an imperfect gneiss.

The granite about Kosciusco is syenitic, and ought to be auriferous. It is clearly intrusive, and appears in denticulated summits occasioned by vertical joints, as well as in huge bosses, one of which forms the southern end of the range. Deeply fissured and cleft, the branches of the Snowy River on one side, and of the Hume on the other, rush down in foaming torrents from the melting snow. The description which is given by Strzelecki is accurate; * but the elevation assigned by him is too low.]

* Physical Description, &c., p. 62.

Having with me only a very imperfect chart, in which the ranges and river valleys appeared to me to be incorrectly laid down, I was also disposed to ascertain, so far as I could, whether the boundary line between Victoria and New South Wales ought not to be placed much more to the south than it appears upon some of the published maps, such as Ham's Squatting Map of Victoria. I had not then with me the general map of the Surveyor-General, in which I now see the boundary line placed near the rise of one head of the Indi, nor had I any other legitimate document to which I could refer; and I name this as my apology for inquiring into a question of the kind. I am, however, gratified at being able to bear my humble testimony to the general accuracy with which the course of the Indi is now delineated. I further venture to express an opinion, that, inasmuch as the frontier line between the two provinces was, probably, introduced into the Act of Parliament upon imperfect data as to the actual chief source of the Murray nearest to Cape Howe, and as the true position will some day have to be unmistakeably defined, in order to prevent inconveniences of various kinds, it might be a subject worthy of consideration, how far the British Government might not be justifiably moved as to the propriety of finally running the boundary line between Cape Howe and the actual head of the Murray at Mount Tambo, close to which, overlapping each other, the waters of the Indi and the Tambo take their rise.

An inspection of the various physical features of that region will show that such a settlement of the point in question would be one satisfactory to the geographical arrangements of the country, and in many ways an act of justice to the province of New South Wales.

Having had an opportunity so recently of exploring the ranges and waters between the Mitta Mitta and the Muniong ranges, in parts whither, I think, no surveyor has been, I cannot refrain from remarking, that a survey of the Omeo country upon the system carried out so effectually in the Survey Department of New South Wales and Victoria would be a great advantage.

Such charts as I have seen are, in many respects, totally at variance with the actual features of that country.

For instance, no reliance can be placed upon the published maps as to the disposition of the waters between

Mount Gibbo and the Muniong; and I am surprised to find, that upon the original tracing by the Count de Strzelecki of his route from the Murray to Gipps Land, which now lies before me, the Indi River is not marked above the position of his Mount Pinnaba, and is actually shut out by the intervention of a range which is placed across the course of the river where I found it running with a broad, deep, and rapid current, having all the characteristics of an important mountain stream. This, too, seems the more remarkable, as from Mount Kosciusco the deep and precipitous defile through which its waters flow, is seen far below, and is very distinctly marked for several miles.

I do not mention this with even the slightest intention of detracting from the well-earned laurels of so accomplished an explorer as M. de Strzelecki, but, on the contrary, to point how difficult it is for a supplementary survey, such, for example, as that in which I am now engaged, to be prosecuted with success until the orographical and potamical features of a district have been accurately defined. I cannot, after my recent traverses amidst these Alpine rugged and scrubby mountains, sufficiently express my sense of the services rendered to science by the patient and fatiguing labours of Strzelecki under circumstances of difficulty, heightened by his reliance upon an imperfect representation of a region which he could not suppose to be otherwise than correct.*

I found the summits of the Muniong to be composed of coarse syenitic granite, partly concretionary, much jointed, and rising in denticulated masses and rounded bosses, so as to present, in connection with the slopes of snow, the outline of a true "Sierra Nevada." No mica slate, or other schistose rock, save such granite, appears along the peaked summits of the range for the space of several miles; these are over-looked by the partly snow-clad, peak-ridged summit of Kosciusco. But, on my ascent from Mow-wat to Burramungee, I passed over highly inclined and nearly vertically cleaved glistening mica slate and clay slate, which pass into a gneissiform granite before the actual summit is attained. The structure of the granitic masses, and the disposition of the rivers in N.E. and S.E. channels diverging

* [This was written in 1851. Probably, in 1861 the country will be more fully known.]

from the summit, prove the granite to have been in part injected since the formation of the schistose formations. In some places the granite becomes porphyritic, entangling segregated lumps of finer texture, and containing patches of eurite, leptenite, and tourmaline-pegmatite, with some quartz veins. The action of the snow has removed the softer materials from the surface, and the quartz, therefore, remains exposed, and thus exhibited shows a peculiar disposition in regular lines. The tourmaline places the granite not far from that of Dartmoor, and one might expect tin in the vicinity. I obtained one small specimen from the granite.* None was, however, found amidst the detritus.

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* [The discovery of payable tin in the Ovens and other districts since the date of this Report, renders it necessary to claim what of right belongs to me. I therefore reprint the following letter to substantiate that claim:—

"TIN ORE.

"*To the Editor of the Sydney Morning Herald.*

"SIR,—Observing in your impression of this morning a notice of the determination of tin ore like the 'stream tin' of Cornwall by Mr. Storer, of the U. S. Ex. Ex., in the alluvia of the Ovens, I take occasion to state that this valuable ore is not confined to the Ovens, but exists, as I have found during my late exploration of *this* colony, as well as of Victoria, in a vast number of localities, always with gold derived from granite, and frequently where no gold has been discovered. I found it abundantly in the Bendoc and other districts of the southern country, and about the Rocky River, and all through New England and its flanks. I doubt not, hereafter, it will become a most useful addition to our productive resources.

"The first notice of tin in this colony, or in Australia, will be found in a paper on Mining which I contributed to your columns on 16th August, 1849, now more than four years ago. Again I have reported its existence in the Alps, in my Report of 24th December, 1851; and in my last Report of 14th October, 1853, I have mentioned its universal distribution in wide tracts of country.

"I was first led to anticipate tin from observing the presence of tourmaline-granite, and the indication has not deceived me. It is from precisely such granite that it has been derived in Cornwall; and coupling this fact with another, viz., that tin exists in great abundance at Banca, and gold also in others of the islands of the Indian Archipelago, we have every reason to conclude that both these metals (since the geological formations are persistent) will be found in certain localities all through the range of the Australian Cordillera up to Torres Strait.

"W. B. CLARKE.

"St. Leonard's, 13th January, 1854."

The passages alluded to in the paper on Mining are these:—"And here, merely for the sake of usefulness, we suggest, that though tin has

One of the party washed the latter for gold, but no gold could be discovered. I was lying ill at the time upon the rocks, and was unable to superintend the operations; but on the descent from the junction of the heads of the Crack-em-back River, I sought for the metal in vain, though prospecting at all available localities between it and Thredbo, where the ravine expands.* This disappointment to others at the summit of the Australian Alps, nearly 7000 feet above the sea, was satisfactory to my expectations: it serves to

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not yet been found in this colony, it may hereafter be discovered. It is not improbable that it will be found along parts of the Murrumbidgee, where granite occurs with abundance of *schorl*; since, in granitic districts of Cornwall, oxide of tin has a marked connection with schorl, which latter mineral is a principal ingredient in the tin lodes. *The writer of this suspects, however, that he has found crystals of tin in granite from the locality mentioned, though he did not pay particular attention to the fact.* The abundance of copper in this colony would naturally suggest the probable occurrence of tin; though it is equally probable, that the abundance of our copper is mainly due, not to the existence of true granites, but to the occurrence of trap rocks of the more usual varieties." —*S. M. H.*, 16th August, 1849.

Mr. G. M. Stephen also mentioned the existence of oxide of tin on the Ovens in a letter to the Editor of the *Melbourne Argus*, 31st March, 1853.

Mr. Storer's letter is subjoined;—

"U. S. Ship Vincennes, Port Jackson, January 24, 1854.

"Sir,—I have the honor to inform you that I have analysed several specimens of sand and small water-worn pebbles, from the locality known as the "Ovens," which are found, owing to their great specific weight, mixed with the gold at the bottom of the miners' washing apparatus. They came into my possession through the kindness of Mr. F. Bousfield, of Sydney, having been collected by that gentleman at the above-mentioned locality.

"I find them to consist entirely of a very rich ore of tin, similar to the "stream tin" of Cornwall, which yields from 50 to 70 per cent. of pure metal. Not only the *black* sand of this deposit, but also the yellowish and grey particles—some of them nearly transparent—which occur in it, yield unmistakeable evidence of tin. Believing that these facts are not universally known, even if heretofore noticed, and deeming their promulgation may, by calling attention to the subject, lead to investigations concerning the quantity, localities, and practicability of working this valuable ore, I consider it my duty to mention the results of my examinations to you.

"I am, Sir, very respectfully, your obedient servant,

F. H. STORER,

"Chemist and Geologist to Expedition.

"To Commander Cadwalader Ringgold, Commanding U. S. Exploring Expedition to China Seas, &c."]

* [Gold was subsequently found in this very locality. See Report of 20th May, 1852.]

assist in disproving by a valid example the necessity, asserted by some, for the existence of very high mountains, in order to justify the expectation of gold. I am glad, if for no other reason, that I have been enabled to carry a cradle, prospecting pan, pick and shovel, over some of the highest peaks of this continent, and up and down the faces of generally precipitous mountains, the planes of slope of which are, in other instances, perfect escarpments.

This example would not, I confess, be so powerful in illustration as it seems to me, were it not that in the very same granite, at a much lower level, and in a range connected with Muniong, I found not only gold, but garnet and ruby, and other associated minerals.*

* [The heights of the Muniong Ranges have not been generally made known. I have already stated that Strzelecki made them too low. His barometer was known, according to a statement made by His Excellency Sir W. Denison to the Tasmanian Society, to be out of order. I had no barometer on the Alps; but I had frequent opportunities of obtaining the elevations of various points by means of the theodolite, and in this way I intersected Kosciusco, &c., from localities of which I had by barometrical measurement, obtained the level. I supplied them to my friend Dr. Mueller, whose botanical researches in this very region, in 1854, have been published in the *Journal of the Philosophical Institute of Melbourne*, and the heights following, set under my name are those I sent him. As incorporating my own with his, and comparing them with Strzelecki's, I give here an abstract of them from *Dr. A. Petermann's Mittheilungen*, 1859, p. 280; *Gotha*, 1859, arranged in a tabular form :—

ELEVATIONS IN THE AUSTRALIAN ALPS.

	Strzelecki.	Clarke.	Mueller.
Mount Kosciusco	6500	7308	....
Mount Dargal	5490	....	....
Mount Pinnaba	4100	....	....
Mount Hotham	....	....	7500
Mount Latrobe	....	....	7300
Second height on the Muniong..	....	7064	....
Muragural	....	6987	....
Jallula	....	6934	....
Ram's Head	....	6838	....
Big Bogong (Tumut) (Jagungal)	....	6763	....
Bald Head (Gungarlin R.) ..	....	5337	....
Mount Gungarlin	....	5337	....
"Crack-em-back" Hill ..	....	4697	....

By this list, it appears that Mount Kosciusco is not the loftiest summit, and that there are eight higher than the height assigned to it by Strzelecki. Dr. Mueller's observations were made by boiling water, "mit dem Koch-thermometer." I am bound to say, that I consider my own only approximations, especially Big Bogong, and that I do not believe in the possibility of perfect measurement of heights by any instrument at present invented.]

I will now enumerate the various localities which I have examined, since my last Report, in search of Gold.

A.—On the N.E. side of the great basaltic plateau of Maneero :—

1. Cooma Creeks.
2. Murrumbidgee River at Mittagàng.
3. Rock Flat Creek, from the spring to near the junction with the Umaralla River.
4. Jillamatong Creek.

In none of these localities did I detect at first the presence of Gold. The rocks are various slates, quartzite, quartz veins, limestones, and trap.

B.—On the S.W. side of the basaltic plateau :—

1. Ural - Creek, from the junction with Stony Creek to Wulwya. There is a little Gold at the junction.
2. Colibragong, at Iron Pot Creek. [There is a little Gold nearer the Snowy River.]
3. Moamba River, four miles west of Jillamatong Hill. * Gold occurs in the drift of the river bed in fine particles, intermixed with garnet and hyacinth, and in the decomposing granite fragments from the Moamba Range.
4. Tongaro or Jacob's River. Gold, rather scarce, is found in the pebbly alluvium at the junction with the Snowy River; but not for some distance above the junction.
5. Moyengul River. Similar results at the junction with the Snowy River, but not within a mile of that junction.
6. Berrima River. Slight traces of Gold. Slate and quartz shingle with granite.
7. Wiendel under the Cobberas. No Gold found. (Porphyry).
8. Kurnoolee or Warrigal Creek. (Ditto.)
9. Indi or Limestone River, the principal head of the Hume River, at the source; at Wararkwary, and at Tangaruocan, places nearly forty miles apart. No Gold discovered—slate and granite.

* [Jilla matong is a common designation for a solitary hill. There are several in the southern country; one near Braidwood; one near Cooma; and this near Moambâ; it is sometimes called Moambâ-hill. Matong means "one." Mungee, another common termination, means "fish."]

10. Jugylmungee Creek, joining the Mitta Mitta, near Gibbo Mountain. Fine Gold near the junction.
11. Creek rising in Currancoomungee Range, near Omeo. No Water; but the rocks present an auriferous character. Granite piercing slates.
12. Omeo Plain. Gold occurs occasionally in fragments of ironstone conglomerating quartz.
13. Mitta Mitta River, and creeks on the left bank. Gold very abundant in the decomposed and decomposing granitic detritus.
14. Gibbo River. Gold near the mouth.
15. Buumba River. No Gold discovered.
16. Waters issuing from the snows of Mount Kosciusco at Burramungee (Ram's Head), and at the head and in the course of Crackemback* River. No Gold found.
17. Wallandaby Creek. No Gold found. [Afterwards discovered.]
18. Snowy River, above Jindebein. Fine Gold at a considerable depth in the fluviatile drift, near the usual crossing place.

There are various other localities in this extensive region in which I anticipate the discovery of Gold; but my time did not allow me to do more than examine the geological structure; and in some places, where the rocks appear to be auriferous, there is no water, as is especially the case in some dry narrow water courses resembling the head of Major's Creek at Araluen. One of these occurs under the trachytic peak of Thalunderamungee.

The examples cited above are instructive, as illustrating a phenomenon forced upon my attention throughout the southern country, and which first attracted my notice at Araluen. I mean the occurrence of gold in granitic rocks of a certain class. The schists and quartzites, so prolific in the basin of the Macquarie, appear to be often barren in this part of the colony; and I have travelled for miles in succession over the exposed outcrop of quartz veins without discovering a trace of gold. On the contrary, I have always found it in connection with granite of some kind;

* [The origin of this name I was told by the Aborigines who speak English to be the steepness of the ranges, to ascend which would *crack a man's back*: I do not know the authority for writing the word "Krackenbang."]

and the prevalence of this fact leads me to the conclusion, that no gold is likely to be so generally discovered in this part of the territory, as that fine kind which is spoken of above.

The want of a proper confidence in the bearing of this fact will deter many persons from availing themselves of the provision, however plentiful or scanty, which has been made for them. Being too indolent to labour, and greedy of gold in the mass, many will turn away from the localities of granite gold with contempt or disgust; whilst it is highly probable that, in the enormous area through which granite has risen, there is, in the aggregate, as much of the precious metal as in a smaller region where it occurs in larger masses.

On the Mitta Mitta, there is sufficient gold in dust and flakes to remunerate industrious persons by a return of from seven to nine shillings per diem; and unless my data are erroneous, gold is distributed in this way for 30 or 40 miles in length and across an extensive river basin. On arriving at the river, I very soon discovered the habitat of the gold to be a peculiar species of granite, and after washing some of the alluvium, I broke up the rounded blocks upon the river beach and washed the fragments. Gold and hyacinth were in this way instantly procured.

The auriferous character of the alluvium had been ascertained by a small party of four persons who had been working for a day or two in a small space on the left bank of the river, but they were about to abandon it, because the gold is fine.

They expected to obtain it in lumps; but I explained to them the improbability of such discovery, and showed them under what circumstances it is alone to be expected there. The parties are all occupiers of New South Wales. As the rock producing the gold is distributed largely in the Inieemungee Range and at the head of the Mitta Mitta, and as its boulders line the banks of the river for many miles, I doubt not, ere long, a profitable field of labour will be developed.

I enclose herewith a sample of the gold and a specimen of the rock from which I obtained it, by the simple process of crushing and washing on the spot.

The Gold of Gibbo is of the same character, but there is at the base and on the slopes of that range, in addition, much argentiferous galena.

So far as I could judge from large tracts of worthless country just over the boundary, I do not think this Colony has lost very much, save in these metalliferous deposits, by the separation, *i. e.*, about these localities; and even where the land and water are favorable, there exists a fly, which, in some instances, renders it impossible for cattle to thrive. I saw so much of this pest, that I was very glad to get away from it. Even the wild cattle which we fell in with exhibited signs of distress and poverty, in pasture up to their shoulders; and our horses and dogs at the encampments were, as well as ourselves, persecuted beyond endurance.

The Mitta Mitta is in a better country, and Omeo is one of the most beautiful localities I have seen, but the climate is fickle, and the land subject to droughts.

This season it is as green as emerald, "*dives pictai vestis et auri.*"

The Mitta Mitta is a very considerable river, deep in places, wide, and extremely rapid. Where I crossed it it was scarcely fordable, and running with a violent current over vast masses of shingle and blocks of stone brought down from above. [Lower down I crossed it in a hollow log.] It is now swollen by rains and snow, but, probably, its bed in a drier season will repay a search for gold. At some height above the present bank, the metal is found in the more ancient alluvia, and in the gullies and ranges of the left bank we found it in the superficial soil.

Although this Gold Field is in another province, yet it is impossible to disregard the value of its indications, as they affect the extension of similar rock formations in this. Upon the strength of these indications, I rely with confidence on the future discovery of gold in the river channels and ranges running north-westwardly between the Murray and Murrumbidgee, and it is very satisfactory to me to be able to prove the truth of this opinion by placing before you an extract from a letter which I have just very opportunely received. It will certainly show, that in my predictions I have not been deceived.

Carrabost, Tarcutta Creek,
20th November, 1851.

Sir,—Although some years have passed since we met at Appin, [April, 1846,] I have, during the last few months, often recalled to mind your saying that you knew where to find gold on the Bathurst side, and finding that you proved a good authority in the case, I was tempted to go prospecting here, as I hear you stated that this was a likely locality to find gold. I think you will be glad to hear that your prediction proves to be correct. This place is situated on the right hand branch of the Tarcutta Creek coming up, and is about 45 miles from its junction with the Murrumbidgee River.

A shepherd in the employment of Messrs. Walker and Co., at a place called American Yards, eight miles lower down the creek, has also found gold there, of the same description as it is here; and he tells me that he has found some on the hill side that looks "as if it had been melted;" but he will not show me any of this.

I am, &c.,

(Signed) FRED. E. MANNING.

Rev. W. B. Clarke.

Before I conclude, I will also mention that gold in small quantities has been found on the eastern side of the Coast Range in the Nimitabel Mountains, in Bobundara Creek, and at Toonginbooka, the latter by two persons whom I saw at Jejedzeric, and whom I requested to prospect there.

This Report has already extended to such a length, that I do not add any geological description of the country under review; but I shall be ready to supply any preliminary information that His Excellency may desire before I report independently on that head. The meteorological observations which I made on the Snowy Ranges and Rivers, I have forwarded to Captain P. P. King, R.N., not being willing to burthen this Report with any additional detail.

[Circumstances, however, now render it necessary to make a few additional remarks on the Omeo and Mitta Mitta gold-fields. Notwithstanding the amount of gold obtained there, it seems not to have satisfied the expectations of the multitude who flocked thither. But I am still of opinion, that the country will bear a further trial; and such is the opinion of some experienced diggers also—men of intelligence, who interpret the geological indications in a favorable way.

Connected as the Omeo gold-field is with the Ovens country, the following extract from the last Annual Report (1859-60) of the Victorian Board of Science may be useful:—

"The Buckland District is divided into two divisions by the Buckland and Ovens Rivers. In the former there are two quartz reefs which employ about thirty miners, and the others are employed in alluvial mining. In the latter about two-thirds are engaged on the quartz reefs, which are numerous and exceedingly rich. This division has been but little prospected as yet, and there is every prospect of good alluvial diggings being opened in the valley of the Ovens.

"No information has been received respecting the Omeo division (p. 171)." See onward, Chapter XV.]*

* As affording some information relative to the commencement of the diggings at Omeo, and the routes thither, the following documents may be given.

OMEO DIGGINGS.

To the Editor of the Sydney Morning Herald.

SIR,—I do not address you on this occasion for the purpose of expressing any satisfaction at the verification which has now been made of my statements respecting the Gold Fields along the Mitta Mitta and at Omeo, because I have been always confident that the day is not far distant when every report I have made to the Government will be completely confirmed by the abundant testimony of experience. But, as the Omeo country will, doubtless, attract thousands to venture their skill and labour, now the ice has been broken; and as I have had personal trial of the difficulties and inconveniences of the journey thither from this colony, I wish to say a few words to such as propose going to Mitta Mitta, with the desire of pointing out those difficulties. The state of the road from Eden to Maneero I have mentioned in my Report of 28th August, 1852, and to that Report I must refer those who wish to know if the access by that route is advisable.

Supposing the journey to be undertaken by the usual southern line to Cooma viâ Goulburn, there is no necessity for me to say more than that this is not the difficult part of the journey. That commences at the Snowy River, which must be forded. There was a hollow log in which I once crossed it, but it sank the day after, to the loss of some property, and nearly the loss of life to a young lad who was in it, and who was sometime ill in consequence. If the river be in flood from rain or melted snow it is frequently dangerous to swim over.

From the Snowy River there is a track by way of Moamba to Ingebyra, Jacob's Point, coasting the Snowy River or crossing a lofty mountain to the Tongaro River, to the foot of the Nine-Mile Pinch. Much of this is perfectly impracticable for drays, notwithstanding the readiness with which bullock teams clamber steep ranges.

The Nine-Mile Pinch is a constant climb for an hour and a half, with but a few small spots for rest, up a most terrible ascent for heavily

Postscript of last letter omitted — It announces the intention of forwarding a specimen of auriferous granite from the Mitta — See p. 5. Report — VII

CHAPTER VIII.

REPORT No. VIII.

ON THE OCCURRENCE OF GOLD ON BOBUNDARA CREEK, KARA CREEK, GUNGARLIN AND EUCUMBENE RIVERS.

\+ *Cooma, January 3rd*, 1852.

I have the honor of reporting, for the information of His Excellency the Governor-General, that I have examined the auriferous locality on Bobundara Creek, and find that the gold is there distributed in a peculiar way. The schists and quartzites, which are so greatly interrupted by granite on the west side of the county of Wallace, disappear for some distance along Bobundara Creek, but are intruded into by basalt of the ranges and plateau, separating the waters of the Murrum-

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laden pack-horses. Thence the track lies across a partly open and swampy country, over the Ingeegoodbee River, the Berrima or Burramandara Mountain, which is a great mass of granite, and three creeks, to a rolling country in Victoria, above what is called Freestone River, (why, I know not, as the rocks are all porphyry), after crossing which, there is a tremendously steep ascent to Billigetmungee, right under the Cobberas. This bit of country is, on the whole, bad enough, but the rise from the Freestone is quite impassable for carriages. Years ago, I am told, two or three drays were got up after a day or two's labour; but to attempt it now would be a deliberate wickedness against cattle. Hence, there is a wild, broken, rough descent to Native Dog Creek, just at the base of the Dividing Range between Gipps' Land and the Murray, after crossing that villanous swamp called "The Play Ground," where it will be good fortune not to find snow.

From Native Dog the country is steep and broken, and there is a good view from the summit of the range, of Mount Buffalo on the Ovens, and of the gold region below it. Crossing the Indi, or Limestone River, the real head of the Hume or Upper Murray, and thence through a scrubby, granite, swampy country, the traveller reaches one of the waters running to the Mitta Mitta, and through an extensive swamp under Mount Leinster; and thence by a picturesque but very wild broken country, Omeo is reached.

\+ First paragraph omitted referring to the receipt & intended transmission of the [illegible] alluded to [illegible] bidgee and Snowy Rivers; and on the side of a hill south of the creek and near the track leading from Cooma to Mafra, the latter rock breaks out from below the slate, which is bleached and transmuted at the points of junction.

The plain of Omeo is very extensive and beautiful. Behind are the lofty summits from Mount Leinster to Gibbo; on the left Mount Tambo; on the right, the slate ranges between Omeo and the Mitta Mitta, and before a broken mass of mountains heading that river and its tributaries. The slaty rocks reposing on the granite are well divided by quartz veins, and have been extensively denuded. Minute Hill and other mountains, as well as a great transverse ridge running athwart the plain, are of porphyry. The ground is strewn by gravel and broken fragment of rock, and everything betokens a gold country. The slate formations varies from clay slate to mica schist, which latter forms the ridges on the right bank of the Mitta Mitta. In my Report of 24th December, 1851, I have stated, "Gold is distributed over an area of thirty or forty miles in length, and across an extensive river basin."

Of this distance, sixteen miles have been already proved along the Livingstone, as reported by Mr. Commissioner Shuter, and the remainder is on the Mitta Mitta. There are no stores at Omeo; and the difficulties of the country will render the suggestion of Mr. Shuter important, about obtaining provisions from Port Albert, in Gipps' Land.

There is another route to Omeo from Moamba; in fact, two. A good bushman, with a suitable horse, may cross in something like thirty-five miles, over the south end of the Kosciusco Range, to the Indi at Tangaruccan; but the better route would be to Wallandabee and Thredbo, and along the right bank of the Crack-em-back to the gap under the Kosciusco Range; this is, however, through much swampy ground, scrubs, and gullies, and along very steep sidelings; and both routes about the gap are rendered impassable most years by snow, from May to October or November; to say nothing of the steep descents and ascents for pack-horses heavily laden to the Indi. From that river the route lies along exceedingly steep and scrubby ranges, above Buckwong Creek to Jelbagong mountain and swamp, and thence to Buumba River, which is divided from the Jugylmungee Swamp under Mount Leinster by the high and steep range of Widginderra. As the opening of this gold-field will induce a large population to pass through this country, the wilderness which it now is (being inhabited by very few and distant station-keepers) will fast wear another appearance; but it must be impressed on the minds of intending diggers that there are no inns in that region, and very few places where supplies can be had. I received much hospitality from all I met on my journey, but a multitude cannot expect accommodation. The Maneero settlers will probably convey supplies by degrees across the country, but at present they must be carried by the traveller. The winter is coming on, and there will of course be heavy snow drifts; in such a case it would be madness for strangers to take the Maneero routes, unless well provided. But in the summer they will find gold along these routes in various places; and I anticipate from the opening of Omeo a similar success for many other localities on which I have reported, and others which I did not notice officially, such as the country about Native Dog, Jelbagong, &c. I judge from the same indi-

A very interesting amygdaloid occurs at these points, and gold, in particles occasionally coarser than those so commonly met with in the southern districts, is found in contact with the amygdaloid, and between the planes of

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cations and experience which enabled me to say in December, 1851, writing of Mitta Mitta,—"I doubt not, ere long, a profitable field of labour will be developed."

It may be of service to give a rough table of distances. We may call the distance from Eden to Cooma 100 miles; and from Sydney to Cooma it is called 254 miles, but it is more.

	Miles.
From Cooma to Jindebein	26
Jindebein to Moamba	28
Moamba to Ingebyra	12
Ingebyra to Jacob's Point	9
Jacob's Point to Nine-Milé Pinch (summit)	13
Nine-Mile Pinch to Freestone	13
Freestone to Limestone	16
Limestone to M'Farlane's (Omeo)	15
M'Farlane's to Crook's (Mitta Mitta)	9
	141

The whole distance, therefore, from Sydney overland is, according to my reckoning, about 400 miles, and from Eden about 250 miles. From Port Albert it is, as below, 307 miles.

The exact distances from Cooma by way of Kosciusco I do not know; but I do not think there is much difference between it and by the former route. On each journey the time, from and to Jejedzeric, taken up was nearly the same, namely, from 50 to 53 hours actual riding, at a walking pace, between 9th and 25th December, with very fine weather, and occasional furious thunderstorms and heavy rain. My party consisted of from 5 to 7 persons, with from 8 to 11 horses, and we carried our provisions, and gold digging tools, a tarpaulin for a tent, cradle, &c. We had several dogs belonging to Mr. Brooks, of Jejedzeric, who accompanied me, but save in Hilamarong Swamp, we saw no kangaroo. Game, therefore, cannot be relied on.

The following route from Gipp's Land to Maneero may suit some who go by way of the former.

	Miles.
Port Albert to Bairnsdale (main road)	98
Bairnsdale to Bruthen	53
Bruthen to Galantopè	30
Galantopè to Walgalamarang	15
Walgalamarang to Toonginbooka	24
Toonginbooka to Snowy River, at Jacob's Point	21
Jacob's Point to Crook's	66
	307

The whole distance from Sydney to Port Albert, overland, is thus 561 miles.

W. B. CLARKE.

St. Leonard's, 19th April, 1854.

the joints traversing that rock, as well as in the rock itself. I have considerable doubt as to the probability of such a matrix being profilic, and I, therefore, think that little gold will be found in it; but the metal does occur in the surface soil, and again near the punt crossing place of the Snowy River at Beard's station, from which to Mafra the prevailing rock is granite.

I conclude from all the geological conditions of the

MR. PRATT'S ROUTE.

	Miles.
From Eden to Bombala	52
Bombala to Little Plains	13
Little Plains to Deleget	12
Deleget to Tubbut	17
Tubbut to Deddic	13
Deddic to Snowy River	5
Snowy River to Rooks, the summit of Black Mountain	8
Rooks to Bow Yard	13
Bow Yard to Pender's Heifer Station	18
Pender's to M'Farlane's (Omeo)	12
	163

This route will be seen to be as near, if not the nearest, to Omeo, for parties from the Sydney side. Drays are in the habit of bringing from one ton to thirty cwt. from Eden to this place, according to the season. From here to Deddic a dray can take about twenty-five cwt.; from Deddic to Rooks, summit of Black Mountain, you would be compelled to use pack horses; from Rooks to Omeo a dray can take about thirty cwt.

M. T. PRATT.

Bombala, May 13th, 1854.

FROM THE OVENS TO OMEO.

(From the Correspondent of the Melbourne Morning Herald.

Mr. Shuter, Gold Commissioner, and Mr. Cadet Garnett started from this for the Omeo country on the above date; with a view to ascertain all particulars with regard to the discovery of gold there. They took with them a pack-horse carrying tent and provisions, and arrived the same day at Yakindandah, about eighteen miles from this. The next day they crossed the Little River, at Mr. Mitchell's station, and put up at Mr. Lockhart's, on the Mitta Mitta River, on the 9th. Proceeded on the 10th to Mr. Wyse's station, being the highest station on the Mitta Mitta by the short cut—a distance of about 25 miles from Mitchell's station. In this vicinity they found scattered parties of diggers at work on the various creeks, and some upon the Snowy Creek—all doing very well, and the whole country bearing the evident indications of being a gold district. From Wyse's they had nothing to guide them but the country in this neighbourhood, that the preservation of the gold is somehow connected with the trap, which is evidently younger than the schists, and over considerable areas along the dividing plateau, marked by the summits known as the Brothers, the Peak, Jennybruthera, &c., occurs in intimate proximity to granite and schists.

As the occurrence of gold on the side of the hill in question is, under the circumstances, somewhat peculiar, I

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course of the river, which runs through broken chains of inaccessible mountains, and which are barely passable on the sidelings; frequently crossing and recrossing the fordable parts of the river the whole way, so as to obtain the most practicable footing.

About 20 miles beyond Wyse's station, the river flows through a steep gap in the mountain, which seemed at first to have rendered further advance impracticable; but after some difficulty in searching, they found a track upon the east side, formed by the treading of the wild cattle and the aborigines of those mountains. This track runs along the side of the range for seven miles, at the height of 200 or 300 feet above the river. Here it is dangerous for horses, from the steepness of the mountain pass and the broken nature of the ground. Stones loosened by the horses' feet, went bounding from rock to rock, when they sunk with a sullen splash in the waters below, and warned the travellers of the fate that awaited them or their horses if, lucklessly, either were to miss their footing. Four days they continued the winding course of this river, along the sides of the mountains, when on the 13th they arrived at the foot of Mount Gibbo, one of the principal ranges of the Alpine mountains—which runs from the heads of the Murray River, nearly in a south-westerly direction, but ends at the point of the Mitta Mitta so abruptly as to prevent the possibility of following the course of the river any longer. Turning now to the south they ascended the mountain, and after five hour's ascent they found a gap, where alone is a practicable path by which they could pursue their journey; and on emerging from this gap to the south, they beheld the broad plains of Omeo, extending, perhaps, over one hundred square miles, with scarcely a tree to interrupt the eye, wandering over this magnificent view of champaign country.

On the west of this plain, and not on the east as represented by Ham's Squatting Map, runs Livingstone Creek, where the diggers are at present at work. Fifty men, the pioneers of, perhaps, an army of miners, are here assembled, and all are said to be doing well. "Any one," the diggers said, "can get half an ounce of gold a day here with ease by surfacing." The Omeo, are what is termed dry diggings, and the gold found is in general nuggetty. Some of the diggers there, had for months been prospecting for gold, which, they said, they got in most places, and often in sufficient quantities to remunerate them; but still resolved to prosecute their search, they at length settled down here, contented with their discovery, where they are determined to spend the winter season.

The diggings, as at present known, extend along the margin of Livingstone Creek for about 20 miles; they lie between two branches of the Mitta Mitta, and are about 12 miles north-west of Lake Omeo.

have thought it proper to make particular mention of it. I may also add, that having found in a branch of Bobundara Creek a fragment of quartz conglomerate cemented by iron, which contained a visible particle of gold, it is not unlikely that the gold dust on the hill side in the amygdaloidal rock, which is very ferruginous, may owe its exhibition to the presence of iron, and so be resolved into another example

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They are principally dry diggings; that is, the gold is taken from the surface, or by sinking three or ten feet. The plain of Omeo has also been tried by a party of Californians, and declared by them, if worked with the usual appurtenances peculiar to wet diggings and sinking, to be the most profitable portion of the gold field.

It is strange that this country, which has so long been declared by geologists and practical diggers, to be the centre and matrix of the gold regions; should have so long remained unworked, except by a few straggling adventurers. It is impossible to obtain from diggers an exact account of the results of their labour; but at the lowest calculation, and by their own confession, half-an-ounce a day per man is under the produce of these diggings. This amount even is an extraordinary yield, in a place found to be an extensive gold-field, and as yet only partially developed.

The Omeo country is fully 300 miles N.E. of Melbourne, and situated north of Gipps Land, from which direction, no doubt, most of the supplies will come. Port Albert will then become an important place, as provisions will be brought from Melbourne by the coast to within one hundred miles of the diggings.

I have been making every enquiry about the weather, and can arrive at no certain information. Some tell me that it is now too late in the season to go there, as the mountains will be soon covered with snow; others say, that for the next two months the road will be practicable. Before diggers and their families start on a long journey this is an important question for them to ascertain, so that they may not be overtaken in the snow, and driven back after undergoing fatigue and expense. The Ovens and its neighbouring diggings being as near as sixty miles in a direct line north-west of the Omeo, though the route would be about 127 miles, eight or nine days' journey, the consideration is, therefore, not so great with those here who are anxious to try their fortune at the Omeo diggings, and have no objection to winter in the snowy mountains, as probably they could settle themselves before the severe weather set in. Many intend waiting for the spring season before starting.

I have said nothing, as yet, about the road for travelling. Mr. Garnett travelled to the end of the Gibbo range, along the banks of one of the small creeks,—ascended a low spur of the Gibbo Mountain, until he reached the crest, and along the top of this is the only known way by which carts and drays can travel. It is about forty miles in length. But this road is only barely passable, rising and falling very abruptly, which renders great force necessary to succeed in taking drays by this road; and occasionally it is desirable to unload and use mules to overcome some of the great obstacles which present themselves. All these difficulties have been overcome by perseverance. However, only six drays have gone that road within sixteen years, since the country was, I believe, discovered of the connection between the two metals, of which I have already reported some striking occurrences in this colony.

Should this view of the case be correct, I shall probably find it established by other localities on the flanks of the basaltic plateau.

I beg leave also to report, that on further examination of Kara Creek, which is also called Iron Pot Creek, gold

by Europeans. During the four days Mr. Garnett was on the mountain, he suffered greatly from want of provisions and water, both for himself and horse, and also from the rain and cold at nights. Except one man near the foot of the mountain, who had been lost for some days, he saw not a human being or a dwelling of any kind. He descended the Gibbo mountain at the "Head of the Murray," then followed the Kadgawa Creek to the river, and returned by Albury to the Ovens on Tuesday, the 28th instant, thus completing the journey in 28 days over a tract of country that would baffle many an experienced bushman.

Melbourne, 10th April, 1854.

Sir.—I have the honor to inform you that, in accordance with instructions received from the Resident Commissioner at Beechworth, to proceed to Lake Omeo, with a view of obtaining definite information relative to a gold field alleged to have been discovered there, I arrived on the 15th ultimo at Mr. M'Farlane's station, which is situated three miles to the north-west of Lake Omeo, having accomplished the journey from Beechworth in five days.

2. On the following day I visited the Livingstone River, and there found seventeen tents, with a population of about fifty miners at work between Mount Livingstone and the junction of the rivers Livingstone and Mitta Mitta.

3. The Livingstone River takes its rise about seventy miles north of Lake King, and after a north-westerly course of from twenty to thirty miles falls into the Mitta Mitta.

4. The present gold field consists of the country extending from Mount Livingstone down the river of that name to its junction with the Mitta Mitta, an area of sixteen miles in length, and from two to three miles in breadth.

5. The Livingstone river has, on its west bank, steep timbered ranges, which, in some places, descend to the water, and in others recede to the westward, thereby leaving several flats, which I should suppose to be auriferous. On the east bank, several tiers of lightly timbered quartz ranges divide the river from the open country about Lake Omeo.

6. These quartz ranges, but more especially those immediately abutting on the banks of the river, have yielded gold in more or less quantities to the miners prospecting there.

7. * * * Part of the miners are satisfied with working in the dry creeks, of which there are a considerable number, both from the east and west, and all of which may be considered to be more or less auriferous.

8. About seven miles from the present gold workings, and five miles from the junction, the river flows through a swamp a mile and a half in length and a quarter of a mile broad, which by the miners is supposed to be the spot where the largest quantity of gold is deposited.

made its appearance near its junction with the Snowy River; and that it also occurs in the vicinity of the junction with that river, and the Gungarlin and Eucumbene rivers, on the Snowy Ranges.

A specimen of gold dust from near Quedong has been placed in my hands to-day. As it is my intention to examine the county of Wellesley, and to explore the waters falling from the coast range towards Cape Howe, I shall shortly be enabled to report more satisfactorily on the con-

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9. This swamp has been tried in different spots by a party of Californian miners, who, although they were unable to bottom their claims on account of the water, yet found sufficient indications of the presence of the precious metal to induce them to determine upon remaining during the winter, and to resume operations during the spring, when the water will not be so abundant, and when they hope to be enabled to procure the necessary implements to construct pumps.

12. They further informed me that the above-mentioned swamp closely resembled the one at Reid's Creek, and were universally in favour of the opinion that prevailed, that were a sufficient number of miners concentrated on this gold-field, to give it a fair trial, it would become one of the most important, or, in their own words, "the largest and best paying." This is the opinion of every one I saw, both amongst the miners and the persons employed on the different stations in the vicinity, and in which I cannot but concur, as far as a careful inspection of the general appearance of the country can warrant me in doing.

13. The river, on leaving the swamp, continues its course for four or five miles in a northerly direction, until it empties itself into the Mitta Mitta; thereby giving an extent of auriferous country 16 miles in length, and averaging from two to three miles in breadth, as already stated.

14. I have thought it advisable to define the limits of the gold-field in the foregoing manner, although I cannot but think it highly probable that the country to the south of Mount Livingstone, and also the Mitta Mitta river, having received the waters of the Livingstone, are equally auriferous.

15. The miners appear to be all well satisfied with the result of their labour, and I should consider that the earnings of a hard-working man on this gold-field would vary from 25s. to 35s. daily.

This average, perhaps considerably larger than on any other gold-field, has I think every probability of being correct, as it is manifest that no body of men would remain working in one place during three or four months, exposed not only to the various casualties of a miner's life, but also to the heavy expenses incurred by being compelled to send occasionally two or three men with packhorses to fetch provisions from a place 150 miles distant, unless they considered themselves sufficiently remunerated.

16. The main difficulty at present experienced by the miners is that of providing themselves with rations. Animal food they can get at the different stations, but they must obtain the other articles of daily consumption, viz., flour, tea, sugar, &c., by sending into the Maneero country, or to Port Albert, the latter place being preferred.

17. Water they have in abundance in the Livingstone river, which is a running stream throughout the year.

dition of the formations on that side of the basaltic region. I am the more anxious to make this extensive investigation, because, I understand that rumours exist which have little foundation, and these may attract persons into this part of the country who may be disappointed at the general character of the gold distributed over it.

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18. I have further the honour to state that difficulty of access to this gold-field will undoubtedly deter it from becoming so important as it is possible it would become, were it placed in a more favorable position.

20. The road from Maneero is practicable in the summer, but hardly so in winter months.

21. The overland road from Melbourne is also bad during the winter, but it is undergoing some improvements.

22. The road from Beechworth by the way of the Mitta Mitta is practicable for horsemen, but not for drays.

I have the honour to be, Sir,
Your most obedient Servant,
C. SHUTER, Com. for the Gold Fields.

To the Chief Commissioner of the Gold Fields, Melbourne.

Extract from Melbourne Argus, November 15th, 1858.

"It was long since stated by the Rev. W. B. Clarke of New South Wales, that in a geological point of view he considered the Lake Omeo district as the great centre of all the Australian gold-fields, and that in or near to this richer fields would yet be found than any then known. The rivers and creeks running through the Ovens district to the Murray, all rise to the north-west of the Snowy Mountains on that side of the lake, which is curiously situated in a great basin with mountains all round it, and as no heavy gold or very rich spots were found in that district, not even near the Mitta Mitta, which flows from the immediate vicinity itself, Mr. Clarke's prediction has been set down as untrue. The discovery of the Indigo lead, so different in its character from any heretofore known in the Ovens district, may yet lead to the discovery on that side of the Alps of deep sinkings equal to those at Ballaarat; and there is now good reason to expect that during the present summer more than one rich field will be opened up, near the streams that flow to the sea from the mountains to the south-eastward of the lake. It has been known for some time past that small parties of men were getting gold in different parts of Gipps Land, but where no one much cared to inquire. That part of Victoria being quite cut off from direct communication with any of the populous gold-fields, none of the rumours got abroad from which rushes usually originate. Now, however, gold is regularly sent up from there every week, and the number of men at work, at the places where they are working, has been pretty well ascertained. There are but a few parties engaged in the search, and they are scattered over a great extent of country, finding gold near Prospect Creek, a tributary to the Mitchell, joining the latter about ten miles from Lake King; on the Wentworth, another tributary of the same river, and joining it about twenty miles higher up, and on the Zambo and Snowy Rivers. A sample of gold

[The association of basalt, and granite, and slates with gold is a fact better understood than it was in 1852. In Victoria, the deep sinkings of Ballaarat,* for instance, pass through two and three basaltic flows before the drift is attained: and on the Uralla, in New England, and elsewhere in New South Wales, basalt covers the drift which

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from the first named creek, sent to town the week before last, consisted entirely of nuggets of very great fineness as to quality, and some of them of a good size. Gold has also been found in several places in Gipps Land, apart from the rivers named, and now that this gold is constantly to be seen in the hands of the respectable buyers, who have nothing to gain by misdirecting applicants for information, and it is pretty well known to have been obtained in a short time by a small number of men, many of the miners who have been unsettled by the rush to Port Curtis, will doubtless find their way to Gipps Land, and assist in opening up the rich fields, which, from present indications, we are justified in believing to exist on the south-eastern spurs of the Snowy Mountains. Thus, in both directions from Lake Omeo, there is a probability of much being done this summer to prove to a certain extent the truth of Mr. Clarke's prediction."

* The following sections in the Ballaarat field may not be uninstructive (See 2nd Ann. Rep. Board of Science, p. 9—11.):—

1. *Shaft on Inkermann Lead, Ballaarat.*

	ft.
Surface soil	4
Basalt	85
Clay	4
Drift	4
Clay	36
Slate	76
Auriferous drift	6
	215

2. *White Horse Lead.*

	ft.
Surface soil, &c.	12
Basalt	55
Clay	38
Basalt	80
Clay	47
Basalt	45
Black and yellow clays	36
Auriferous drift	12
	325

3. *Cobblers' Lead.*

	ft.
Surface soil	3
Basalt	63
Decomposed ditto	9
Basalt	70
Yellow clay	6
Basalt	77
Hard-burnt sand, tough yellow clay, and drift	28
Basalt	38
Loose dark drift	10
Auriferous drift	5
	309

4. *Section at Buninyong.*

	ft.
Dark loam	4
Basalt	149
Coarse drift sand	2
Hard grey cemented sand	12
White gravel, with quartz boulders	6
Basalt	51
	224

The shaft was carried down to 300 ft., whence a drift was carried to the lead of gold.]

rests on granite. The sinkings there through basalt are in many cases 100 feet deep. It is not, therefore, improbable, that as basalt and granite occur in abundance on Bobundara Creek, the gold there may be derived from underlying drift. There is an interesting example of such cases on Stony Creek, in the Castlemaine District, Victoria. The water falls 52 feet over and through basalt, and then continues its course in the Silurian slates. It so happens that the channel lies over the ancient auriferous deposit, and, therefore, the gold is got by tunnelling under the basalt. There may be just such instances in Maneero.]

REPORT No. IX.

ON THE SOURCES OF THE UMARALLA, KYBEAN, BROGO, BEMBOKA, M'LAUGHLAN RIVERS, AND OF CAMBALONG AND BROGOLONG CREEKS; AND ON GOLD LOCALITIES THEREON.

Camp at Buckalong,
29th Januavy, 1852.

I do myself the honour of reporting to you, for the information of His Excellency the Governor-General, the following particulars relating to my geological survey of that portion of the county of Wellesley which is marked by the separation of waters flowing northwards to the basin of the Murrumbidgee; south-westward to the basin of the Snowy River; and eastward to the coast. There are so many interesting considerations connected with the divergence, in such various directions, of so many channels of drainage, from a very limited area, that it appeared to me next in importance to the locality distinguished by the source of the Murrumbidgee itself. I have therefore made it my business to examine very carefully, with respect to all the objects of my survey, this south-eastern extremity of the ranges and plateaux separating the basins of the Murrumbidgee and the Snowy Rivers, and forming the distinguishing feature in the orography of the district of Maneero. A glance at the chart will be sufficient to show, that not only does it thus separate the two river basins referred to, but that it also unites the "Great Coast Range" on the east, which separates the eastern and western waters,—and the Snowy Ranges north of the Muniong which separate the Murrumbidgee from its great affluents—the Tumut, Coodradigbee, &c.

I encamped for some time on the base of the Coocoocmanulla Range, and explored in succession the heads of Rock Flat Creek, Granny's Flat Creek, Groggan's Creek, the heads of Winifred Creek, and other sources of the Umaralla River; all the heads of the Kybean River; the sources of the Brogo and Bemboka Rivers, the heads and a considerable portion of the M'Loughlan River, including some creeks not noticed on the charts; and, moving my camp to the base of Galmerang or Mount Cooper, included in my explorations the various creeks and gullies in the area, bounded by Native Dog Creek, the M'Loughlan, and a line running from Geenung to this place.—The actual area explored is, probably, about 250 square miles in extent.

(1.) The geological structure of this area, may be briefly described as made up of various granitic rocks irregularly interpolating and disturbing quartz-bearing slates of different colours and degrees of hardness, of which the normal strike is along the meridian, and of which the edges and lower ranges are partly overflowed by trappean eruptions, which, under the characters of amygdaloid, phonolite, greenstone, and of augitic, and pyroxenic basalt, have contributed to produce the solid materials of the transverse N.W. and S.E. plateaux and ranges, beforementioned as separating the basins of the Murrumbidgee and Snowy Rivers.

(2.) The elevations above the sea of various points in the above-named area; calculated without reference to corresponding observations undertaken by my friend Captain P. P. King, R. N., (to whom I refer my own data, for the purpose of greater exactness, and final determination), are given in the following table, which till the corresponding observations have been discussed, must be considered only as approximately true.

	FEET ABOVE SEA.
1. Malady's Peak	3880
2. Rock at the Spring Rock Flat Creek	2736
3. Groggan's Creek junction with Granny's Flat Creek ..	2678
4. Nimitabel	3465
5. Head of Winifred Creek	3709
6. Wynford Hill	3436

		FEET ABOVE SEA.
7.	Kythera	3088
8.	Gap Range, between Kythera and the Kybean	3285
9.	Kybean, half a mile above the junction of the eastern branch	3404
10.	Head of Kybean, west branch	3769
11.	Dividing Range, head of eastern branch	4010
12.	Spring under Copper Mountain	3585
13.	Coocoocmanulla (Camp)	3408
14.	Coocoocmanulla Range	3750
15.	Head of Brogo	3432
16.	Head of Bemboka	3383
17.	Bald Hill above the Brogo	3680
18.	Head of Umaralla	3363
19.	Division between the Umaralla and the M'Loughlan Rivers	3571
20.	Main Head of the M'Loughlan	3380
21.	Head of Deep Creek	3674
22.	Hill of columnar basalt, above Glen Bog station	4000
23.	Between Cow Bed Creek and Deep Creek	3518
24.	Junction of Deep Creek and the M'Loughlan	2983
25.	Jutaba Station	3033
26.	Head of Jutaba Creek	3296
27.	Junction of Garland's Gully and the M'Loughlan, nearly opposite Boco Rock	2592
28.	Bungee Peak	3089
29.	Ranges between Bungee and Galmerang	3225
30.	Galmerang or Mount Cooper	3102
31.	Jincabillee	2715
32.	Buckalong Hill	2583

I have not included in this table many elevations which I have calculated, because the above are sufficient to give a general idea of the surface of this region, and of the manner in which I have conducted my survey, and because there would be difficulty in ascertaining by the charts the exact localities omitted. Further discussion of the data upon which the above results are founded, will not, I think, materially disarrange the relative differences of level, however it may slightly alter the approximate values assigned to the respective elevations.

(3.) In a region of such general height above the sea, and within a short distance of the coast, between which and the edge of this region are deep gullies and defiles open to the ocean and separated by extremely narrow walls of rock, it is not surprising that a very remarkable climate should prevail in the highland country. An examination of the meteorological tables, which I have kept, will show, that there is perhaps in all New South Wales, no locality subject to such extraordinary variations of atmospheric conditions, as the country at the heads of the rivers forming the subject of this Report, and from information collected by me from such residents as have lived in it for any considerable period, the deductions from my personal observations have been fully confirmed.

Within less than ten minutes of longitude to the south-westward, the climate is varied by paroxysms of extreme dryness and cold, arising from exposure to the west and north-west gales, hot and cold; but here, where also one station, (Coowunjewaa) derives its name "Greenland" from the snows of its winter;* the summer is distinguished by dense fogs, and extreme dampness—the daily product of the sea breeze which sends clouds of wet mist up the ravines of the Brogo and Bemboka, and other deep indentations of the coast ranges, covering the country with darkness, at times, that hinders all out-door occupations, and producing a phenomenon which, if there were an escarpement to the west instead of a dry lofty region, would, no doubt, realise the recurrence of a cloudy canopy, such as that, which, at Cape Town, forms the so-called "Table Cloth." For, in both instances, the clouds are formed by a warm moist sea wind from the S.E. blowing up a slope towards a loftier level. In the present instance, I have been enabled to discover, that though the sea breeze finds its way nearly as far west, on some occasions, as the snows of the Muniong, it does not generally attain a thickness above the sea of more than 5000 feet. It is the mere westward portion of a stratum of air revolving vertically, under fixed atmospheric laws, which returns to the eastward during the night, under the influence of the dry west wind—the under surface of which, heated by day, quickly evaporates the moisture brought from the ocean, leaving a clear midnight and dawn, or producing by the interchange and conflict of electrical conditions, very fearful thunderstorms, of which I had, on several occasions, personal experience. I was overtaken by similar clouds on the summit of Jillamatong near Braidwood, in October; on the top of Blue Peak near the Umaralla, in January; and on the ranges south of Omeo, in December.

(4.) I have not been able to resist this apparent digres-

* Snow fell at Kybean, on Sunday morning, 4th January, 1852, and was a foot deep! At Cooma, at 8·30, A.M., the temperature was 48°. Snow also fell at Jejedzeric, on the night of 8th Dec., 1851; and in consequence of that fall, the Muniong became again covered. See Chap. XII.

sion, because, as you will at once perceive, these meteorological phenomena are the result of the interference of the *geological* conditions of the country, and therefore, quite within the scope of my inquiry and discussion. I will venture to mention another example, in the country which I have been surveying, of the manner in which geological conditions produce meteorological accidents. In Naas Valley, west of the Murrumbidgee the wind is always north or south. During several years in which a Meteorological Journal was kept, at my desire and charge, there is no entry of any wind but either from due north or due south. The head of the valley I found to have an elevation above the sea of upwards of 3000 feet; its direction is south and north; any wind, therefore, from a quarter approaching south, which is generally strong, flows down the valley; and any wind from quarters approaching north, if sufficiently powerful to counteract the slope and gravity of the pre-occupying air, will flow up and become a north wind. East and west winds are excluded by the mountain walls that form the sides of the valley. Now these walls run south and north, in obedience to the geological strike of the schistose granite, of which the country is formed, the valley being a trough between the long parallel meridional joints producing the schistose character of the rock. (See Chapter V.)

(5.) The mineralogical productions of the great trappean eruptions, either at points locally distinguished, or at points of contact with the older formations, appear to be worthy of notice. Very fine examples of columnar basalt occur, not only on Coroo (the most northerly of the Three Brothers), but in the neighbourhood of the Great Coast Range, and in various parts of the *coulée*. In the amygdaloid I found chabasie in beautiful crystals; ice-spar; calcareous spar, and other *hydrous* minerals common in the trap of the Liverpool Ranges, and in foreign examples of the same formation, offering an additional proof of the truth of the doctrine—that amygdaloids of decidedly igneous origin can only be filled with nests of hydrous minerals by the percolation of liquid mineral matters into the hollow cavities of the rock after its cooling and consolidation, and by subsequent chemical and galvanic segregation and disposition of the so-conveyed mineral particles. Amongst other minerals of a siliceous character, such as agates and chalcedony, the surfaces of which have that peculiar appearance which I recognized on quartz at the contact of trap with the bands of that rock in slate (near Jejedzeric), and which is such as would be produced by the action of fluoric acid (which is a well known constituent of some kinds of trap) upon silica, I have found a very interesting specimen of precious opal. There are also traces of copper * to be met with, and along the M'Loughlan River and its tributary creeks I think a mineralogist, with ample leisure and means, would be able to make a plentiful collection. My own time has been, of course, occupied by more important considerations.

In one of the gullies to which I allude, and which enters the M'Loughlan, opposite to a point about midway between Boco Rock and Wog-wog, I came upon some decided evidences of mineral veins, in vein stuff formed of well crystallized phosphate of lime and brown spar, not unlike specimens collected by me in 1820 and 1821, in the lead districts of English Cumberland, and especially near Derwent-water. The complicated manner in which the trap and its detritus enfold and overflow the insulated outcrops of the fragmentary slates and quartz dykes that traverse the slates, and the enormous length and thickness of the grasses that now cover the whole country. (which presents the appearance of one huge field of ripening grain,) did not offer much encouragement to me, with the thermometer at 93° F. in the shade, to follow out the indications. But they are sufficiently strong to justify me in pointing out the valley of the M'Loughlan as a locality likely to lead to some interesting discoveries at a future time. I am convinced that both lead and copper will, some day, be found along the course of this river, which has features of a very prominent kind, although the usual volume of its waters is insignificant, in comparison with the aspect of the rocks and ranges between which it flows.

(6.) As in the other rivers, so in the M'Loughlan, I prospected for gold. I was at the time unsuccessful. [Gold was afterwards found on the M'Loughlan.] But I am able to report that small quantities were procured from Punch

* Copper is found occasionally in the detritus on the surface of a summit (and of its slopes) on the eastern edge of the Coast Dividing Range, not far from the source of the Dulundundu River—hence its name "Copper Mountain."

Bowl Creek, near its head. This creek is one of the branches of Winifred Creek.

The gold was very fine, and evidently of granitic origin. It occurred in a *green mud** of the very character of that which in Major's Creek, Araluen, is so abundant and full of gold. A person in the neighbourhood, named Reed, who guided me to the spot, had found it there at a depth of six feet from the surface. The hole he had dug was then full of water. The spot I searched was at the outbreak of springs at the head of the rocky portion of the creek, which I crossed, on another occasion, eight miles lower.

On the Kybean River, above the junction of the branches, a small sample of gold was procured; and on the Umaralla River, on the upper branches, similar success was met with.

At Coocoocmanulla the granite is highly hornblendic and passes into a syenite. My impression is that gold exists in that neighbourhood, although I did not discover it; and probably the gullies falling into the Bemboka will produce a little. I found indications of it. [Close to my camp at Coocoocmanulla, there was a locality in which the bases of the tilted beds of slate and quartz alone remained. It exhibited a most singular appearance. It was as if the mass had been carried away bodily.]

I am convinced that the horizon of these rocks is too elevated and the surface of the country too broken to allow of wide-spread deposits. The surface of such a region in this country has not been exposed to the long continued forces necessary for wide and deep accumulations; for although everything confirms the belief that water has sojourned upon it, even in comparatively recent geological times, yet it has been probably either too violent or too quiescent to produce results such as are exhibited in the channels where the dynamical forces have been continually at work. One of the conclusions to which I am led by my extensive search for gold in the higher lands is, that at an elevation at or above 3000 feet it is useless to expect gold in any abundance even from the rocks known to produce it, except in hollows or pockets amidst the steeps. Gold deposits are, therefore, in such regions, patchy.) Not in original

See page 10.

* I suggest, that it is not unlikely the colour may be due to hornblende, or may be, if auriferous, occasioned by some combination of potash (derived from the felspar of the granite) and gold.

The present prolific localities are, I believe, below or not much above, if at all above 2,000 feet from the surface of the sea. Here, then, on the eastern side of the elevated land of the Colony, we have again almost demonstrated that very high mountains are not a *sine quâ non* for the occurrence of Gold. [The elevation of the great Victorian Gold-fields confirms this opinion. The highest point at Ballaarat is under 1,600 feet; and the main level of the Bendigo Creek is about 700 feet; Castlemaine itself is just 910 feet.]

The fact, that in the valley of the Brogo, where greater indications exist than elsewhere in this region, not much Gold has been found at present, will not on the other hand do away with the idea, that some of these rocks are auriferous, and that, therefore, the conclusion above named is not satisfactory; for I am persuaded that Gold does exist somewhere along the course of that wild and precipitous channel. It is in this river that a locality commonly known as "Robinson's Hole"—I presume the word is used in the Teutonic sense for a deep place, (*höhle* of the Germans,)—is situated. All such places are in Maneero called "Holes."

The rocks are principally slate, but granite occurs on each side of the river for a considerable distance. As this spot may hereafter come into notice, I introduce here some bearings by which its locality may be fixed. The abrupt and lofty walls by which it is enclosed, render it impossible to fix its position from below; standing, then, on what is called the "Bare Hill" or "Bald Hill," on the edge of the escarpment of the Coast Range surrounding the expanding valley of the Brogo, the part of the river known as "Robinson's Hole," bears 36° E. of north (mag.)

From the "Bare Hill" the bearings were on the Hump of the Dromedary, about 34 miles or so, N. 55° (mag.). Bemboka Peak, N. 115° (mag.) Murrumbidgee Range, N. 320° (mag.).

Should this place ever become prolific, it will be a difficult matter for ordinary gold-diggers to profit by it; it is impossible to conceive a more wild and dangerous pass. The slate rocks, which present the appearance of insulated cleft masses, or narrow nearly vertical buttresses (frequently knife-edged), however accessible to venturous and hardy climbers, will scarcely furnish, without engineering, a safe or easy road to persons bringing provisions for a more than limited stay, and I am convinced that numerous accidents would mark the occupancy of the diggings. Nor from what I have seen of the Brogo, do I believe, that a practicable road can exist direct, between this place and Twofold Bay. It may be a fortunate thing that nature has guarded so thoroughly this alleged auriferous spot. That gold does exist there I have had evidence; but, even if I thought very favourably of it, I would wish to say little about it. For, although I am not in the habit of shrinking from pedestrian labours of the kind, I could not, with a safe conscience, recommend the public to make a highway in and out of a defile, which is filled almost daily by dense vapours and clouds from the sea, and which alone occasion danger.

REPORT No. X.

ON THE METALLIFEROUS ROCKS OF MERINOO, &c.

Brogalong Creek,
6th February, 1852.

In my last Report I alluded to the probable metalliferous wealth of the country in the neighbourhood of the M'Laughlan River, and, in a former communication, I think, to the existence of gold at Quedong, which is not far from the junction of that river with the Snowy River, though upon the Deleget River.

I have now the honour of stating, that although I have been unable to make further enquiries into the mineral character of the rocks below that part of the M'Loughlan to which I referred, I have examined a portion of country, included under the term Quedong, along Slaughter House Creek, and about the junction of that Creek with the Deleget River; and I find my expectation confirmed.

Between that Creek and Cambalong Creek, the country is occupied by slates, traversed by quartz and trap belonging to the overflow to the northward, with occasional patches of granite; between Cambalong and the Deleget the formation is of slate, which, at Merinoo, exhibits a broad band of limestone, full of fossils, which leave no doubt of the age of the formation. I have traced similar limestone bands in the slates in various other parts of this district, and there, as here, the slates in proximity with the limestone are also charged with fossils. No question can exist that the limestone and slate are portions of one formation; for I found at the junction of these rocks, on one side of the band, no less than twenty-four alternations of fossiliferous limestone and schist, within a breadth of seven feet. The limestone, which has a strike nearly north and south, has been broken through by the agency which produced the direction of the river, aud thus there are two opposite faces of limestone, the northern one presenting a cliff 70 feet in height.

As the structure of the limestone is concretionary, the main mass slopes down on each side of the cliff, so that water, in rainy weather, finds a course along its surface. In these channels there exist smooth hollows, worn out by water, and along the face of the rock, furrows; both similar to features common to limestones of the Silurian epoch, in other parts of this colony. Into these hollows has been washed the superficial detritus of the hills, and in this detritus so collected gold occurs. As the extent of the limestone country is considerable, and its aspect such as to lead to the belief that it is metalliferous, being bare of grass, and extremely ferruginous in hue, occasioned by the presence of cupriferous ironstone, I think it not improbable, that more than an insignificant quantity of gold may be discovered hereafter.

But the value of this locality appears to me to rest upon other considerations.

Exactly where the largest auriferous hollow occurs, veins of copper and lead several feet in width make their appearance in the limestone, and pass through to the face of the cliff in a S. E. direction. The vein stuff is chiefly barytes, and the ores are chiefly fibrous and earthly green carbonate and yellow and iridescent sulphurets of copper, with interspersed crystallized sulphuret of lead. The latter stands out of the face of the limestone in some places, in independent patches.

As copper and lead exist in various parts of this tract of country, it is extremely probable that a mining field may be here profitably worked. At present, I am only able to report upon the existence of these ores, of which, I forward samples by the Bombalo Mail, of the 7th instant.

What renders this locality interesting and full of promise, is the fact that, in addition to the four metals, gold, iron, lead and copper, existing in so narrow a compass, there is also abundance of excellent limestone to serve as a flux in case of its requirement, and abundance of water in the everflowing Deleget River, together with wood upon the ranges at no considerable distance. The elevation of the metalliferous locality is 2,056 feet (approx.) above the sea.

One would willingly hope that so striking an assemblage of necessary and useful appliances may be found hereafter of more importance to the commercial, than so bare a tract appears to be to the pastoral interests of the community.

REPORT No. XI.

ON GOLD LOCALITIES ON MAHARATTA CREEK, BENDOC RIVER, &c.

Maharatta Creek,
26th February, 1852.

It was my intention to lay before you some particulars of my exploration of a very interesting geological region lying between the Deleget River and the sea coast; but I am compelled by unavoidable duties to defer this statement till next week.

I do myself the honor, however, of stating, that I have detected the existence of gold, not only in this Creek, both above and below Calkin, but also at Boroungoma, on the Bendoc River; and that I observed indications of its presence in the banks of the upper sources of the Jenoa River, in the county of Auckland, between Bondi and Nungutta, and above the waterfall of Diliganea. The gold on the Bendoc River is distributed in an alluvium of slate and quartz, overlying the highly inclined edges of schistose rocks, and covered by a more recent fluviatile drift of sand. Its color is bright, and though the particles are extremely fine, it occurs in some abundance in particular patches of the alluvium.

It has been found in different portions of the river banks for several miles, between the westerly bend and the boundary of the colony. My impression is, that the source is beyond "Deleget Hill," a mountain which attains an elevation of more than 4,000 feet above the sea, and is the most conspicuous object in this part of the colony.

Several persons, since I came into the neighbourhood, have obtained gold along the Bendoc River; and two or three are candidates for a reward offered by the inhabitants of Bombalo, who have partly referred the decision to me.

On my return from the coast, whither I propose going on the 1st March, I hope to return to the Bendoc and Deleget, to inquire into the circumstances under which the gold occurs higher up those streams.

At present but little is known of those rivers towards their sources, as, I believe, they have not been surveyed much beyond Deleget Hill. The Boundary of the Colony intersects the auriferous tract; and it will be fortunate if the abundance of Victoria be shared with the neighbouring Territory. I enclose a small sample of the gold from the Bendoc River.

CHAPTER IX.

ON THE GEOLOGY OF THE SOUTH EASTERN PART OF THE COUNTY OF WELLESLEY, WITH REMARKS ON MANEERO GENERALLY, IN RELATION TO AURIFEROUS ROCKS, AND ON THE COUNTRY BETWEEN IT AND THE COAST.

REPORT No. XI.

PART I.

Eden, Twofold Bay,
6th March, 1852.

I have now the honor of fulfilling the intention to which I alluded in my last communication, by reporting to you, for the information of His Excellency the Governor-General, some account of the geological features of the country between the meridian of my last stations and the coast.

Sufficient data may, I think, be collected from my previous Reports to show that the principal formations in Maneero are granites, quartziferous Silurian schists, trap, and an overlying deposit of conglomerate, grit, and sandstone, which for the present I must consider of doubtful age.

The granites are partly older and partly younger than the slates, which repose upon the former, and have been partially disturbed by their elevation, and also intruded into by the latter. The trap formation consists of basalt, greenstone, phonolite, and amygdaloids of various kinds, which are not, I conceive, of altogether one period of eruption, but which have risen through the older granites and the slates, and overflowed them, producing very well pronounced changes at the points of eruption, sometimes connected with metalliferous veins. Various instances occur of *vertical* columnar basalt, especially along the Cambalong Creek; and in many places the amygdaloids are covered by basalt, which from the character of the joints and its general structure looks like a stratified rock, being divided by cross joints, which separate it into masses convenient for building purposes, and to which it has been applied, as at Jutaba. The appearance of stratification is the result of the overflow.

In general, I have found the amygdaloids the lowest of the trappean rocks; but in one instance mentioned in a previous Report, at Bobundara, I found a rock of that class emerging from beneath the schistose formation, transmuting the latter, and accompanied by the presence of Gold. [Undoubtedly, Gold might be deposited in the amygdaloid by the same agencies that produced the other minerals in the cavities of the rock.]

The trappean region appears to me precisely similar in physical features, to that between the Grampians and the Lammermuir Hills in Scotland. Each occupies a trough between granitic mountains, which it has filled up, sending its streams of *subaqueous* lava to considerable distances on each side of the general line of the axis of eruption.

In Maneero this axis has a N. W. and S. E. direction, and ranges from the head of the Towamba River in the county of Auckland, towards the principal head of the Murrumbidgee, at the northern extremity of the Snowy Mountains or Australian Alps. [It is in some respects similar to the occurrence of the Liverpool Range in N.S.W. and of the transverse part of the Dividing Ranges in Tasmania.]

Connected with this general trend of the trappean formation, which has produced the plateau or "plains," as bare tracts occupied by basalt, &c., are improperly locally designated, are various outlying hills and ranges insulating patches of the schistose rocks, or piercing and transmuting the larger masses of the system. But the disposition of these local exhibitions of igneous agency, their texture, structure, and composition, prove them to have a common relation with each other, and with the great development which has occasioned the remarkable connection between the Snowy Ranges to the west, and the Coast Ranges to the east, and the no less remarkable anticlinal division between the waters flowing, on the northern side, to the Murrumbidgee, and on the southern to the Snowy River.

It is to the trappean outburst which is, undoubtedly, of some antiquity, that the broken and disturbed condition of the present surface of the counties of Beresford, Wallace, and Wellesley is, in considerable measure, due; it has directed the principal drainage of the country in two opposite courses, and has produced innumerable physical disarrangements.

Yet, notwithstanding these powerful interferences with a previously existing order and geological disposition, it is remarkable how persistently many of the creeks follow, in portions of their channels, the natural lines marked out for them by disintegration of the softer materials of the schistose rocks along the generally meridional strike of the system to which they belong. So marked is this fact, that I think a person skilled in observation might predicate without many failures, the character of the formation from the trend of the drainage channels, or *vice versâ*, the general trend of the drainage from the knowledge of the formation. This statement, however, is subject to deduction at localities where the schistose rocks are in contact with granites or trap.

The older granites are generally very quartziferous; but I would guard myself from any supposition that by the term "older" I mean more than a relative antiquity compared with the probable age of what I term "younger" granites, which are mostly hornblendic and in alliance with members of the trappean formation. I do not wish it to be inferred that I speak of any of those granites, as such rocks are frequently denominated, as "*primary*" or "*primitive*;" for though I have seen granites in various other countries, as well as in many other parts of Australia, I confess I have never seen any granite which has a right to be considered primary, nor do I believe that any geologist has ever seen upon the surface of the globe any mass of granite, which, carefully examined in relation to what is accurately known of chemical and mineralogical combinations, and of the associations with other formations which generally obtain, can be pronounced "primary" or "primitive," according to the ordinary or geological acceptation of these terms.

By the "older" quartziferous granites of the region in view, I mean those granites in which quartz enters in the largest proportion into the constituent particles of composition, in which there is but little or no hornblende, and which do not pass by insensible gradations, or without visible interferences with trappean rocks, into rocks of porphyritic structure and composition. [It may be, perhaps, true, that in some cases the porphyritic rocks are merely transmuted schists.]

By the "younger" granites, I mean those in which felspar and hornblende or other extraneous minerals, modify by their abundance the true granitic type.

The bearing of the above observations will be seen in my subsequent remarks. In order to apply them it will be necessary to bear in mind, that the elevated region of Maneero is bounded by two nearly parallel chains, the Snowy and Coast Mountains, in which many of the most elevated portions are composed of granite, and that this now elevated region, as before mentioned, is actually a trough occupied by members of the schistose formation, which has been denuded, pierced, and overflowed by trap.

The extension of granites under the whole is more than a matter of mere conjecture, the rocks of that class breaking out through the schistose rocks at various points, and along the Snowy River, occupying a very extensive area almost to the exclusion of all other rocks.

The now elevated plateau of Maneero is, therefore, to be considered as bounded by two walls of granite, which, as proved by numerous pinnacles, bosses, and solitary masses, which mark the course of the formation on each limit of the region, were formerly higher, and these walls bear indubitable marks of elevation from a lower horizon to that which their summits at present occupy.

On either hand to the westward of the Alps, and to the eastward along the Coast Range, (both properly Dividing

Ranges), the broken, pierced, and disturbed regions on the flanks of the granite mountains, gradually decline in height towards the level of the interior, and steeply to that of the ocean.

At the base of the granite, which composes the older portions of these chains, there issue various members of the trappean family, and, in combination with the diagonal ridge of trap before described, transmute and derange the granite, and slates in junction with it. It is to this that I attribute, in part, the porphyritic rocks, mentioned in former Reports, as occurring along the basin of the Shoalhaven; and on the Murrumbidgee between Micaligo and the Berudba River, and to other similar rocks which I have recently examined, along the upper channel of the Towamba River, in the County of Auckland, which from their position and structure can only be so explained.

With the above explanations of the general features of the country, you will be enabled to comprehend more distinctly what I am about to state, respecting that particular portion of it, to which this Report has more immediate reference.

On inspecting Mr. T. S. Townsend's admirable map of the Maneero District, with a tracing of which I was favoured in compliance with my request, [and which is nearly the same as that now appended to this Volume with my own additions,] you will perceive that there is a point on the Snowy River, whither converge the following drainages, viz.:—Matong Creek, the waters of the Snowy River from the north, the Meringi or M'Loughlan's River, the waters of Cambalong Creek, Brogalong Creek, the waters of the Bombalo River, Maharatta Creek, Aston Creek, the Bendoc or Little Plain Rivers,* and the Deleget River.

All these waters flow into the Snowy River, at a part of its course marked by most striking phenomena of geological disturbance, the convergence indicating a point of depression, just as the radiation of rivers from the head of Moamba River marks a point of elevation.

The area to which this Report has especial reference is bounded by the meridian of that point of depression to

* There are two rivers forming this so-called "River;" one, I think, has not yet been traced by the Surveyors; it comes from the Dividing Range.

the west; and on the east by the Dividing Range between these converging waters and the coast.

The northern part of this area, along the M'Loughlan, Cow Bed Creek, Native Dog Creek, Undowah Creek, &c., is occupied by the overflowing trappean rocks, which extend along the Cambalong, Brogalong, Bombala, and Coolumbooka waters for a considerable distance, and also along Maharatta Creek, piercing the Silurian rocks and altering the beds of stratified conglomerate grit and sandstone, to which, at the commencement of this Report, I have casually alluded. [I have coloured geologically about 2700 miles of Maneero, but it is quite impossible to publish that map on this occasion.]

The schistnse beds occupy in this area, by far a larger region than in any other part of Maneero.

All the members of the formation are therein well developed. These consist of (1°) grey, bluish, and yellowish slates, having cleavage coincident in strike with the meridian, where the strata range in that direction (for the schistose formation undulates in its bearing within limits of from 20° to 30° east or west of north), and becoming puckered, crushed, and broken, where the strike diverges from the meridian, exhibiting signs of deranged orbicular concretionary structure, to which, after well weighing the matter in my mind, I am inclined to refer the cleavage of these beds. (2°) Of grey, or brownish white, soft or hard, felspathic beds of schist, which pass into a true grit or sandstone, and become occasionally very quartzose, bands of quartz and transversely fibrous veins of quartz traversing them. (3°) Of bands of limestone or marble, characterised by organic remains of genera and species well known as Silurian, to which epoch I refer them, till I can submit the specimens collected by me to a comparison with ascertained species from Europe and America. [This has been accomplished by my friends Mr. Londsdale and Mr. Salter, and by the aid of Sir R. I. Murchison. They are mentioned in Siluria, 3d ed., p.p. 16 and 296.]

The whole of the beds of this schistose formation have been exposed to the effects of metamorphic agency. Where the slates are most distinctly declared, the cleavage as distinctly marks their trend from south to north, as in other parts of the large region which I have examined during my present exploration; and I think, perhaps, some persons confounding this cleavage with the original laminæ of deposit, have, in cases where there has been nothing else to guide them, too generally referred what is the result of concretionary forces to deposition and mechanical influences. The true bedding lines are often totally obscured over wide spaces of country; and again, the cleavage has been frequently obliterated where it ought to be expected. In Slaughter-house Creek, to which, for example's sake, I refer, the joints of the fossiliferous grits and slate partook the character of bedding lines, and the true beds could only be ascertained by observing the position of the fossils which were lying at highly inclined angles, betokening the elevation to which the beds had been subjected.

In other localities, as at Buckalong or Brogalong Creek (as well as near Reid's Flat on Cooma Creek, the north of the present region), I could only infer the fact of elevation from the succession, in traversing the country transversely to the apparent line of strike, of beds of slate, limestone, quartz, and of porphyry, which occupies there the place of a bed. [I have frequently searched for graptolites in New South Wales. They were first found by Mr. Aplin, of the Geological Survey of Victoria, near Keilor, and since have been met with abundantly at Castlemaine and Bendigo. Mr. Selwyn on the spot assigned to me a reason, why the difficulty of finding them occurred, viz., that the slates are so affected by cleavage, that it is only when the cleavage and bedding-planes coincide, that they can be discovered.]

I have since found Graptolites 1865
in this region. WBClarke

Now, after considering these varying evidences of past changes, I have concluded that the condition of the schistose formation, in the area now under review, is due also to elevation. We have, therefore, in this area, another illustration of the relation of metalliferous deposits to disturbed localities; for I have already reported the existence of lead, copper, iron, and gold about those portions of the McLoughlan and Deleget Rivers, which are within the limits of visible disturbance. And although no great mineral wealth will, probably, be found to distinguish the upper portions of the creeks and rivers enumerated above, yet fact and geological inferences combine to illustrate the meeting of the Deleget and the Snowy Rivers as within a metalliferous district; since I last reported upon which, subsequent research has proved, that Gold exists dispersed in the soil over a considerable tract along both the Deleget and Bendoc Rivers.*

On these rivers granite occurs along the upper part of their courses. It also occurs on Brogalong Creek, and along the Coast Range, from the boundary of the colony to the head of Coolumbooca Creek, whence, as before reported, it ranges northwards between th counties of Dampier and Beresford to the head of the Shoalhaven.

The granite along Brogalong and Maharatta Creeks is bounded by the schistose formation. At the point where the contact is exposed, free from the trappean or conglomerate formations, a very interesting proof is afforded, not only of the elevation of the granite through the schistose rocks to a somewhat higher level than it once had in comparison with the latter, but of the changes produced on each rock at the plane of contact.

The slates are hardened; the granite becomes divided by joints parallel with the strike of the slates, so as to become almost schistose; and at a somewhat different point, but still along the plane of contact, porphyry makes its appearance, and define the limit of the two formations.

On Maharatta Creek a far greater transmutation has occurred. Where the granite crosses that creek, a few miles below Calkin, the contact is marked by similar apparently schistose structure in that rock; and the slate and associated beds become granitified, passing through all conceivable variations of binary or ternary composition, from true soft slate to hard quartziferous granite of the ordinary character. Contortions, resulting from the pressure of the granite, have been, as it were, stereotyped on the hardened now siliceous slates; joints of the same strike pervade the altered and unaltered rocks for some distance on each side, and veins of quartz intrude through both granite and altered schistose beds. I noticed similar changes further up the creek, where the altered beds are traversed all the way up the slope of a hill of some considerable height, above the creek, by veins of granite on each side of which metamorphic action is apparent.

* The descending order seems to be this:—(1.) Detritus of schist and quartz cemented by clay and sand, containing gold. (2.) Clay, like pipe clay. (3.) Boulders and pebbles of quartz, with gold. (4.) Bedrock.

I have before mentioned changes induced in the granite of the same age about Jejedzeric, by the trap which is in association with dykes of pegmatite and compact felspar.

The principal changes produced by the trap in the present region, are in breaking and disturbing the beds of conglomerate, grit, and sandstone, which from the neighbourhood of Bibinluke and Bombalo, to within a few miles of the boundary of the colony, range as a western outwork of the granite along the Coast chain.

In my account of the Upper Shoalhaven I described the occurrence there of a range of "bald hills." (p. 25.) The range I now mention is also "bald," that is, the trees disappear from the summits, and the stony ground, bare of grass, is clothed by a thick covering of *casuarina* scrub, seldom two feet high.

I doubt not that both ranges belong to one formation; their outlines, composition, and position having a very remarkable agreement.

The lower members of this formation are beds of quartz conglomerate, rugged, wild, and barren, standing up in walls which may be traced by the eye for a considerable distance, and passing into grit and sandstone, scarcely differing, except in colour, from many of the carboniferous rocks, and to which they may eventually be referred.

Their general colour is a brownish claret; they are horizontally deposited, and occasionally inclined by subsequent derangements, and are traversed by joints rectangled to the strike, which is chiefly N.E. and S.W., the main strike of the sandstone rocks about Illawarra, Sydney, and the Hawkesbury.

Where the trappean rocks are in contact with these beds they become hardened, and the pebbles of composition become cemented with the finer material in one homogeneous siliceous paste, just as near Merton, on the Hunter, similar changes are induced by greenstone on similar conglomerate.

The sandstones are capable of being used for building purposes, and the grits make excellent grindstones.

Members of this formation I have traced at intervals, and in small outlying patches, always transmuted when overlying trap, or pierced by it, over a wide region. I found it, bearing the same character as respects its texture, structure, and vegetation, north of the head of the Brogo

River, as at Copper Mountain, about the source of the Dulundundu River; and I have come upon it in various obscure localities in the trap country, as between Bibinluke, Brockalong, and Jincabillee; along the McLoughlan River, between Boco and Bungee's Peak (Geenung), below Galmerang (Mount Cooper), and on granite to the north-west, between Jejedzeric and Arapool (Arable of the maps). I found it also in the midst of the granite at the head of the McLoughlan, in the swamp called, very expressively, Glen Bog. [In fact, it may be traced from the head of the Shoalhaven to that of the Jenoa.]

In some places it exhibits marks of erosion and decay, from the action of water, being hollowed into cavities and fluted by narrow channels, exactly as the rocks upon the shores of Port Jackson: and in the valley near Jincabillee, it is, more than I have elsewhere seen, *polished* so as to reflect the light, and rounded from all roughness whatsoever. The only parallel instance* I have observed of this surface, is in the Rock Flat Creek, near the spring, where an island of the schistose formation rises to about 100 feet above the level of the valley, everywhere surrounded by basalt; and the broad band of quartz which stands out farthest to the north is *polished*, as if by constant friction of some smooth and probably *soft* surface. It is not, probably, worthy of present notice, by what hypothesis I may be inclined to account for this phenomenon. The consideration of it would lead me too far away from my immediate purpose; but so striking a circumstance ought not to be altogether passed over unrecorded, especially as hereafter it may assist in casting a light upon the mysterious obscurity which shrouds the early history of this vast Territory. I may, however, profitably point out how these evidences of the destruction of a formation which may once have extended over many thousand square miles of country, agrees with the testimony to wasting and decay which is

* Another, not so distinct, occurs between Aston Creek and the Maharatta Creek. [I found near Bolivia, in New England, a surface of granite at the top of the hills equally *polished*. But that may have been in a different manner. It is, however, an interesting fact, that at Bolivia the *polish* is the result of the constant leaping of *Rock Wallabies* over a block of granite at the mouth of a cavernous place frequented by them. I leave the text of this Report as it stands. The Bolivia example is, perhaps, a new fact for geologists.]

offered by the occurrence of lofty pinnacles and huge concretionary nodules of granite that crest, at intervals, the summit of the Great Dividing Range above the coast, sometimes lifting their spires to the tops of the forest, and sometimes spreading their broken fragments over the slopes which sweep around.

I have seen several of these lofty masses rising to 60 and even 100 feet in height. Careful examination proved to me that they owe their general outlines to the directions of the joints and planes of fissure, that were once continuous through vast areas of rock, of which these are alone the relics, now shaped into rounded forms by the slow but certain processes of nature, and still gradually crumbling into dust by the effects of that decomposition which attends all concretionary structures in decay. The frosts of winter, the snows and rains, and the summer's heat to which they are alternately exposed, are the silent but sufficient chiselling by which nature fashions the solid structures of the globe into those forms of picturesque beauty which often greet the weary geologist in his solitary researches; and it is impossible to contemplate these spectacles of change without a perplexing sentiment as to the little we really know of what has been, or as to what may become of the surface of a planet thus impressed by the visible demonstrations of powers that nothing can resist.

The ages upon ages which may have elapsed since the original surface of the mountains first emerged from the abyss to the light of day, or to be subjected to the attacks of omnipotent elemental powers, cannot be contemplated without a feeling of depression as to the lust of man for those treasures which the mountains produce in their decay; nor is there anything more humbling to one who would inscribe upon the rock of granite the testimony of man to the sovereignty of his dominion than the thought that these monuments of ages are themselves, year by year, adding their disintegrated materials to the sands that are perpetually swept into the ocean, from which the parent rock emerged.

There are several remarkable pinnacles of granite, no less interesting to the artist than to the geologist, in the rugged crests of the mountains east of the source of the M'Loughlan River, which run up parallel with the loftiest trees of the forest, and which, if the latter were levelled, would form prominent land-marks over miles and miles of country.

The formation, from my account of which I have thus digressed, I have considered of "doubtful age." Its composition shows, nevertheless, that it has resulted from the destruction of the schistose formation and perhaps some granite, especially from the dykes of quartz that intersect them both.

It has characters closely allied to some of the conglomerates, grits, and sandstones of the Hawkesbury rocks, as well as of those which are at the base of the similar series of rocks along the Hunter. It ought, therefore, to exhibit some traces of a carboniferous character.

Now, at some spots along the M'Loughlan River there are deposits of a lignite or imperfect coal, which is capable of being employed in the forge; and having examined its substance, and the conditions under which it exists as a deposit, I am led to consider that it may belong to the formation in question. [There are also fragments of fossilized wood lying about on that river; and above Bombalo proper, the grit is charged with casts of vegetable remains, baked into the rock by basalt. I consider these to be of the Miocene epoch.]

In Report No. III. upon the Shoalhaven, I mentioned the existence of beds of sandstone and grit at the base of the limestone of Wianbene, derived in part from porphyry. It is, therefore, not improbable that the same formation may occur in certain localities on each side of the Great Coast Range; though the evidence of actual Coal is doubtful.

Should my opinion be found to rest on sound deductions from the few data we possess (and in the absence of fossils we have nothing more satisfactory than deductions), we shall see that the exploration of these southern counties serves to establish the fact of the once more extensive area of a formation which now occupies a depressed region along the coast to the N.E., and which appears in outliers only further west. It extends our knowledge of the forces that have been at work in all periods of geological history, modifying and renewing the surface of the globe.

In stating above, that there are no fossils by which to determine the probable age of this supposed carboniferous formation I did not include numerous fragments of silicified wood of coniferous trees, which lie in the midst of trappean detritus along Mount Cooper Creek, in the immediate vicinity of altered quartzose conglomerate, because these alone are of no positive value in the determination of the question. These fragments are enveloped in the black trappean earth, exactly as the fossilized trees are in similar earth on "The Holsworthy Downs," not far from Scone on the Page River. The only explanation which I presume to offer of the occurrence of such fragments in such localities, is that the wood in its natural state was washed into lagoons, of which the now black soil was the mud, and that siliceous springs issuing in the lagoons from the trap rocks of the vicinity gradually converted the wood, by processes familiar to those who have studied the nature of such transformations, into stone. To justify this view, I remark, that to this day the base of the trappean rocks in Maneero pours out numerous springs, and as much of the trap is extremely calcareous, tufaceous deposits are frequently met with, producing a recent conglomerate, in which an impure lime cements fragments of quartz and trap.* Such I saw at Jillamatong Creek, under the Northern Brother, and in the vicinity I found wood *only partially* mineralized. The fossilized wood of Mount Cooper Creek is more nearly allied to much of that which is common in the carboniferous beds of Newcastle and Wollongong. The occurrence of fossilized wood in association with igneous rocks is not an unusual circumstance. I have found branches of trees converted into opal in the midst of the trachyte of the Drachenfels at Koenigswinter on the Rhine; true coal occurs entangled in trap on Desolation Island, and I have seen the charcoal and markings of trees in the lava of Madeira. In fact, there is nothing more remarkable in the envelopment of wood, and in its

* [In Rock Flat Creek, there is a remarkable spring of aerated ferruginous water, which bubbles up from below the basaltic rocks, at their junction with the slates. It was once frequented by people who mixed brandy with it, and spent their time in drinking. A great amount of tufa has been deposited by the water. The carbonic acid gas evolved comes up in gushes variable in force and intervals. I found the temperature on 25th Nov., 1851, on two trials, to be 61°, (the air at the time 62°), which is said to be constant, summer and winter; consequently, as the elevation of the spot is 2736 feet above the sea, this is a warm spring. The water issues through hollows in the tufa, one of which is 3 feet by 2 feet 6 inches, over.]

conversion under water, by basalt or other trappean rock, than there is in the occurrence of charcoal in true subaerial lava, as in the case of Madeira, or as it occurs on the flanks and slopes of Vesuvius, where the igneous torrent invades and entangles the growing forest. Nor is the occurrence of wood in the black earth of Holsworthy or Mount Cooper, fossilized by springs, more extraordinary than the conversion into stone, of trees in Flinders' Island, or in Antigua, which appear to have partially changed whilst living, or the piles of Trajan's Bridge by the waters of the Danube.

In the localities within the region under review, where fossil wood occurs, there occur also innumerable concretions of lime, which are, decidedly, the result of deposition from the trap, and of the same nature as the cementing tufa of Jillamatong; and as I believe similar concretions are, which occur in the black earth of Prospect Hill, near Parramatta, in the plains below Darling Downs, in New England and in other localities in New South Wales.

The occurrence, therefore, of the fossil wood is not alone sufficient to determine the age of the supposed carboniferous formation in Maneero. It must, then, be still considered "of doubtful age;" but as the conglomerates, grits, and sandstones, supposed to be derived from the schistose formation, are like it traversed by veins of quartz in various localities, it is certain, that it is of an age of considerable antiquity, or that the processes by which the schistose formation was charged with quartz veins and bands, were continued long after the destruction of portions of that formation had taken place, and the fragments had been deposited and re-consolidated under another aspect. It is not improbable that, as the trappean rocks have burst through and transmuted the schistose formation, and also hardened the regenerated fragments of it, certain members of the trappean rocks may have (being of different epochs) produced the whole of the quartzose impregnations.

If, as I believe, the different eruptions of trap may have continued to a much later period than those alluded to, it is not improbable that the same origin which produced the barren quartz dykes may have produced those which have been found prolific in gold; and as we find granitic rocks which produce that metal to be in intimate alliance with certain kinds of trap, we shall discover in the above disquisition a bearing upon the question as to the origin of gold, and of its apparent capricious occurrence in quartz, granite, ironstone, sandstones, slates, and conglomerates of *apparently* various epochs.

The question as to the age of its *alluvial deposition* is of a totally different kind, and is by no means prejudiced by the above remarks. I will only add, that the occurrence of peculiar trap, charging the fissures of rocks with silex dissolved in steam, the cooling and condensation of which I believe to be the true origin of quartz veins, may have produced auriferous impregnations as well as siliceous; and thus, where the silex was not in combination with gold, no gold can be found, though quartz dykes and veins abound. Similar remarks apply to the occurrence of hornblende in association with granitic eruptions, and to ironstones resulting or not from the iron in combination with hornblende or other minerals.

The apparent capriciousness of the distribution of gold in matrix may, therefore, result altogether from causes *easy to comprehend*, but still very difficult to illustrate by positive testimony. The whole question depends upon a more perfect knowledge than we at present possess of the natural history of trappean eruptions.

That gold does not always occur in quartz veins of the same age, nor in all kinds of granite of one age, is a fact now unanswerably demonstrated by, in part, my present researches. (See Chapter IV.) *Why* it should thus occur, I am, at present, unwilling to attempt to declare. It is, however, one step in the inquiry, to have shown the possible variations of its occurrence, and the relationship of those rocks in which, under any circumstances, it has been found.

As concluding my remarks upon the general geological phenomena of the part of the district more especially under review, but which are applicable to other portions of Maneero and of the Colony at large (where formations of similar ages occur), I think it right to mention that I have found no traces of what is called "foreign drift." The detritus is all local, oftentimes over the rocks whence it has been derived, and more frequently this detritus consists of clean, unabraded, or very slightly rounded fragments of quartz, slate, grit, granite, &c., except in river beds where violent waters produce considerable friction. The unabraded fragments are portions of rock, divided by joints, which have been snapped off by the expansion under heat of the moisture deposited in the fissures from dew, rain, or snow, and also by the effect of frost. The rains carry down the lighter detritus to the creeks, where the softer slates become disintegrated, and the harder rocky fragments assume the usual character of fluviatile drift. [The age of the gold-bearing drift is probably tertiary. In Victoria I have seen almost direct evidence of it; and I have no doubt that Mr. Selwyn's distribution of such drift under the heads of Pliocene and Miocene is strictly correct. Since this Report was written, I have seen similar drift in New England; and it occurs there between granite and basalt on the Uralla River. Seed vessels of plants allied to living genera have been often found deep below the surface in the auriferous drifts of Victoria and New South Wales, together with portions of stems and branches of trees and vegetable matter partly converted into peat, even under a thick coating of basalt. The late illustrious botanist, Dr. Robert Brown, detected a cone of a Banksia in a specimen of the kind brought from Victoria by Mr. Redaway.* This is not, however, in my opinion, sufficient to prove the drifts younger than Mr. Selwyn makes them; because, with a considerable number of plants of living Australian genera, *four species of Banksia* have been found in the tertiary formation of Hæring in the Tyrol†—a fact which opens a new view of the relations of the hitherto-supposed anomalous character of the living Australian flora. Having compared the drawings of these plants with the living plants of the same genera in my own neighbourhood, I have no doubt of their resemblance. What adds to the importance of this discovery is, that the Hæring beds are considered Eocene,‡ consequently much older than even Miocene.]

* *Murchison's Siluria, 3rd ed. p.* 492.

† *Von Ettinghausen, in Abhandlungen der Kaiserlich-Königlichen, Geologiscken Reichsanstalt II.*, 1855. See, also, a Notice by Mr. Bunbury, of Dr. Wesel's and Dr. Weber's "*Neuer Beitrag zur Tertiär Flora der Neiderrheinischen Braun-Kohlenformation,*" 1856, *in Geological Memoirs of the Q. J. Geol. Soc.*, vol. xv., p. 5. 1859.

‡ If the Hæring beds are really co-eval with those of Sotzka, and if the latter are, as Dr. Rolle says, older than those of the Vienna basin, then, as the latter are Miocene, the Hæring Banksias will be Eocene. But if Brongniart's view of the Brown coal of the Lower Rhine is correct, then the Hæring beds are Miocene. As to the Miocene age of the Vienna Basin, of which it is declared to be by Messrs. Huot and Reuss, (see *d'Archiac, Progrès de la Géologie II.*, 882—885), the evidence for the age of the Sotzka beds, reviewed by Count M. in the Q. J. G. S. (XV. 9), is in favor of their really being older than Miocene.

REPORT No. XII.—PART 2.

The general structure and disposition of the formations in the County of Wellesley, have been already explained, and allusion has been made in Report No. IX. (of 29th January last,) to the Geological features between the counties of Beresford and Dampier.

Anxious to complete a section from the head of Maharatta Creek to Cape Howe, I proceeded to Bundian on one of the upper sources of the Jenoa River, which disembogues at Malagoota Lagoon, a few miles westward of the Cape, in the hope that I might be able to find an Aboriginal guide through the dense and difficult scrubs that encumber that line of country; various disappointments, however, led to my abandoning the attempt. I was enabled, nevertheless, on that occasion, and on a subsequent exploration of the ranges in that direction, and from information given to me by the Reverend E. G. Pryce, of Cooma, who had some years since, in a more favorable season, penetrated to the Cape, to obtain a general idea of the nature of the country beyond my point of observation. From what I saw and heard, I believe that although a tolerably good mountain road, on which I travelled, already exists between Calkin and Bundian, it would be impossible to travel with wheels between the latter place and the Cape, in consequence of the abrupt and difficult cliffs about Nangutta, and the ranges of that vicinity, and the dense scrubs, swamps, and hills of blown sand that succeed towards the south-east. [The country lower down between the Jenoa and the Snowy River is generally believed to be worth little.]

On my journey to Twofold Bay in March, in the hope that I should be able to reach Cape Howe, by travelling parallel to the coast from Kiah, I was overtaken as before mentioned, by a violent southerly gale accompanied by heavy rains, which so swelled the Womboyne and Murrica Rivers, and so flooded the swampy grounds, that the experienced guide who promised to accompany me to the Cape warned me not to attempt the journey till a future time, it being in his opinion almost impracticable, if not altogether impossible.

The desire which I knew existed to obtain information respecting a good land route to the Cape, in consequence of the proposed design of erecting a Light House in that vicinity, was one inducement of my endeavours to accomplish the undertaking, especially as I had heard, that Captain J. L. Stokes, R.N., had, about eight months before, been prevented by similar obstacles in his attempt to reach the Cape by land.

My journey was, notwithstanding, not altogether useless, for I obtained a section between Maneero and the sea, and combining my observations along that section with those obtained before and afterwards on the traverses to and beyond Bundian, I gained a satisfactory insight into the structure of the country over a considerable part of the county of Auckland.

I proceed now to report upon my exploration of that county, premising a few preliminary observations on the routes that have been made across it to the sea.

The most northerly of these routes, from the Pass at the head of the Bemboka River, which descends the Nimitabel mountain, and which was formerly much in use, is now, although the shortest line of communication from Cooma, generally abandoned, in consequence of the dangerous state of the mountain and the precipitous character of the descent. No one who has once made it would, I believe, willingly, if he could avoid it, undertake to make that journey a second time.

The route taken by the mailman from Talaqueong, by Tantawangola and Kamerooka, is rendered difficult to strangers by the extent and denseness of the scrubs and the state of the declivities and creeks.

Another route lies between the Maharatta pass and Towamba, and this is, no doubt, the shortest route; but, though once in use, it is now nearly impassable from the destruction of the road by heavy rains, that during the last two years have so much injured the country in Auckland and Dampier, (and even in Wellesley and Beresford,) and from the quantity of fallen timber that encumbers the tracks.

There is, unquestionably, a better line than that last mentioned starting from nearly the same point of departure, and one which might be made easy, by a slight amount of engineering, to the infinite advantage of the settlers in the southern districts of Maneero; but the ordinary route is that which leaving the upland region at Talaqueong, [at a height of 2800 feet above the sea], begins in an extensive and sometimes dangerous swamp, and traverses the bed and banks of the Towamba and Mataganah Rivers, and winds over a succession of ranges which are steep and fatiguing. Crossing and re-crossing the rivers continually, even in seasons when there is no unusual amount of floods, this road, though in places very good for short distances, owing to the labour and ingenuity that have been expended upon it, is by no means devoid of danger to inexperienced travellers, as accidents can testify; and I am persuaded, that it might be rendered less difficult by a careful survey of the leading features that border it, especially on the descent from the swamp at Talaqueong to the lakes at the bottom of what is called the Coalhole, for the abrupt wall of rock that borders this descent to the southward may be followed along its summit, and has been so followed by those who are accustomed to exploration, with less difficulty and with more expedition than attend the present tracks.*

Notwithstanding the public announcements that have been made, in order to attract persons to the search for Gold in Maneero, respecting the excellent road from Eden to that district, I can only express my surprise at the regularity with which the Mail is conveyed to and fro, and at the comparative readiness with which even loaded drays are directed through that broken and mountainous country. Nor can I help remarking, that a positive necessity exists for a considerable outlay along the whole line from Pambula, as far as the crossing of Rock Flat Creek; for there are portions which are unsafe, and in rainy weather actually impassable, "the slough of despond" being the fittest image to illustrate such localities as Hole's Flat, Rock Flat, and the trappean paste that covers wide areas in various places between Jutaba, Bombalo, and Talaqueong Gap.

I take the liberty of making mention of these particulars, as a duty no less to the Government than to the community, having had frequent experience of the difficulties named, during the last eight months, in often traversing some of the localities in question, having assisted one traveller who could not, otherwise, have completed his journey, through the difficulty of the ascent, and having been cognizant of the accident which befell another (the

[* A new route has recently been surveyed by Mr. Bransby, whose elevations agree very well with my own, showing that the country has a persistent series of breaks and levels.]

Mail man from Cooma) whose life was in imminent danger for some time, in consequence of the state of the swampy ground which he had to travel over in the dark. There are other instances of similar accidents during my journeyings in that district, which have only attracted no attention from the public, because they are, probably, of so frequent occurrence.

The circumstances just alluded to result altogether from the natural, and but slightly improved, geological features of the country, to the consideration of which the preceding seeming digression from the immediate object of this Report, is a not unsuitable introduction.

The eastern border of the Main Coast Ranges which separate the maritime counties from the basins of the Snowy River and the Murrumbidgee, and which have a generally persistent character from the head of the Derra or Shoalhaven River to their final obscuration south of the boundary line of the two Colonies, is marked by a series of depressions, overlooked, nevertheless, by high peaks, where the ridge dividing the waters is extremely narrow, and towards the coast most abrupt. It is at these points of depression that the Passes are found between the upland country and the coast, and so narrow is the ridge at these points, that it may be stepped across in from six to nine paces.

The original discoverers of these Passes have given various significant, but still not the most pleasing, names to them. As in the case of the deep ravine at the head of the Brogo to the southward of Robinson's "Hole," this term is applied to the similar localities at the base of the escarpments bordering the line of descent. With some trouble I obtained the Aboriginal names, but, as identifying the localities, I will enumerate them in their order from the south, by both the Aboriginal and the Colonial designations, hoping, nevertheless, that the former will, upon maps of the country, eventually replace the latter, of which there are, already, too many of like signification in other parts of the Colony:—

1. Bondi or Bundian Pass, between Calkin and the head of the Jenoa.
2. Wog Wog Pass, between Killerooma and Yarramgun.
3. The Devil's Hole, head of Maharatta Creek, otherwise Burrimboco.
4. Hell Hole, otherwise Wambamgarragan.

5. Coal Hole, otherwise Comblobhimblo.
6. Great and Little Purgatory, otherwise Tummàmah.

The designations of some of these localities have been assigned by the bullock-drivers and stockmen, who took that expressive mode of defining the fearful nature of the original state of the descents, their depths and gloominess; and certainly, it is satisfactory to even those who may not be as mythological or poetical as a bullock-driver, to be informed that, after escaping the perils and inconveniences of such a "facilis descensus Averni," and the risks of Purgatory, the explorer is enabled to arrive at length upon the shores of Eden, which, if nothing more than Australian, is certainly a Paradise compared with the region through which it is approached.

The Pass of Bundian is bordered by the defiles collecting the head waters of the Jenoa, of which the northern is guarded by the heights of Coonbulico, Wallagarra, Nangutta, and Ekalûn, and the southern by the spur of Diliganea, which precipitates the stream collected to the southward of the Pass, over a wall of granite 67 feet high, and which forms the cataract of Windindingerree. These waters unite a little above the station of Bundian (Bondi), being in vertical descent below the Pass 1173 feet, and falling at the rate of 234 feet per mile; and after reinforcement from the Nangutta ranges, just upon the boundary line, the collected supplies are known as the Jenoa, which passes away to the south-east and meets the salt water at Malagoota, after falling (in direct measurement along the plane of slope), about 50 feet per mile. The distance from the Pass to the discharge of the water into the Ninety Mile Beach is but 41 miles; the Jenoa, therefore, takes the most direct line of descent, being bounded by ranges, the joints of which indicate its course. The fall of Maharatta Creek, on the other side of the Pass is not more than 16 feet per mile of direct distance; so distinct are the features of the table-land and the sea-board.

The south-east direction is so persistent in the main channels of all the waters in the county of Auckland, such as the Jenoa, the Towamba, the Bemboka and Brogo, which are parallel to the range separating that county from Dampier, that viewed in relation to the courses of the main streams and ranges in the counties of Wallace and Wellesley, and to the possibility of indicating the apparent continuation of the same lines of fissure on the western side of that region, or of parallels thereto in the deep and precipitous ravines watered by the Jingalaba, Amboyne, Catamurra, Toonginbooka, Ingeegoodbee, Moyengul, Tongaro, Burrungubbuc, and the upper Gungarlin, and by various transverse portions of the Snowy River to which these are affluents, as well as by the Buckenderra and Wulwya Creeks which also belong to the same system, (all of these being also parallel to the great line of trappean eruption which separates the Snowy River system from that of the Murrumbidgee,) there can be no doubt, that the drainage of the county of Auckland and the peculiar disposition of its headlands are due to the same powerful agency which has left such evident traces of its violence in other parts of Maneero, directing the rivers in lines of fissure, fracturing and dislocating the schistose rocks and opening a channel for that series of igneous eruptions by which those rocks have been transmuted and overflowed.

Transverse to this south-east line of joints which traverse the country in one direction, we find also another (in obedience to the laws of dynamical elevation), indicated no less by the lower part of the river channels in Auckland which bend from their previous courses, less in the Jenoa than in the Towamba, toward north-east, parallel to the direction of the ranges and rivers in similar portions of the area already indicated, as, for instance, between the Bundian and Wog Wog passes and the junction of waters at the mouth of the Deleget River with the Snowy River, and in the deep precipitous channels of the Mowamba, Crack-em-back, and upper Snowy River,—in each case this north-east direction being due to the same causes. Thus we, necessarily, might anticipate that the Towamba River, which occupies the middle of the region between the Jenoa and the Bemboka, would exhibit in its affluents accumulated from Burrimbocco, Wambamgarragan, Combloblumblo, and Tammàmah, evidence of the same phenomena. This evidence is clear in the courses of the Wog Wog, Perricoe, Mataganah, Burragat (Pussy Cat) or Pryce's River, which flow transversely to other portions of the Towamba waters.

So, again, in the Bemboka and Brogo waters, and in the district between Twofold Bay and Murrimbulla we trace the same influences, the trends of the ravines, channels, coasts and drainages in the Yowaka and Pambula country, following the same two general directions.

Lastly, if we notice the extreme accuracy with which the general direction of the Alpine or Western Dividing Chain, from the junction of the Coodradigbee and Murrumbidgee to the heads of the Murray and Tambo Rivers, is paralleled by the Eastern Dividing Chain or Coast Ranges, from 35° south to the Boundary, and by the coast itself from 36° to Cape Howe, we shall see how wonderfully distinct are the definitions in nature of the meridional directions of the great features of the granitic walls bounding the schistose trough between them and the littoral country to the eastward, and of the jointed or fissured trends in south-east and north-east directions which supply the minor features of physical conformation.

The County of Auckland, therefore, partakes in all its general phenomena the character of the highlands above it, and is therefore proved to belong, notwithstanding its maritime position, to the same natural province.

The regularity of its superficial phenomena is very interesting:—notwithstanding the apparent confusion of its deeply cleft groups of mountains, it is remarkable, that the distances between the general lines of courses of the Jenoa, the Towamba, and the Bemboka Rivers are nearly the same; and where smaller rivers occur as in the case of the Pambula, the Womboyne, and Murrica, a similar degree of consistency is apparent.

It may be also added, that the County of Dampier supplies an equal degree of testimony in these respects, to the influence of the same physical agents; but as my present business is with the County of Auckland, it is not necessary to enter into further consideration of the country between the Moruya and the Murra, than is presented by the remark, that as in Auckland the main trends are south-east, in Dampier they are north-east, which equally with other phenomena, is in perfect consistency with the divergence already pointed out, of the ranges and rivers radiating from the highest part of the Muniong Alpine region, in the vicinity of the Ram's Head and Kosciusco, an unquestionable point of elevation, below which between the Crack-emback and Mowamba will be found, hereafter, deposits of gold.

The Towamba presenting, as before stated, peculiar means of comparison with other lines of drainage, and also affording in the various ranges traversed by its waters the most favourable means of investigation; no line of section could probably be obtained more suitable for Geological inferences than that which I followed in a nearly due east course from the Talaqueong Gap at Bindago, to the mouth of the Pambula River.

Before I enter upon an account of that section I must premise some remarks in addition to those already given, respecting the eastern limit of the Eastern Dividing Chain.

The main features of this Chain have been already pointed out, and also the existence of a line of peaks in the neighbourhood of Maharatta Creek. Of these, Theringo, Yarramgun, and Killerooma, belong to the "*divortia aquarum*"; the range, of which Berrimgbo, Nelbung, and Coolungubbera are summits, is connected with it by a very narrow ledge deep down the defile below the Gap, whence the waters flow on each side to the Wog Wog. This range, therefore, separates the Towamba from the Jenoa waters, and breaks out in varying elevations in the direction of Mount Imlay, otherwise Baloon, the approximate height of which is about 2900 feet above the sea.

The waters drain on each side of this range to the Towamba and the Jenoa, and near the eastern extremity between Wallagarra and Nalbaugh, a trifling quantity of gold has been found.

The prevailing rocks in this range are granites of various kinds, passing from one of true ternary character to a nearly true porphyry, being traversed as the granites of the Main Dividing Range are by binary rocks in the form of dykes or elvans. Quartz dykes of segregation also occur, and the granites occasionally assume a hornblendic, syenitic, structure, scarcely distinguishable from ordinary greenstones. I found dykes of the latter passing through the granite on the Coast range, at the head of Maharatta Creek, under the peak of Yarramgun; and as I saw similar dykes of the same substance in the granites of Carangal, south-west of Lake George, and in the Gourock Range, I presume these circumstances are general in the Great Eastern Dividing Chain.

The predominant colour of the granite in this part of the country is pale, but often there are patches of a reddish hue arising from the rock having been stained by ferruginous saturations. The felspar varies from small grains to considerable crystals, with clear sparkling faces; the quartz is limpid and highly crystalline; the mica is in small greenish tables. Patches of this granite are in a state of decomposition, resulting from its exposure, at such an altitude, to the effects of the very frequent rains, mists, and winter snows. During my stay upon Maharatta Creek, I noticed how frequently when all was dry and clear to the westward, the heights of Coolungubbera were under dense clouds or dripping fogs.

Although, there are enormous nodular masses of granite in this region, yet the rock sometimes assumes a stratified appearance, from the prevalence of parallel joints dividing it into bed-like forms; and it was not, till I obtained from the summit evidence of this fact, that I altogether abandoned the doubts which existed in my mind, as to the possible (though improbable) occurrence of sandstone upon the northern face of Nelbung, which, at a distance, presents the character of a cliff.

Coolungubbera is a prominent feature all through the southern part of Wellesley; I saw it on many occasions, as from the summit of Galmerang, from the summit of Deleget Hill, and from the heights above the junction of the Deleget and Snowy Rivers; in the latter instance, seen along the depressed region of Quedong and Maharatta Creek, it exhibited from the contrast in the distant horizon, bolder features than comparatively belong to it, but it is characterised by a white patch of fallen granite blocks, which strikes the eye at once.

The granite which forms the base of Coolungubbera rises towards the north, and forms the main ridge of the Chain, where it is not broken or overflowed by trap, or obscured by the grits and conglomerates of Sojeree and Dulundundu, previously described. But even near Talaqueong, the flanks of it are pierced by dykes, or marked by segregations of porphyry. In this respect, all the granites of Maneero are similar. And just as at Jejedzeric, a porphyritic structure obtained in various dykes that traverse the granite; so, on the summit of the Muniong; on the descent to the Tongaro, near Jacob's Point; at Cooranugga Creek, near Calkin, and on the descent to Bundian, as well as below Combloblumblo—the same structure is observable. In the creek below Bundian there are numerous drift boulders of a very beautiful porphyry derived from dykes in the granite of the ranges above.

Near the Pass, the granite is nodular, distinctly jointed, charged with much hornblende, the chief constituents being white quartz, greyish white felspar, and greenish mica. Dykes of quartz, reddish and white; dykes of compact siliceous granitic rock; and of fine and compact greenish hornblendic granite, varying in direction from 22°, 30°, 47°, 80,° to 180° distinguish the blocks. In the fine hornblendic granite occur shining crystals of glassy felspar. The mica is also, occasionally, disposed in regular angular forms; and in the quartz between its particles which are prismatic, is abundance of epidote. All these facts point to a period of no great antiquity as the epoch of this granite.

At Windindingerree Cataract the granite also exhibits a little hornblende, with large elements of felspar and quartz, the latter sometimes pierced by the felspar; adularia is present; and quartz dykes pass through the granite, being occasionally studded by a little mica and some chlorite. As at Araluen, there are here patches of fine segregated granitic materials traversing the mass.

The phenomena are parallel to those which distinguish the granites of Savoy, and, as those rocks produce a little gold,* it is not singular that gold should be found in small quantity amidst the detritus of Diliganea. The hollows in the waterfall are blackened. The same coloring of the surface distinguishes the granites of the Wollondilly;† and it has been observed in Guiana and in other foreign localities.‡ It is, probably, the effect of some decomposition of an element of the granite, under the influence of the water impregnated slightly by some salt derived from the decomposing substance.

Below the waterfall the drift fragments are, various granites, hardened schists, and quartzites; a massive felsparite, salmon-coloured, full of green epidote and a very minute bluish mineral, apparently Häuyne; flesh-coloured felspar, with crystals of glassy felspar and epidote in spots

* Bakewell's Travels in the Tarantaise, vol. 1., p. 375. M. Brochant also mentions the occurrence of *auriferous pyrites* at Anzascar, in the Alps. (On the granitic rocks of Mont Blanc, *Annales des Mines*, 1819.)

† W. B. Clarke in Quarterly Journal Geol. Soc. vol 1. p. 342.

‡ Humboldt mentions "leaden coloured granite," in the Oronoco River. (*Aspects of Nature*, 1, 188).

and points of a highly shining aspect, and some sharply-defined crystals of quartz.

Further back, at Cooranugga Creek, the granite is also traversed by dykes of segregation, composed of fine semi-crystalline compact siliceo-felspathic rock, generally inosculating with the granite at the planes of distinction, free from the protuberances of quartz studding the surface of the granite, and transversely fibrous. Whatever subsequent changes these dykes may have undergone, it is clear that most of them are contemporaneous in origin with the masses they traverse.

The granite of Yarramgun is distinguished, at the summit, by partially decomposing masses of similar composition to that of Coolungubbera, in which large crystals of glassy felspar are surrounded by a yellowish felspathic base charged with crystals of quartz and shining greenish mica, of the usual six-sided form, the whole mass being often stained by reddish ferruginous matter. The granite at the base of the mountain near the descent to Burrimboco consists of white quartz, black mica, and white felspar. The whole is jointed from north-east to south-west; and from south-east to north-west.

In the granites between Bundian and the coast, the same passage from the natural composition to one of highly porphyritic structure is apparent, and from specimens of the Gabo Island and Cape Howe rocks, which I obtained from Mr. Tyers, I find that the same salmon and flesh-coloured varieties which I noticed in the upper part of the Jenoa basin are abundant there. A most beautiful rock from the island consists of a variegated porphyritic syenite, in which glassy felspar, hornblende, a little mica, and fine limpid crystals of quartz are disseminated in a crystalline base of salmon-colour; it is a lovely example of the relationship between porphyry and granite. This rock occasionally exhibits the perfect blending of the felspar and quartz as cooled and crystallised at the same time, mutually indenting and entangling each other.

The surface of the block from which my specimens were derived is polished by the sea. The rock would, undoubtedly, be highly useful and ornamental in architectural works. [It has since been employed for curb stones in Sydney, as at the Exchange, &c.]

The Gabo rock passes into granite in its course along the Connewarra Range, (one thousand feet above the sea,) and on the ranges dividing the Jenoa and Towamba basins, on Mount Imlay, and Colungubbera. [I have seen it passing along the coast, but have not been on Gabo Island; red and grey contorted schists repose upon it, forming the coast for many miles north and south of Twofold Bay.]

The same connection between granite and porphyry is exhibited on a very instructive scale along the Towamba; and the further connection with epidote is also illustrated in the section between the head of that river and Pambula, the mineral occurring in great abundance in the trap rocks which have issued from the granite.

Epidote is a well known associate of rocks of igneous origin. It occurs abundantly in dykes on Derwent Water in the English lake district; in the Malvern Hills*; in North America; and it again occurs in this Colony in the Bathurst country, and near Mount Tennant on the Murrumbidgee.

Its occurrence in quartz veins of the schistose rocks shows that it is diffused very extensively. I regard it as an indication of the comparatively recent epoch of the eruptions along the line of fissure marked out by the escarpment of the coast range, and of the probably continuous exhibition of the phenomena connected with the formation of the granite, porphyry, trap, and quartz dykes of the various portions of that chain, and of its eastward spurs.

On the descent from Binago to the junction of the creeks forming the head of the Towamba, we have on the north side granite; on the south various trappean rocks† belonging to the eruptions which have overflowed the schists in Maneero, of which the most remarkable are the amygdaloids, the cells being partially filled with various minerals, amongst which quartz, iron, and *epidote* are abundant.

Similarly, epidote is common in the amygdaloids of Lake Superior, as we learn from a valuable Report on the Geology and Topography of that region, by Messrs. Foster and Whitney.‡ According to these authors, the hornblende of

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* Memoirs of Geological Survey of Great Britain, Vol. II., p. 34, &c.

† In the black paste resulting from the decomposition of these rocks there is found, near the Coal Hole, much fossil wood of coniferous species.

‡ Silliman's American Journal (n.s.), Vol. XII., p. 226.

the trap in that region is often replaced by epidote, and "the seams of quartz and calcspar containing *copper* are almost always accompanied by this mineral." Again, they say: "besides these is a singular rock of a felspathic base, of a light reddish colour, through which irregular crystals of red felspar and small rounded particles of quartz are discoverable, interspersed with a greenish mineral which appears to be epidote."*

Now, according to the analysis of epidote by Gerhardt,† the general formula is one "which comprises garnet, anorthite, *olivine*, and a great number of other minerals." The presence then of epidote in the granites, porphyries, and trap of the County of Auckland, justifies the conclusion that they are all of a continuous epoch of eruption, and that the granite of that part of the Great Coast Range is, to a great extent, of comparatively no very ancient period. Combined with the positive testimony offered by the phenomena at Dundundera and Maharatta, it is proved to be intrusive and younger than some of the sedimentary rocks of Maneero.

These Australian epidote rocks appear to be nearly allied to the Malvern syenites and granites (of England) and the Lake Superior rocks (of Michigan), and taking into the account all the conditions of those regions which relate to the connection of the intrusive with the sedimentary deposits which they traverse in a meridional direction, (which is the direction also in Auckland and Wellesley,) we may assume that the eruption and elevation here may have been, as in Europe and America, (the zoological evidence pointing the same way,) *Post*-Silurian.

Bearing in mind, also, the auriferous nature of similar granites in Savoy, it is not inconclusive to infer that the impregnation of some, if not all, of our Australian auriferous rocks, took place *after* the deposits of the Silurian epoch. At any rate, according to the list of minerals in the Ural Mountains, given in the "Geology of Russia and the Ural, by Murchison, de Verneuil, and Von Keyserling," (vol. 1, p. 640), *epidote* in veins of quartz, in porphyry, and in borsovite, blocks of which are found in the auriferous detritus of Borsovsk near Kishtymsk, has been noticed.

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* Id.

† Journal de Chimie, Sep. 1848, p. 214.

M. Delesse (Bulletin de la Soc. Géol. de France, (2de série VI., 242), shows that epidote occurs with quartz and *ripidolite* (a green variety of chlorite) in the protogene of Savoy. I am not sure that ripidolite does not occur in the rocks under review. That may be worked out hereafter.

The object for which these references are adduced, is to show the probability that the rocks of the district under review are of similar age to those from which the comparison is made; and not, that, of necessity, gold must exist because epidote is present. That mineral is assumed to be an indication merely of the class of igneous rocks to which I refer the granites of this part of the chain overlooking the south-eastern corner of New South Wales.

On the descent to the Towamba, the pale granite of the higher part of the Pass above Combloblumblo changes to a pinkish variety, in which green mica and hornblende are abundant, the huge masses being thickly interspersed with dykes and segregations of quartz. At the mouth of Tummàmah, porphyry of considerable width and regularly jointed crosses the Towamba, the gorge being bounded by escarpments of that rock, in a meridional direction. Trap also occurs in various places cutting through the granite, which is much decomposed in the banks of the river, and for some height above on the sloping spurs of the mountains.

The bed of the river is filled for miles with innumerable blocks of granites and porphyries, or of other trappean rocks, and of hardened schists, derived from rocks of that class which occur at the head of the creek joining the Towamba near Bibinluke. Hornblende is in these rolled masses a very abundant mineral. Epidote occurs in the porphyries, and iron, often stalactitical, lines the cells of the amygdaloids. [Iron occurs in the same way in the amygdaloidal trap between Ettrema Creek and Narriga in the Shoalhaven district.]

At Bibinluke the valley begins to expand, the hills become lower and more pointed at the summits, with smoother and more sloping and lengthened ridges. The sand of the river is formed from granitic detritus.

Looking upwards from the summit of a hill which stands out into the valley below Euglama, the deeply fissured ranges and level head of the Pass to the westward, reminded me strongly of the appearance of Araluen valley seen from the Pass above the Moruya River, and not finding a name I called the station Araluen Hill. The soil and detritus around this locality are also similar to those which occur in the valley of that name.

This locality is marked by the occurrence of a few small patches of slaty rock in contact with the granite.

Ascending the Mataganah River from this point as far as the old station of that name, marked on the maps as "The Stockyard," but which is altogether deserted, granite (shown in the fragments of that rock mingled with those of quartz, porphyry, and quartzite), but of a different character, forms the bed and bounding walls of the valley. The granite is here of a bluish cast and fine proportions, is traversed by dykes of trap, and succeeded by undulations of very siliceous or felspathic and porphyrytic rock, which is in turn succeeded by schists at the head of Pryce's River, and these again by granite of ternary composition, rising into a high broken country belonging to the Jingery Mountains, which separate the Towamba waters from those of Pambula, Yowaka, and Bimmil. [We have here the occurrence of alternating rocks, so often before alluded to.]

The summit of Jingery appears to belong to a nearly meridional axis of granite, of which Wolumla Peak to the north and Baloon (Mount Imlay) to the south have the same general elevation—from 2000 to 3000 feet above the sea.

The slopes of the Jingery ranges are very densely wooded, and the surface is strewn with a deep local detritus of the granitic and schistose rocks of the neighbourhood. In the ravines granite crops out, and on the flanks are indications of the schistose formation.

To the eastward there have been a series of dislocations and other geological accidents, rendering the aspect of the country exceedingly broken, and its exploration difficult. In fact, the only passage through it, is made by following the drainages and ascending the ranges that lie between them.

The schists, penetrated by quartz veins, rise into some elevation on the north side, and schists and conglomerate upon the south side of the descent from the Jingery range at Belbin, from which the head waters of the Pambula begin to collect at the junction of the schists and granite.

The character of the formations between this part of the

Jingery and the sea is very different from what it is to the westward.

A mass of epidote trap has burst out from the granite and has transmuted the slaty rocks between Jingery and Bobbera, and which rest in beds of inconsiderable inclination upon the base of the granitic slopes, into jasper or other hardened metamorphic varieties.

The slates are no longer of the pale blue, greenish, or greyish hue of the Highlands of Maneero. They are purple, or red, containing, near the trap, much epidote in veins, and are traversed by quartz coloured by the same mineral.

Bobbera is a steep narrow range crested by quartzose conglomerate traversing beds of red slate, which possess cleavage, but which below the summit are extremely hard. These are, towards the base of the slopes, full of epidote.

These red slates and conglomerates, cut through by various dykes of epidote trap, distinguish the principal formation of the whole country to the eastward of the Baloon, Jingery and Wolumla ranges, and between them and the sea, occupying the coast from the Womboyne River to Murrimbulla, and, in patches, to the north of the Dromedary.

In all this area, the formation exhibits the effects of mechanical forces by which the beds of rock have been folded into continuous undulations which have been snapped asunder in some places and in others reversed, and it is due to these phenomena that the surface of the country is alternately found sweeping along in slopes or curves, or intersected by deep creeks, admitting the tides and salt water into the recesses of the hills.

Between Bobbera and Pambula the alternations of red slate, quartz, conglomerate, and coarse grits, with dykes of black trap and green trap and amygdaloid, in which epidote is present, are very numerous; and at the head of the Pambula estuary a broad prominent mass of blue and green amygdaloid is covered on the top of the bank, by conglomerate and grit of a granitic character.

In the fluviatile drift in the bed of the river and in the heaps of local detritus that lie around, I found fragments of contorted quartz dykes, baked sandstones and grits, the laminæ of which could be traced by the parallel folds into which they had been bent; and also portions of dykes of trachytic trap, consisting of crystals of glassy felspar in a base of compact felspar, the dykes being bounded by the hardened grit into which they had intruded.

It seems, therefore, plain, that a considerable igneous action has affected this area, and there is no question, that the agents have been porphyry and trap, with which epidote has been in intimate association.

At Pambula this porphyry makes its appearance under a mass of conglomerate of a very striking character, and which has resulted from the destruction of rocks transmuted and broken up by its intrusion. The pebbles of this conglomerate betray the forces from which they resulted.

The porphyry consists of a yellow felspathic base studded by crystals of felspar and double pyramids of quartz, and is of a different age to the porphyry which belongs to the granite of the upper part of the Towamba.

Where this porphyry is in contact with schists, the latter are contorted, hardened, and rendered jaspery or porphyritic, being filled with undulating layers of chert and cornean.

A siliceous fluid has penetrated and *coated* the rock, probably by the agency of fluoric acid dissolving silica, or by that of steam and the alkali of the felspar.

The fragments of the conglomerate are only partially rounded; many are abrupt as if broken up after the hardening process had taken place, and they are cemented by a siliceous paste full of epidote. They consist of every variety, and of all sizes of fragments, of the altered rocks of the vicinity. A band of this conglomerate runs along the east side of the intrusive porphyry for more than two miles in the direction of the prevalent strike of the Coast and Back ranges, which is towards south-south-east, and is distinguished by veins of quartz with abundance of *molybdenite* on the road to Eden. About this point a mass of epidote trap and amygdaloid comes into contact with the conglomerate and is succeeded by red slates and grit, and reddish brown sandstone, the red slates having a cleavage from north to south.

The porphyry appears to be continuous in direction as far as Eden, though it is covered, in the intermediate space, by the Bimmil ranges which rise to an elevation of from 500 to 700 feet, for it breaks out on the summit of the hill in and above the township, and is seen intruding in a long elvan between vertical planes of hardened and transmuted rocks at Look-out Point and close to the Custom House, which stands on what was once an island, to which the Biga blacks give the name of Mongera, and those of Eden, the names of Min and Weäcoot.

One remarkable feature of the neighbourhood of this dyke of porphyry is, that on its north-east side, both on the Pambula River and on the north coast of the bay between Weäcoot and Worange, a depression of the surface gives room for the admission of the sea water into a shore lake, the former being a mere mud bank at low water, and the latter being often blocked up by the sands of the beach through which it communicates with the sea.

On the beach to the north-west of Eden, this dyke presents itself amidst considerable derangements of the strata, to which allusion will be made hereafter, and it is there, as I discovered at some risk, by watching a passage across the rocks on the reflux of the sea, that at the sea level, veins of clear crystalline and fibrous quartz traverse the porphyry, the result perhaps of the reformed silica set free in the decomposition of the igneous mass under the influence of the agitated ocean waters.

Double six sided pyramids of quartz stud this porphyry, some of which have the partly rounded form, and water-worn aspect of certain quartz crystals in true granites, the result of the impeded original processes of crystallisation and not of any aqueous agency whatever. The rounding off of the angles of true crystals in granitic rocks has been noticed by me in various parts of the Colony, and these occur under circumstances that preclude all idea, whatever, of the rock having been a merely regenerated species.

In order to examine as thoroughly as occasion permitted, the facts presented by the broken district between Pambula and the sea, I went in a boat from the township to the mouth of the river, and returned on foot across the hills.

The whole mass in this area presented the same features, undulating, broken and variously alternating beds of grey and brownish red sandstones, and grits and red slaty rock, the latter of which has the same hue and appearance at a little distance as the red ferruginous trap on the sea coast of Kiama in the Illawarra. It has, however, nothing in common with the latter, though its hue and ferruginous appearance may have been originally due to the ferruginous impregnations of trap, when the sediment from which it was derived was first deposited.

The north head of Pambula River offers a very singular illustration of the phenomena so common in the neighbourhood of the river, and is deserving of especial notice.

A short distance to the westward of the headland, a series of purple, brown, and red sandstones are bedded upon the bank of the estuary in regular sequence.

The sandstones are coarse and gritty, and contain small pebbles of quartz, and where they overlie the red slaty beds there are fragments of the latter entangled in them. They are divided by clean joints which dip from 12° to 20° to north and east. The direction of the strike is 95°, and the dip of the beds from 2° to 8°. There are a few thin seams and strings of quartz, but in the brownish red varieties, which are coarser than the rest, and put on a concretionary character, the quartz pebbles are most numerous.

As a heap of ballast consisting of sandstones and shale, which I recognised as having been quarried in the ballast cliffs not far from my own usual residence at St. Leonard's, lay upon the beach, I was enabled to compare the two kinds of rock, and to determine that they have, notwithstanding the mineral composition, nothing in common tending to identification of the two formations. The Pambula sandstones and grits, whether younger or not than the schists and quartzose beds of Maneero, are very much older than the sandstones and grits of the Hawkesbury and Sydney. And, although there is no fossil evidence to assist in fixing their position in the geological scale, I think they cannot be younger than the Devonian formation. There is in the existence of the red slaty rock much to justify this position. These slaty beds have a distinct cleavage, although the overlying and underlying grits and sandstones possess none. I remember similar conditions in the "Old Red," of the Devonian in Herefordshire, as near Ledbury.

The dip mentioned above is not persistent, for these beds have varying dips and directions owing to the undulations and foldings which they have undergone.

As they approach the Point at the North Head, the dip becomes reversed, and at length, just on the sea beach, they become nearly vertical, the cleavage of the red slaty beds being parallel with the strike of the grits and sandstones on either side.

An insulated mass of these stands out in advance of the cliff. The latter and the portion of the insulated mass nearest to it are filled with millions of quartz veins of all sizes; these inosculate and reticulate each other in a most extraordinary manner, presenting one of the most curious and instructive phenomena I have ever witnessed. It would seem as if the whole mass of rock had been broken in situ (as the hardened chalk is on the Dorsetshire coast, at Ballard Down near Swanage, and along the Isle of Wight and Purbeck axis of elevation) by the violence of the folding, and that silica had been introduced (probably by steam) from below; the quartz runs in all directions, sometimes as fine as threads, sometimes in bosses of various sizes, crossing and re-crossing in every imaginable way. A nearly similar case occurs in the gneiss-like rock at Mittagang, near Cooma. (See p. 115). [It is there called Mittagong, by mistake.]

The strike is here north and south and the dip 21° to west, the main joints being east to west. In the cliff the veins are horizontal, but in the insulated portion the main veins are chiefly vertical. The latter has been evidently snapped off by a violent strain from the cliff on the opposite shore at Haycock Point, and probably the space between the cliff and the insulated mass is also occupied by a fault or the sudden curve of the strata, the outer part of which must have been removed.

The quartz veins pass through the grits as well as the slaty portions of the mass, but the latter are free from them.

The inferences I draw from the above-mentioned facts are these:—that (1°) the original deposits were derived from argillaceous and quartziferous rocks and thrown down into agitated ferruginous waters which disturbed and broke up the surface of the beds last deposited, mingling fragments of them with the next deposit; (2°) that after the deposits had taken place a concretionary action ensued, by which a nodular structure was commenced in the grits and sandstones and a cleavage induced in the slaty beds; (3°) that the whole formation was disturbed and folded into undulating masses which became ruptured and disjointed from each other by violent forces acting by upward and lateral, as well as perhaps by downward pressure, consequent upon the eruption of porphyry and trap which, as we have seen, have broken up and transmuted the strata a few miles to the westward; and (4°) that it may be due to these eruptive igneous forces, that not only mechanical violence was induced, but that quartz veins were produced by the injection of silica reduced by steam from below, the state of the red rocks near the veins showing the action of some liquid or gaseous power upon the mass, which is, in their vicinity, deprived of the usual colour.

It is, moreover, not improbable that the present position of those red rocks, if really below the geological horizon of the schistose formation of Maneero, may be in part due to the sinking of the country along the coast, consequent upon the upheaval of the country to the westward, the natural result of which would be a lateral pressure outwards, producing a comparative depression.

As similar effects appear in other parts of the sea-board in New South Wales, in the carboniferous region, and as even in Maneero itself there appear to be areas of depression, some such hypothesis may be admitted to explain the disturbed and undulating features of the County of Auckland.

This opinion is much strengthened by the coast sections about Twofold Bay.

Those all indicate the presence of the same formation and of similar phenomena. All round from Burrownagun to Boyd Town, Cocora, Weäcoot, and Worange, there is the same red hue, the same kind of disturbances, the same sort of undulations by which the dips are thrown down at different angles and in various planes,—nor can there be any doubt, that the presence of the porphyry which has been before mentioned, indicates the source of that metamorphic action which the rocks in the township of Eden have undergone.

On the face of the cliff on the north side of the township are numerous quartz veins, which reticulate the beds, and these are charged, as similar veins are near Pambula in the vicinity of igneous disturbance, with *molybdenite*; the surfaces of some of the red sandstones become blotchy from yellow spots, and they are also minutely intersected by very fine cracks, on each side of which the red stain is removed and the colour is yellow.

The laminæ of the slaty portion of the red rocks near to the porphyry have been hardened into thin biscuit which covers the tops of many blocks upon the shore, the whole having been hardened.

When the sandstones are untouched they are finely laminated with occasional flakes of mica; white grits alternate with red, and seams of conglomerate are consolidated by a ferruginous cement. But there are also bands of brecciated rock, in which fragments, evidently of older rocks, have been cemented by silica, which gradually passes off into quartz veins. The conglomerate and breccia are chiefly composed of red quartz, porphyry, quartz, and jasper. These also constitute the beach pebbles.

As a necessary consequence of the undulations, the beds are occasionally horizontal as well as highly inclined, and thus, as at Pambula Heads, the quartz veins appear horizontal in the cliffs, where they have intruded between horizontal beds. About the commencement of the North Beach, there is a beautiful example of undulation, by which the horizontal beds on the north-west of the porphyry suddenly rise upwards, just as at Pambula Heads; the face of the cliff distinctly exhibiting a fissure which threatens to separate the cliff at some future day into two portions, one of which will be destroyed.

The summit of these cliffs is formed by yellow sand, under which yellow grit, red, and striped yellow and red beds alternate, the quartziferous portions being the exception, and, as at Pambula, nearest to the points of disturbance.

Some of the headlands along the coast are very hard, and below on these the sea breaks violently, as at Mowara, a high rock seven miles south-east by east from Eden, and at Green Point.

The effect of the sea upon the sandstones and grits has been to remove by decomposition the softer materials, the places of which are marked by very singular forms which can only be likened to a Runic inscription. Blocks so marked may be seen on the beaches about Pambula Heads.

The prevalent dip about Eden is to west 40° north, and the cleavage of the slaty red rock is from 58° to 64° towards east 20° north; the main joints run east 10° south.

In the neighbourhood of East Boyd there are indications of copper, as also below Mount Imlay. The state of the weather prevented my making a careful search for lodes of that metal. [Gold has since been found near Mount Imlay.]

The geological structure of the country, as described in this Report extends towards the County of Dampier, the same kinds of igneous rock, with similar conglomerates, grits, and quartziferous red slates, and sandstones, occupying the district towards the coast, and backed, as to the southward, by granite. They lie about the base of Dromedary Mountain, and extend nearly as far as Boogongo. On the coast north of Bateman's Bay, they are succeeded by beds belonging to the Carboniferous era.

Viewing the reddish and purple deposits of the coast of Auckland in connection with the red and slightly purple deposits along the coast to the northward of Dampier and St. Vincent, as along the Illawarra coast, where these rocks succeed in apparent descending order to the fossiliferous rocks of Wollongong and Black Head near Kiama (which belong to the *base* of the "Carboniferous System of Europe"), and considering the evidence satisfactory as to the Silurian age of the deposits of Maneero, I am tempted to place the sedimentary rocks of Auckland in the intermediate position between the Carboniferous and Silurian systems, and, therefore, to regard them as in some measure representing the Devonian rocks of Europe.*

The porphyry which has disturbed these rocks is younger than they are, but it is of the same kind as that quartziferous porphyry, which has supplied materials for the formation of many of the beds in the lower carboniferous rocks of the Hunter River District, and which is, therefore, older than some portions of the Carboniferous system. The succession, therefore, appears pretty well established, without the aid of fossils, which may hereafter be discovered after further investigation. The only fossil I have seen was a portion of a bone embedded in the red grit of the South Head of Twofold Bay, which some years since was found by my late nautical friend, Mr. T. B. Simpson, well known for his intelligence and zeal in the cause of Australian investigation, and for his search for the papers of my unfortunate friend Mr. Kennedy, who was killed by the blacks in York Peninsula. But as this specimen was sent home by me with a large collection of rocks and fossils, which are deposited in the Woodwardian Museum in the Uni-

* The north of Devon exhibits sandstones and red argillaceous beds, highly contorted. Quartz and porphyry are also associated with them. (See De la Beche's Report on Geology of Cornwall, Devon, and Somerset, p. 47—50.)

versity of Cambridge, I cannot now refer to it more particularly.

The proper determination of the relative ages of various geological formations can only be brought about by very minute and careful comparisons of the order of succession of rocks and of their fossil contents; but I do not presume to have attempted more in this Report than to express those views which I am led to entertain, after having at various times examined the colony geologically from beyond 27° towards the northward, and to 37° to the southward, and from the coast to the interior, at various localities, between 153° and 144° east. Although the information obtained may not be sufficient to arrange the Australian succession in intimate analogy with the succession in Europe, I nevertheless desire to record in this place my conviction, that the general order of succession appears to be so far certain, that further enquiries will be conducted with less difficulty than heretofore, since by fossils collected by me years ago, and which have been determined by Professor M'Coy, the existence of the old Carboniferous system of Europe in this colony, has been satisfactorily established; and in my more recent investigations the existence of the fossils of the Silurian system, and, as I believe, also the existence, as above declared, of a formation analogous to, if not identical with, some portion of the Devonian system of Europe, have been made out. Fossils which belong, apparently, to the base of the Devonian, or to passage beds between the Devonian and the Upper Silurian, exist in the ranges between Yass and the Murrumbidgee.

These facts and inferences are important, as they demonstrate unequivocally that the greater portion of New South Wales is occupied by Palæozoic formations of the older class, and that, therefore, it is one of the oldest countries on the face of the globe.

P.S.—In this and other Reports, where aboriginal names of localities and features are introduced, I have been guided in the orthography of such names, by the sounds uttered by the Aboriginals from whom I received them. There are a considerable number of such names in these Reports, which, till now, have never been recorded, and in some cases, the localities and features do not appear upon any published maps, or in any not published which have been furnished to me by the Survey Office. In instances, when I have deviated from the orthography adopted by Sir T. L. Mitchell, in the mention upon the Maps of the Survey Office of places and features recorded by him, I have adopted the orthography which appeared most in accordance with the pronunciation of the tribes in the vicinity of those localities, having noticed that the same localities are occasionally expressed in different manners upon the Maps supplied by the Survey Office.

It is admitted by geographers to be undesirable to vary the orthography of names once recorded in public documents; admitting this fact, I may, however, remark, that some discretion must necessarily be permitted in dealing with names, respecting which no *law* of orthography can be made to apply, and as there is no Map of the Colony at present which affects to be complete, or upon a sufficient scale to admit the introduction of all the native names, it is, perhaps, impossible at this time to fix what may be the final orthography that will be adopted.

In following the example of Sir T. L. Mitchell, who in collecting the native names has done good service to geography, I have been also desirous, whenever I could, of adopting those which I have found perfectly acquiesced in by the Aborigines to whom they are known. [There is an exception introduced in the Maps of 1860. The diggers' name, Kiandra, has been adopted by the present Survey Office for the Aboriginal name Giandarra.]

I venture, upon the advantage afforded by this Report upon the Southern Districts, to express to all classes of the inhabitants of those Districts, my obligations for the hospitable reception and assistance which they so willingly gave me in the prosecution of my researches.

In some instances I could not, with the slender means at my disposal, have traversed the mountains so readily as I was enabled by the aid afforded me, and it is but an act of justice thus publicly to record my acknowledgments of that and many other welcome services. The Government furnished me with all I requested; but I found, that without a geological staff, and with only two men to perform the necessary duties of encamping, cooking, and grooming, and without any aid of a scientific kind, it was impossible for me to carry out fully all I desired to do.

REPORT No. XIII.

ON THE OCCURRENCE OF GOLD IN THE COUNTY OF DAMPIER, &c.

Pambula, 10th March, 1852.

As to-day, on my way upwards, I have received a confirmation of intelligence previously made known to me, I think it my duty to state to you, for the information of His Excellency the Governor-General, that gold has been found by persons who, I understand, are employed in obtaining it in Dignam's Creek, near Mount Dromedary. My informant tells me, that if there were less water than now abounds, he thinks a considerable quantity of gold would be procurable. If I did not consider it imperative upon me to return to the Bendoc and Deleget country, I would now alter my route and visit the locality.

I mentioned in my Report of 21st October, 1851, [Chapter II., p. 29], the occurrence of gold in the neighbourhood of Wondilla.—Mr. Hargraves, however, having reported, that he found no gold except at Baloury, and that, only, in inconsiderable quantities, I did not think it worth while departing from the plan of exploration I have adopted, to go to that part of the County of Dampier; but I now learn, that Mr. Hargraves did not go further than Baloury, and, therefore, the vicinity of the Dromedary was not searched. Baloury is, I believe, about 24 miles from Bermagüee, [five miles from which Mr. Campbell's people were procuring it in September, 1853.]

Campbell's River and Stony Creek are now named to me as holding gold.

The Dromedary country is, therefore, probably worthy of inspection. [Having since the date at the head of this Report been three or four times in the vicinity of the Dromedary, I have come to the conclusion that gold exists in many localities near its base.]

Between that country and this, gold has also been found in the Dry River (Murra); and I have reason to believe, that it will be found in the creeks running N.E. from the Jingery Range, (which is about 13 miles S.W. of Pambula); as in Greig's Creek, the salt-water portion of which is crossed by the road from Pambula to Eden, a noticeable specimen of gold has been found under peculiar circumstances. [Gold also exists at what is termed Honeysuckle Flat, near Eden, and has been found there on several occasions. Mr. M'Crae, a noted gold prospector, and who is now at the head of one of the parties sent out by the Government of Victoria, applied to me in person, in Nov., 1859, bearing an official letter of introduction, to ask me to procure for him the right of working gold near Twofold Bay, and I told him at the time, that I had reported its existence there in 1852. All these incidental circumstances justify the impression, that the coast counties will, hereafter, produce their *quota* of gold.]

CHAPTER X.

BENDOC AND DELEGET GOLDFIELD.

REPORT No. XIV.

ON THE AURIFEROUS CHARACTER OF THE
COUNTRY ALONG THE BENDOC AND DELEGET RIVERS.

Boroungoma, Bendoc River,
22nd March, 1852.

My 12th Report was dated from Eden, Twofold Bay, from which place I intended to proceed to Cape Howe; but a heavy gale, attended by abundance of rain, having rendered it difficult to pass the rivers to the south, I determined to complete my examination of the country along the Bendoc and Deleget Rivers, (from the former of which I transmitted to you a sample of gold,) before I made further explorations in the County of Auckland.

I have now the honor of reporting to you, for the information of His Excellency the Governor-General, the result of my enquiries and examination into the extent and character of the Gold Field along the boundary of the Colony and around Deleget Hill, about the meridian of 149° E.

It may be useful to comprehend distinctly the position of the locality in question, which, by the aid of the chart, and the general geological description given in my Report of 6th of March, will not be difficult.

From the head of Maharatta Creek, "the Dividing Range" turns south-westwardly, and curves round still further to the west about the meridian of Deleget Hill, so as to throw the drainage of the waters on each side of that mountain to the northward.

The Dividing Range itself preserves a moderate elevation all round, but falls gradually (as it does all the way from the head of the Bemboka, whence I have traced it) towards the heads of the Bendoc and Deleget Rivers. The coast side of the Range, is, in the neighbourhood of the head of Maharatta Creek, marked by some lofty peaks and ranges, such as Theringo, Yarramgun, (with Killeerooma at a lower level) Berrimgbo, Nelbung, and Coolungubbera,* the latter ending, as it were, the more prominent features of the chain, and being succeeded by only a few less remarkable eminences between the heads of the Jenoa and Bendoc Rivers.

At Deleget Hill, which has as singular a relative position to the country around it as the Budawang has to the country along the Mongarlow or Little River, near Braidwood, each being of a similar geological structure and of very nearly the same height,† the high lands again commence; and these are seen from the summit of the mountain succeeding each other in the Nelbundera,‡ Tambong, Kurrabong (or Currawang), and Jingo Ringo Ranges,§ till they rise into the loftier regions of the Alps. These ranges are extremely broken, and have sustained various physical derangements. The singular course marked out by them for the Snowy River, from below the junction of the Deleget River, is well delineated on the chart, but nothing can so

* The south-eastern extremity of this mountain I make 3712 feet above the sea. The elevations of the other points are all under 4000 feet. Coolungubbera is a very prominent mountain, and from some exposed rocks nearly under the point measured, is conspicuous from the N.W. by S.W. to S.E. The point nearest to the actual division of the waters is Berrimgbo; Nelbung lies between. [See p. 181.]

† From 3800 feet (B) to 4000 feet (D).

‡ Belonging to the slate formation. The highest point is about south from Merinoo.

§ These contain much granite.

clearly convey an idea of this dislocated region as a view of it from the summits that overlook it.

On a bearing of S. 42° W. (mag.), from the summit of Deleget Hill, there is a gap or very low depression in the Dividing Range, and S. 10° W. (mag.) from the same station, rises a saddleback hill of no very considerable elevation, called Guningerah; these points marking the principal directions whence the waters of the Bendoc River have their source.

These waters accumulate in swamps and bogs extremely difficult to pass, and in places quite impassable, being deep both in water and mud,* surrounded on all sides by frequently impervious gum scrubs† and cotton plant and fern jungles,‡ which render exploration almost impossible and supply the securest shelter to the eleven§ miserable and timid Aborigines who now form the "remnant that is left" of the once more formidable Bidwilli tribe.

At the back of this runs southward a creek called, I believe, the Bidwilli River.||

The Deleget River takes its rise in three heads more to the west, and part of its waters flow along the base of spurs stretching from a range that separates them from Jingalaba River, which meeting Amboyne Creek in the Tebbut country, with it forms the Deddic River,¶ which runs S.W., transversely to the former directions of the Jingalaba and Amboyne into the Snowy River.

Deleget Hill is, therefore, not, as represented by the general features of the country, a source of disturbance, which persons regarding its prominence and position have sometimes considered it, but a mere projection in a geolo-

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* A stick forced downwards in one place found no bottom at fifteen feet.

† The chief cause of the prevalence of these scrubs is the occurrence of fires once in about every three years, so that the saplins of the scrubs cannot attain a large growth. The species is also one that seldom reaches a considerable size.

‡ The fern trees actually stand in the water in some instances.

§ 7 men, 2 gins, 2 children.

|| There is some confusion about this name, and the Bidwilli country is considered by some to extend more to the west. But the tribe of Bidwilli frequents the locality mentioned. It is not improbable that the creek named may be known under another designation.

¶ The banks of this river are slightly auriferous.

gical direction of rock harder than those at its immediate base. This rock is a very hard semi-crystalline quartzite, being a member of the slate formation mentioned in my 12th Report.

The strike of this quartzite, forming a long irregular ridge, of which the summit of Deleget Hill is the crest, at an elevation of about 4000 feet above the sea, is rudely parallel with the courses of the rivers at its base, with the Dividing Range to the eastward, and with the Snowy River in the Willis and Biddi country; these forming, as it were, parallels with the shorter sides of the irregular parallelogram formed by the Snowy River and its affluents in that area to the north-west of the Deleget River, which is cut unequally by the boundary line between New South Wales and Victoria.

Further to the eastward, six or seven miles along the Bendoc River, and on the boundary line, a high range running northward separates the Deleget from the Little Plain (or continuation of the Bendoc) River; being a portion of the slate formation which, beyond the Bendoc to the east, abuts upon the granite of Quinburra, and which eastward of Boroungoma is pierced by it. Northward from Iandoon, on the Little Plain River, there occur on the summit of the range masses of a granitic rock of a semi-schistose kind, composed of a yellowish felspar, green mica or talc, and a little quartz. It is, probably, one of those singular forms of granite, which, in New South Wales, appears to pass as dykes through slate or older granite. One of these passes through granite between Boroungoma and Dundundera, having nearly an E. and W. direction (92° mag.), and being transversely jointed; (the width of this dyke is from 8 to 12 inches).

The slaty rocks at the junction with this granite, *west* of the spot last indicated, are transmuted into a gneissiform substance, and betray the same intrusive agency as the altered slates near Brogalong 13 miles, and on Maharatta Creek, 5 miles to the northward, and on the *east* side of the same granite. This granite is mentioned in the 12th Report. The additional example now adduced from the western side of that mass confirms my deductions from what I have already noticed on the eastern side.

The continuation of the slates of the range north of Iandoon is marked by considerable dykes of white and ferruginous quartz, not only near Boroungoma, but also on the other side of the River (Bendoc or Little Plain*) on the road to Deleget station, at the highest point of the division between the Bendoc and Deleget Rivers, and not far from Bendoc station. South of Dowenundera, along the Great Dividing Range, granite flanks the Iandoon range, the schistose rocks not coming much beyond the Bendoc; and again, on the N.W. of Deleget Hill, granite† forms the base of the range bounding Heyden's Swamp to the west, and also becomes prominent about Tambong.

The above description will indicate that the Bendoc and Deleget country occupies a kind of trough between bounding masses of granite; that, at the junction with the slate formation, there are evidences of granitic intrusion and transmutation; that the slate formation is marked here, as elsewhere, by hard bands and deposits of quartzite, and that quartz dykes traverse them as well as the slates. The latter, I may add, also send forth strings and thin veins into both slates and quartzite; and pierce the granite as well. I may further add, that these veins are sometimes ferruginous at their edges, and that at the planes of contact with the slates are marked by nests of green mica or talc, similar to that which is an ingredient in some of the granites; and that the slaty rocks alternate with schistose beds of a highly felspathic grit and occasional sandstone rock, all observing a parallelism of location, and apparently subjected to the same general physical laws. These rocks are occasionally concretionary. The strata also undulate both horizontally and vertically, suffering cleavage.

The extreme southern portion of the county of Wellesley is, therefore, in all respects conformable in geological characteristics with those more distant tracts of Silurian rocks already described in my former Reports.

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* I use the term "Little Plain River" because it occurs on the maps; but it is an unmeaning designation. What is called a "Plain" is merely a clear space of very undulating and extremely broken country. This part of the river conveys the water of all the branches of the Bendoc to the junction with the Deleget River. The settlers have given names to the branches, and have made confusion, and these names are as changeable as the occupants of the soil.

† The constituents are black tables of mica, clear quartz, and greyish white felspar of fine proportions.

To complete the connection with the rocks on the other side of the Brogalong and Dundundera granite, I mention that at Boroungoma there exist on the summit of Kurrow Hills, beds of conglomerate of quartz, slate, and iron, and ferruginous grit and sandstone; being outliers of the ranges of Sojerree, Toonit, and Kalungera, which stretch from Bombalo towards Diliganea.

I have no reason to doubt, that the same formation may exist in patches amidst the jungles at the head of the Bendoc, in the fluviatile drift of that river. Five miles south of Deleget Hill, I found fragments of well-developed quartz grit, little differing from the Bombalo rock; but I believe this to belong to the Silurian schists.

I have now to mention that, along the Bendoc and Deleget rivers, the slaty rocks are not generally hardened, but more frequently soft, often friable, with open laminæ. The grits of these softer varieties of slate are also fine and soft; and the whole have, therefore, more easily yielded to the disintegrating effects of the elements and the action of water.

In consequence of this texture, the waters supplying the rivers have found easy passages, not only along the cross joints, but also along the strike of the disintegrated laminæ and cleavage planes and joints, and these evidently determine the main bends of the rivers.

I believe that the various branches forming these rivers have not been all surveyed; but that there are more than are yet laid down upon the charts. I traced them up some miles beyond Deleget Hill, and found them all of one character; clear rapid brooks flowing in valleys of from fifty to one hundred yards wide,* with banks determined by the strike of the slates, and the channel ranging from side to side in the deep alluvial accumulations that fill the valleys, in turns so sudden and frequent as to defy any accurate representation of them without the most patient and laborious delineation. Often there are not two feet of breadth in the isthmuses that separate the tortuous meanderings of these cheerful streams, and these are, therefore, very easy to be cut through; but the soil is, probably,

* The main rivers are of more considerable width. The smaller streams vary in breadth from three to nine feet.

universally water-logged.* The surface is covered by tufts of coarse grass, which hide the actual courses of the streams, so as to make progress along them a cautious proceeding, and a passage through them not always easy, owing to the boggy nature of the immediate bank.

On examining the alluvia filling these valleys, which I was enabled to do nearly as far as Gullengarrigal, on the most western arm of the Bendoc River, I found that they consisted partly of clays containing masses of soft grits, many of which, from the bluish hue, I was enabled to refer to the rocks upon the bank of the valley close at hand; or of shingle composed of quartzite, quartz, crystals of quartz, sandstone, grits and slate, a few *soft* fragments of which are distinguishable.

There can, therefore, be no doubt that the alluvia are all local (no foreign drift, at least, having been detected during my explorations), and derived from the slate formation or overlying rocks. I saw no granite, or materials of veins from granite, except near the granite ranges touched by the rivers.

My examination was assisted by the means afforded by several considerable holes dug in the alluvial clays, a little north of Gullengarrigal, and as far down as Boroungoma, and I was, by these excavations, enabled to see that in some places the surface clay in the valleys is from six to ten feet thick.

On the slopes and summits of the bounding ranges clays also occur, and fragments of quartz and slate are entangled in them. Many of the clays are white, mottled, or red. The pebbles contained in them are only partially rounded.

The superficial drift in the vicinity of the harder beds, and especially near quartz veins, consists of portions of those rocks strewn on the ground, and resulting from the original jointed structure of the substances; by which means dew, rain, snow, heat and frost, have been enabled to produce results equivalent to those of a force of another kind. In some localities, however, as on the banks of the Deleget

* In all the excavations I had made in the flats along the Bendoc, water rose after reaching a depth of from five to six feet, and prevented the search for gold. I believe it will be found in all these flats, and in the alluvial isthmuses between the river bends. I succeeded in one instance near Boroungoma in obtaining gold, from the black alluvial soil of what was once a channel, before the water rose, at a depth of four feet.

River, near the station of that name, and elsewhere, the surface is covered by innumerable small nodules of ferruginous clay and ironstone. The highly inclined position of the bands of quartzite has also assisted in spreading down the slopes of Deleget Hill, and other similar masses, many heaps of fragments which retain their original outlines.

Finally, I have to remark, that in the rivers there are numerous waterfalls, though none of considerable height; and these are occasioned by the bands of the harder rocks which happen to lie across the directions of the bends in the channels.

We have then, in this region, all the aids necessary for the distribution of gold; and, therefore, it is but natural to expect, that if the formations are auriferous, indications must be numerous, considering the extent of country watered by these living streams, some of which are so prolific, that, at all seasons, in some places, they well up out of the ground in advance of the swamps, or run under ground for considerable distances. Nor do I find, that the volume of water is, permanently, much increased by violent rains, the swamps being sufficiently capacious to hold several years' supply.

Now, what deductions from the above-mentioned physical facts would declare, experience abundantly confirms.

The whole of this region *is* auriferous. I cannot say what may be the ultimate result of multiplied labours, but I am justified by my own experience and the testimony of others in asserting that, in every spot in which a spade has been inserted over a very considerable portion of this region, gold has been produced. In other localities it is found from 6 to 10 feet below the surface: but I have myself found it in surface drift; in accumulated alluvial earth filling up ancient channels when the water was still more abundant than now; in the rotten slate under gravel; in the laminæ of slates not rotten; in the interstices of small veins of quartz traversing the grits associated with slate; at the level of the rivers; upwards from the level to the top of the banks, as high as 25 and 30 feet above the waters—in one instance from the surface soil in the bed of a sawpit; and even from the roots of a tree blown down at that height I took a piece of red clay containing shingle, in which other eyes as well as my own saw the gold.

At Gullengarrigal, at Featherstone's, at Allen's, at

Bendoc (Hensley's), at Iandoon (Lawson's stations), at Heyden's swamp near Deleget, at Boroungoma (Nicholson's saw-pit), and at various other places between these stations and Merinoo, at that place; and at Tambong gold occurs. Excluding Maharatta Creek, in which the indications are inconsiderable, we still have an area of upwards of 400 square miles in which gold occurs along the drainages that now water the country.

Perhaps it is not likely, that where it is so widely distributed it occurs in any spot in great abundance; and after all, this very gold field may add but little to the commercial wealth of either Colony. Yet it does seem rational to hope, that there may be some spot more favoured than others in which the metal has been deposited in such quantities as to make it profitable. I will only venture to state facts, leaving others to investigate their importance. In the present imperfect way of prospecting which has been adopted by two or three persons on these rivers, gold has been in my presence procured at the rate of a grain to four spadesful of soil, and other persons have gained five shillings *per diem.*

Whatever may be the commercial value of this region, its importance in a geological view is very great. I have dwelt very long upon its geological features, because of their importance.

Hitherto, I have seen little of gold in this southern country which I could not satisfactorily attribute to the influence and existence of granite. Here the prevalent rocks are of the slate formation; and, from what I have seen, and the examination I have made of the gold itself, I am persuaded that it is local, and derived from the ferruginous quartz veins which traverse the slates and associated grits.

There is no doubt that it occurs in a green soft muddy slate (looking blue when wet,) which decomposes into a greenish mud of the same tint, but not of the same component parts, as that which supplies gold in Major's Creek, Araluen;—I washed it myself from that rock.

On one specimen in my possession, and which weighs fifteen grains, I observe one side to be marked distinctly by the minute points of quartz and the laminæ of a fine grit, and on the other side the gold folds over and entangles several minute pieces of quartz. All the gold that I have seen, included in two or three ounces, is of the same character;

it has rugged distinct protuberances produced, probably, by its original insertion in cellular quartz, or sides exhibiting a delicate roughness as if having been in contact with a plane, slightly uneven, surface.

The greater part already found is very fine gold, like the sample I had the honor of transmitting to you on a former occasion; but I have several specimens of larger size, intermediate between the pieces in that sample and the one named above. With the gold occur the species of iron improperly called Emery, and that peculiar variety which is so common at Araluen. But abundance of Emery also occurs here as in all the gold fields of the Colony.

Whether any still more weighty gold can be procured, will, probably, ere long, be determined. I have done all I can to encourage the trial.

The only fact which I now wish to dwell upon briefly is, that this prevalence of gold so far to the southward must, in connection with the occurrence of it in numerous other localities in which I have reported its existence, satisfy the public that I did not overrate its probable occurrence as co-extensive with the Colony, when, years ago, I encouraged the search for it elsewhere than in the basin of the Macquarie.

It is an astounding fact, and one which I am gratified to have been able to demonstrate, that (taking into account other localities in which I know it to exist beyond, though near to, the limits of the Maneero District) gold is distributed, though in variable quantities, and of, perhaps, small commercial importance, over a region which may be said to embrace an area of 16,000 square miles. In this area I include no portion of country northward of the parallel of Marulan: and I also except the counties of St. Vincent, Dampier, and Auckland: but I have included the trap country dividing the basins of the Murrumbidgee and the Snowy Rivers, because I found gold at the junction of the trap and the slates at one spot, and there are geological data to induce the conclusion that the slate formation extends under the overflowed trappean country; and as similar granites to those in which I found gold elsewhere have been also traced, where my time did not admit of direct search for the metal, I think the area defined might be safely extended. I had the honor of forwarding to His Excellency the Governor-General, in August last, a fine sample of gold from Yass River, (p. 9), and I have since had the honour of reporting the existence of gold in the neighbourhood of Tarcutta, in the copy of a letter from a gentleman who found it there, in reliance upon my authority that it there exists. (p. 134.)

I can, therefore, have no hesitation in declaring the whole of the vast region above defined to be, more or less, auriferous.

Although only incidentally connected with the preceding remarks, I cannot refrain from one observation respecting the Mitta Mitta Gold-field. Certain persons, some of whom never ventured to reach the locality, having been deterred by the difficulties presented by the mountains, and others who found other difficulties in want of rations and supplies, and some who have not had sufficient patience, have spoken in detraction of that locality; for this I was prepared. I have elsewhere stated my conviction, that gold-seekers of a certain class will naturally turn away with contempt and "disgust" from granite gold on account of the labour necessary to obtain it. They will not look at such a place, when within a few days' journey from Ballaarat or Mount Alexander. But when the bustle and gain of those regions shall have passed away, then some few, perhaps, at a future day, will find even Mitta Mitta more profitable than it has been represented, and the Bendoc Gold-field than it now seems to be. [In 1854 the first part of this statement was verified; nor has the latter part been unverified.]

Gold in small quantity has been found on the Dividing Range, between Omeo and Gipps Land, at or near a locality termed Dargo. [A considerable gold-field was being worked a little below this, in 1859.]

I cannot, however, help thinking, that it may be well for the country, that all localities are not equally valuable, and that laborious and sensible persons who prefer attending to their proper business, instead of deserting their occupations and homes to swell a multitude of strangers, who will disperse when they shall have cleared out all the treasure, have, in some spots, a prospect of obtaining a little of the gold at their own doors in moments of leisure, without the risk of losing it all through the greediness of others.

Whatever may be the final result, I have the satisfaction of being conscious that I have done my best to make known the probable auriferous character and value of no inconsiderable portions of territory in this Colony, and of some portions of the neighbouring Province.

And I take this opportunity of expressing my thanks and acknowledgments to His Excellency the Governor-General, and to the Honorable the Colonial Secretary, for the very gratifying terms in which they have been pleased to mention the manner in which I have conducted my survey.*

I have now a duty to perform of another kind. Should this gold field eventually become valuable, occurring as it does on both sides of the boundary line of the two colonies, there will be necessity for arrangements to maintain the peace of the country. At present, there is no police force within many miles of the boundary on the Victorian side, which is, of course, out of the jurisdiction of the magistrates of this Territory. Considerable difficulty occasionally arises when persons living in Victoria seek justice before the Bombalo Bench; and I have heard very sad accounts from persons in Gipps Land, who have been compelled, by the departure of their servants for the gold fields, to leave 7,000

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* [I consider it only my duty to the Governor and Colonial Secretary of that day to append here the documents to which allusion is made; it is due to *them* as much as to myself.

21*st February*, 1852.

"My dear Sir,—

* * * * *

I gladly avail myself of the opportunity of thanking you for the very able and satisfactory manner in which you have carried out the object of your appointment. I have received with great interest your several Reports on the geological structure of the large portion of country, which you have examined in so short a period, and I feel assured that your services will be duly appreciated by the Colonial as well as the British public.

* * * * *

I have read your letter in the *Herald*, and I think you have clearly shown that, whatever may have been Sir Roderick Murchison's predictions about gold, the matter had attracted your attention soon after your arrival (June, 1839) in the Colony.

Believe me, &c., &c.

The Rev. W. B. Clarke, E. DEAS THOMSON."
&c., &c., &c.

No. 52-84. *Colonial Secretary's Office,*
52-2112. *Sydney*, 13*th March*, 1852.

"Reverend Sir,—

I have the honor to acknowledge the receipt of your letters of the dates noted in the margin [20 Sep, 10 and 21 Oct., 10, 15, and 17 Nov., 24 Dec, 1851; 3 and 29 Jan., 6 and 26 Feb., 1852], commuor 8,000 sheep in one flock, under the care of one, and that an unsuitable shepherd. Similar complaints have been made to me by residents in this Territory not far from the boundary, and I know that in some places a woman servant cannot be found.

It is equally certain that, should a reaction take place, in consequence of the development of gold in considerable quantity, this reaction, unless under the influence of a controlling power, will be followed by grave results.

[These remarks made in 1852 have found their justification in 1860. The scene is merely changed from Bendoc to Kiandra. At any rate they prove, that I was well aware in 1852 of the consequences of the "rush" that would one day take place to Maneero, and I wished to provide for it. It is not without what, I hope, is an honest satisfaction, that I have been able to "show cause" for *every* statement I have made.]

[As a proper sequel to what has been said respecting future prospects in the gold-fields discovered by me in Maneero, and mentioned in the above and preceding Reports, the following letter is not without interest. The writer is unknown to me; but his testimony is valuable, as proving the accuracy of my representations and the confidence placed in them by those to whom he alludes. It is taken from the Melbourne *Age*, of 16th February, 1860:—

SNOWY RIVER AND EASTERN GIPPS LAND GOLD-FIELDS.

To the Editor of the Age.

SIR,—As your paper has always most high-mindedly been the earliest to record any new discoveries of gold-fields in New South Wales,

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nicating the progress made in the geological exploration of the country since your departure from Sydney on the 12th September last, and in reply, I am desired to express to you the satisfaction of His Excellency the Governor-General at the large extent of country examined, and the able and scientific manner in which the inquiry into its geological structure has been conducted.

I have, &c.,

The Rev. W. B. Clarke, E. DEAS THOMSON."
Maharatta Creek.

Sydney, 19th April, 1852.

"My dear Sir,—

* * * * *

With respect to your future proceedings, I can only say, that the Government would be glad if you could be spared from your spiritual duties, to continue, in other parts of the Colony, the useful investigation of its geological features which you have commenced in the South.

Believe me, &c., &c.,

The Rev. W. B. Clarke, A.M. E. DEAS THOMSON."]

I beg to hand you the following rough statement of the auriferous prospects of the above district, where at length the Rev. W. B. Clarke's prognostications of its richness have been fully proved. Ever since that gentleman's visit of geological inspection to the Snowy River and Twofold Bay country, many of its inhabitants have systematically each year, while their crops were growing, or after harvest or sheep-shearing, worked or prospected particular spots which were more or less indicated by that gentleman as auriferous, and it has been well known in Twofold Bay, Cooma, Bombala, and Pambula ever since 1851, that some of the neighbouring farmers and small stock-owners depend somewhat on their luck at these private diggings for a yearly augmentation to their means. In addition to these local periodical workers, a few parties of regular diggers of the more enterprising sort—those who prefer remote, quiet, and moderately paying diggings—a large proportion of whom are Americans—have prospected and partly worked the southern part of Maneero, where the many heads of the Snowy River rise; and I have known of a party who have worked continuously for two years on the Deleget River country, on which its native blacks say "there is plenty of gold two days' journey in the scrub from Jackson's station at Deleget Hill;" and I further know, that in 1857 and 1858 some squatters in the neighbourhood had fitted out two expeditions to penetrate to this asserted El Dorado, but their drays could not get through, and some of the since luckiest Adelong reefers formed a part of that spirited venture, which failed because of the want of feed for the bullocks, the thickness of the scrub, the limited resources of the promoters, and a most unfounded fear of the Ninety-mile Beach blackfellows.

Coarse gold was found by some fencers in 1856-7, on the Bendoc River on Mr. Nicholson's station, whilst sinking post holes. In May, last year, gold of a shotty, coarse description was brought into Twofold Bay by a resident of that place, who, it was currently stated, had found it in the Kiah River, near Mount Imlay, within twenty miles of Twofold Bay. The discoverer (R*b**ts) started again immediately to attempt to reach the sources of the Deleget by following up the Bemm River from Cann's station, where also gold is said to have been found. The sources of the Bemm and Deleget are divided by the same set of ranges.

I have been informed that gold has been found up the Jenoa River, not far from Captain Stevenson's station. The country between Twofold Bay and Alexander's station on the Jenoa (forty miles S. W. of Twofold Bay) is mostly a series of quartzose hills, covered with iron bark, and described by an experienced digging friend of mine as closely resembling Tarrengower. This same digger, in 1857, *en route* to Adelong, from the Jenoa River, tried the country nearly up to the newly-discovered Gibson's Plains diggings, and he spoke most favorably of the places which he had tried. Of Deleget and Bendoc he said, "for sluicing, and by large parties both these places will answer very well; the gold is of a very good quality, and large."

Now, as Gibson's Plains cannot be worked for four or five of the winter months, owing to the snow, diggers could not do better, if in parties, than to try the tributaries of the Snowy River, down off the high ground, where snow is a rarity, and where one of the finest winter climates is to be found. (The alpacas are to be located in the same quarter, at Nimitabel, from the same cause of good winter weather.) And if any of the diggers can do it, let them prospect the main branches of the Snowy

River itself, by boats, and thus avoid the difficulties of the scrub, and of land carriage. Tea, sugar, and biscuits would be provisions enough, for the main river abounds with fish and game.

I am convinced from information gathered at and near Twofold Bay during the last seven years, that the higher, or Maneero, as well as the lower waters, of the Snowy River, will prove, on being properly tested, to contain as much gold as any of the rich Victorian diggings, and especially in quartz, and thus afford winter employment to those who, being prevented from working on the higher grounds, will be allowed to register their claims there, and proceed to less inclement situations. As to the route to Gibson's Plains from Melbourne, Twofold Bay is the only judicious plan,—well-marked roads and inns at convenient distances have existed these twenty years there; and the colliers bound from Melbourne to Newcastle, going in ballast, would gladly take passengers and horses, or bullocks, and drays and stores cheaply; or the Sydney steamers might lower their charge to meet the present bad times. Two days by steamer, or about double that time by a collier, would reach Twofold Bay; and as that place is not much more than half way between Melbourne and Sydney, the Victorian merchant will be able to compete on equal terms with the Sydney men in supplying the new gold fields with every kind of merchandise.

In conclusion I assert that the eastern extremity of the Australian Alps, out of which most of the Snowy River runs, will be one of the greatest gold fields yet discovered.*

J. C.

CHAPTER XI.

GOLD LOCALITIES ON THE MUNIONG RANGE.

REPORT No. XV.

ON THE OCCURRENCE OF GOLD IN GRANITE AND QUARTZ ON BOTH FLANKS OF THE ALPS BETWEEN THE TUMUT AND THE SNOWY RIVERS.

Jejedzeric, 3rd *May*, 1852.

I have the honor of reporting to you, for the information of His Excellency the Governor-General, that previous to my final exploration in the county of Wellesley, I became acquainted with the existence of occasional particles of gold in the quartz veins running through the schists of Nelbundera (Nelbuthery) Ranges; and that on my journey hitherward I obtained a confirmation of its existence in the

* Sir R. Murchison gave me full credit for the opinion here confirmed, in his address to Roy. Geogr. Soc., 1853: upon which Mr. John Calvert, (*Gold Rocks of Great Britain*, p. 237,) comments thus, "*I should differ in opinion from the Revd. Mr. Clarke*," what will he say, when he hears of Kiandra? W. B. C.

granitic detritus of the vicinity of the Snowy River, at Ianmungee. On a former occasion, I reported that gold had been found near the junction of the Eucumbene and Snowy Rivers; in addition, I have now to mention that it also occurs in various places along the Burrungubbuc and Gungarlin Rivers, which flow from the Snowy Ranges, between the Big Bogong and Table Top Mountains, and unite with the Snowy River. This gold is fine, and comes from decomposed granite.

On the north-western side of the range, at the heads of these rivers, the waters accumulate in deep channels, intersecting rocks of the slate formation (which meets the granite of the Alps in the gulf between the two mountains above mentioned), and flow to the Tumut. Between Big Bogong and the Round Mountain to the east of Dargal, at a considerable depth below the summit level of the main ranges, gold of a coarser variety than that found to the south-east is also found in one or more of the creeks falling to the Tumut. [The coarse gold comes from quartz veins.]

I have also ascertained that the metal exists in quartz detritus near the mouth of the Eucumbene; and that fine gold, evidently of granitic origin, exists in the detritus of the creek falling from Wallandaby Ridge, between the Crack-em-back and Mowamba Rivers.

In none of these fresh instances of the occurrence of gold, in this part of the county of Wallace, has there, *at present*, been any evidence of abundance; but the facts, taken in connection with those previously reported by me, and affording further evidence of the auriferous character of the region in question, appear to be, on geological grounds, too important to be neglected.

REPORT No. XVI.

ON THE EXISTENCE OF

GOLD ALONG THE RIVERS AND CREEKS FLOWING FROM THE MUNIONG RANGE, &c., AND ON SOME OTHER AURIFEROUS LOCALITIES.

Yarralumla, 20th May, 1852.

In my Report No. VII., dated 24th December, 1851, (p. 131), is a list of localities examined in search of gold, and under the section B, Nos. 16 and 17 are reported as having furnished no gold. In the former part of that Report I mentioned that the limit of my actual search along the Crack-em-back River, (p. 129) was Thredbo, and at the end of the list I stated, there are other localities in which I anticipated the discovery of gold.

Under the impression that one, at least, of those localities would be found along that part of the country which is watered by the Crack-em-back and Wallandaby Creek, near Thredbo, I was anxious to satisfy my expectations before I left the Highlands of Maneero; and, therefore, with a view of making further examination along the rivers flowing from the Snowy Chain, I traversed the country from the south-east, (after a somewhat careful exploration at the junctions of the Snowy River and the Delegat, and other waters in that neighbourhood,) and started for the heads of the Tumut, which rise between Big Bogong and Table Top Mountain.

As in November I had been prevented by the state of the snow from penetrating to this point from Alum Creek, I was the more desirous of closing my survey by a second attempt. The state of the weather was, however, such as to offer great difficulties, and I was compelled by a daily rain of a semi-tropical character, to wait with patience for an opportunity. Taking advantage of a cessation of rain, I set out to fulfil my intention; but I regret to state, that I was unable to accomplish the object, having been driven back from the Snowy Plain by a return of as violent and inclement weather as it has been my lot to encounter during the ninety-five days of rain with which my expedition had been previously obliged to contend. [The climate of the Alps is discussed in the following chapter.]

I have, however, the honor of reporting for the information of His Excellency the Governor-General, that I was, during this journey, able to satisfy myself on some of the enquiries which I was desirous of making, and that I visited the Snowy, Crack-em-back, Eucumbene, and Gungarlin Rivers, at points which I had not before examined, and that I found gold along their banks in the fluviatile drift, and in the old accumulations of shingle above the water level; the rivers all being in flood rendered it impossible to do more.

The prevailing and almost exclusive rocks in the area watered by these rivers are granitic, the slate formation making slight demonstration of its existence on the upper parts of the Gungarlin River, and in patches upon the granite overlooking the Gap between the Eucumbene and Gungarlin, at the edge of the Snowy Plain. [On one part of this Plain I saw evidence of the ássociation of granite and slate under such circumstances as to justify the views of certain geologists mentioned at p. 90.]

In the Report No. VII., I have already shown the disposition of the Snowy and Crack-em-back Rivers, in channels diverging from the Muniong Range, and an examination of the chart will show, that the other rivers now referred to also flow in channels ot similar kind, which are due to the jointed structure of the granite mass. These channels are bounded generally by vertical or nearly vertical walls in the higher parts of their courses, but they occasionally expand and allow the accumulation of boulders and drift at spots favourable to their formation.

At Thredbo, where the range between the Crack-em-back and Moamba Rivers (on the latter of which, I have before reported, that I found gold,) sends its spurs down to the former river, and from one of which diverge some small creeks, on passing over that country in December, I mentioned to my attendants that I expected that gold would one day be found, but there was then no opportunity of testing the opinion. I have, however, now ascertained that the opinion was well founded, for gold has been found and some specimens of a coarse kind procured. The discovery has induced some settlers in the vicinity to commence operations, but I am unable at present, to report how far they have been successful, not being willing to rely implicitly on flying rumours. [See letter at p. 213.]

The gold which I washed from the detritus and shingle, and from the decomposing granite below them, on the Eucumbene and Gungarlin Rivers, and on the banks of the Snowy River, at the points opposite its junction with the Crack-em-back, is of the same bright colour and partly flattened shape, which distinguish the generality of samples in the southern granite districts. The distance from rocks of the slate formation, and other circumstances render it more probable that its matrix is granitic than that it has been derived from quartz veins in slate: for the quartziferous slates at the head of the river are too distant to allow their gold to be drifted thus far.

The present amount which has been procured is too small to allow of any valuation of these localities, but I will not refrain from expressing in this place *an opinion, which I think will be eventually confirmed, that at a period, not perhaps very distant, Maneero will be enrolled in the lists of profitable Gold Fields*, and it is in consequence of the drainage of the inhabitants towards the fully developed localities of Victoria, that the question has not already been decided. I have been careful not to encourage hopes that might lead to disappointment, but the dispersion of gold so generally, though militating against the likelihood of many very profitable centres, still *points significantly to the high probability of the existence, at least, of one.* [One was here found in 1859–60.]

As speculating and mining companies are now beginning to be formed, I think it more prudent to confine my Reports to mere details of facts, than to enter upon disclosures of localities by the partial assistance of theory, however applicable theory may be in the discussion of the subject.

All I now wish to impress upon His Excellency's notice is, that gold actually exists in the localities I have named; and that I have undoubted evidence of its existence in all the creeks and river basins between the various points upon which I have reported already, having employed other means than direct personal inspection to satisfy myself upon the subject. By enlisting other persons in my cause, and by the institution of careful enquiries among persons who have traversed the country on their way to Mount Alexander, I feel justified in stating that, *towards the upper portions of the north-western, or commonly called true head of the Murrumbidgee, gold exists.* And, *that in all the creeks falling to the Tumut, between Big Bogong and Table Top, as well as between the Tumut and Albury*, and indeed *all the way to Mount Alexander, there is more or less gold, ascertained by gold diggers*, whose custom it is to prospect every evening at their several *bivouacs;* and, from examination of whom, I have been enabled to obtain information supplementary to my own experience. [All confirmed, in less than eight years.]

The enquiries which I have made since my arrival at *this* locality satisfy me also, that gold is procurable in the whole of the district between the Murrumbidgee, the heads of the Lachlan, &c., and the Cullarin Range; and, therefore, the inference arrived at in my Report of 22nd March, respecting 16,000 square miles of country, is strictly within the limits of the truth, and very far within them. [This statement attracted at the time the attention of His Excellency Sir Charles Fitz-Roy, who noticed it especially in his despatch of 8th July, 1852, to the British Government. It was also commented on by Sir Roderick Murchison (Siluria, 1st Edition, p. 453), who perhaps, very reasonably, thought the statement required some reduction:—for, he says, the British public are "*not to suppose, that the geologist, who thus reports, intends to say that profitable researches could be carried out over that vast area.*" Whether this is an extreme case or not, may be judged from the recorded measurements of the following areas of Gold Fields in Victoria, given in the Second Annual Report of the Board of Science in 1859.

Area of	Ballaarat Gold Fields ...	2248	Square Miles.
„	Beechworth (Omeo, &c.)	6300	„
„	Sandhurst (Bendigo, &c.)	5464	„
„	Maryborough.	4165	„
„	Castlemaine (Forest Ck. &c.).	3241	„
„	Ararat	2650	„
	Total	24,068	„

Having been the *first* to give publicity to opinions respecting the enormous probable mineral wealth of Australia, and having declared in 1847, that "New South Wales will, probably, on some future day, be found *wonderfully rich in metals*" (*Sydney M. H.*, 28th Sept. 1847, and *Tasmanian Journal*, vol. III. p. 370), I am, of course, bound to show, that in a statement, which I admit deservedly claimed and elicited remark, I was strictly within the limits of probability, and also of fact, as is proved by the above table.]

I have in Report No. IX., of 29th January, suggested that above 3000 feet it is not probable that gold will be generally procured in abundance. But that limit of elevation does not preclude its *existence;* and, like all other *opinions*, this, however well founded, must bear the test of trial. I mention, therefore, now, that the locality on the Gungarlin, which produced gold, is 4000 feet above the sea; and at a point on the Gap between that river and the Eucumbene, where *coarse* gold was procured, the elevation of the creek on the bank of which it was found is, at the spot in question, more than 4000 feet above the sea. [The elevation of the head of the Eucumbene, to which I directed the settlers to go, is higher still.]

This does not, however, appear to me to invalidate my conclusion respecting the *summits* of the Alps, which are 3000 feet higher than the Snowy Plain.

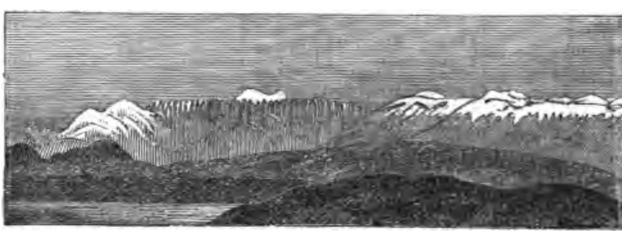
The gold procured at this creek on the edge of the Snowy Plain, and which lay upon the surface of the granite, is not water-worn, but retains its original indentations, and was covered by not more than two feet of soil, composed of fragments of granitic rock.

Assuming, then, as a datum, that the granite does contain gold, and I know not whence unabraded indented particles, like the specimen I allude to, could otherwise be derived, it is but natural, that rivers flowing in such direct channels and with such impetuosity as the Alpine torrents of the Snowy and other connected rivers, should be expected to bring down from points intermediate between their rise and well-established channels, whatever substances their own violence, or the powerful agency of snow, disintegrating the parent rock, (and the rounded blocks peeping out from the Snowy Plain bear testimony to that agency, being strictly what the French call *roches moutonnées,*) may remove. It follows, therefore, that in the banks of these rivers gold may be looked for with considerable certainty of finding it, even where no examination has yet been made.

If, in the course of my investigation, from want of sufficient manual assistance, I have not saved the gold-hunter the trouble of working out, according to his own desire, the indications exposed to him, I trust that in the Reports I have had the honor of submitting to His Excellency, I have rendered some assistance to those who are willing to explore still further the capabilities of the country, and at the same time aided the enquiries of those who take an interest in the physical geography of this vast continent.

I have written cautiously upon the gold question, because I do not share the enthusiasm or the assurance of those who, without careful examination and manual trial, either by themselves or others, take on themselves to pronounce authoritatively, without descending from their horses or their carriages, on the identical spots which they are sure will repay the employment of labour, and who are ready at a moment's notice to mark down all as available localities without fear of disappointment.

Lastly, if it be supposed that I ought to have tested more fully the capability of the ranges under the summits of the Alps before I left that district, I beg to observe, that though not ready to shrink from difficulties and not unwilling to encounter adventures, I did not think it prudent to contend with the inclemency of the approaching winter in an inhospitable position among the mountains; when I recollected that the month was May, and that in the month of March preceding, a party of Aborigines, coming from the Murray River to Maneero, were overtaken in a snow storm, and that, whilst one man was severely frost-burnt and crippled, two others were completely smothered in the drift, within a short distance of the very spot upon which I and my party encamped on the 22nd and 23rd December, 1851.



Eastern View of Kosciusco and the Southern end of the Muniong Range, December, 1851.

From a Sketch by the Author.

CHAPTER XII.

ON THE CLIMATE AND VEGETATION OF THE ALPS AND MANEERO HIGHLANDS.

I.—CLIMATE.

In this place, I think, I may suitably introduce a few remarks on the climate of the Alps. Incidentally, in the course of my expedition, as striking meteorological phenomena occurred, I have recorded the circumstances in my Reports;* and combining those notices with the following observations, which have been purposely collected from my memoranda, the inquirer will be able to obtain a slight idea of the peculiarities of the weather and climate generally in the Alps and in the higher regions of Maneero. The indications afforded by the temperature of the snow-fed rivers seem too valuable to be altogether neglected: my only regret is, that when I was crossing the highest portions of the mountains in the summer, I had not the opportunity of making *barometrical* observations, having broken all my barometers in previous excursions, and not having received any fresh instruments till I had returned from my first expeditions over the Alps. In the autumn, however, I was more fortunate.

TABLE OF SELECTED TEMPERATURES.

Date.	Hour.	Locality.	Temp. of Air.	Temp. of River, &c.	Remarks.
1851.					
Dec. 10	6·35 p.m.	Snowy River, at Jindebein.	58	51	
„ 12	2·50 „	Moamba River	68	65	
	6·30 „	SnowyRiver,Tongaro Junction.	76	66 64	
„ 13	Noon.	Camp on R. Tongaro abovejunct.	90	62	
	6 p.m.	Moyangul River, Creek joining it.	77	62 68	
„ 14	10·30 a.m.	Moyangul River.	81	57	
	2·35 p.m.	Ditto.	89	62	
„ 15	9 a.m.	Creek, summit of Pinch Mountain.	73	62	
	Noon.	Toonginbooka R.	73	56	First run of water in Victoria.
	4·30 p.m.	Wiendel River.	75	67	
„ 16	8·30 a.m.	Kurnoulee River.	65	53	East side of Dividing Range.
	Noon.	Indi River.	71	61	Head of Hume, a mile or two below West side of D. R.
„ 17	2 p.m.	Livingstone R., Omeo District.	68	61	
„ 18	9·30 a.m.	Ditto.	66	62	
„ 19	11 a.m.	Buumba River.	79	57	
„ 20	11 a.m.	Indi River.	86	62	40 miles below head; violent thunderstorm.
„ 21	9·30 a.m.	Ditto.	75	65	Increase of warmth from the fresh in the river occasioned by rain.
„ 22	Noon.	Summit of Muniong to the S., underKosciusco.	72		Only water here was melted snow.

* See p. p. 17, 64—66, 120, 124—125, 138, &c.

Date.	Hour.	Locality.	Temp. of Air.	Temp. of River, &c.	Remarks.
1851.					
Dec. 22	8 p.m.	Summit of Muniong to the S., under Kosciusco.	60		
,, 23	3·30 a.m.	Ditto.	57		Strong N.W. wind.
	7·30 ,,	Ditto.	59	40	Facing the west. Water in the rocks running down. This is the temperature of melting snow.
	9 ,,	Crack-em-back R.	72	57	Small arm.
		Ditto.		53	Large arm, rushing from the snow at junction of streams.
	11 ,,	Do., 6 miles below.	80	54	
,, 24	Noon.	Snowy River, at Jindebein.	78	54	There were violent thunder-storms and deluges of rain, and the rivers were in flood. The Snowy River seems to have gained a temperature of 3° in 14 days; but this could not be from increase of *snow water*,—therefore I attribute it to the rain.
1852.					
April 16	3·45 p.m.	Deleget R., Nelbundera Hut.	69	60	
,, 20	10·55 a.m.	Junct. of Deleget and Bombalo R.	75	64	The Deleget was warmer than the Bombalo.
,, 30	2·35 p.m.	Snowy River, above Ianmungee	74	63	The river here rushes over blocks of granite in its bed.
May 12	9 35 a.m.	Eucumbene, at Calkite.	62	55	River in flood. Rain all night.
	3 p.m.	Gungarlin River.	57	52	On the Snowy Plain, 7 miles from head of the Tumut. River in flood.
,, 13	3 p.m.	Junct. of Snowy R., and Crack-em-back.	49	51	The whole of this day there was a heavy gale, with rain, sleet, and fog. At 10·17 a.m. on the Snowy Plain, the temp. was 37°; wind, S.E.
	4·52 p.m.	Junct. of Snowy River and Eucumbene.	47	53	Raining hard. This and the preceding observation prove that the Snowy River is colder than its tributaries.

The highest temperature of river water observed on the Snowy River, at midsummer, was 66°; the lowest at the end of spring was 51°. The temperature of the water at the "Crack-em-back," close to the snow, shows how influential is the temperature acquired by the rocks in summer: for it was as high as 53° just under its source, coming down in a torrent from above. The above table will do away with any idea of an insupportable climate. Probably, some of the river temperatures were due to the heavy thunder rains of summer, and the equally heavy storm rains of winter. All the rivers I crossed in April and May, 1852, were in flood, and

I had to swim over them. In June, Gundagai was drowned, and it was the gathering of the tempestuous weather preceding which induced me to quit the Eucumbene and the Snowy Plains above it, just as I had found gold therein.

I may mention that on the 28th October, 1851, the day I ascended Kugarloa, or Sugar Loaf Mountain, near Gidleigh, to obtain its altitude and to take angles from its summit, I saw the whole of the mountains and high land along the Murrumbidgee, and from Jallula and Marragural at the head of the Coodradigbee, and all the ranges at the head of the Murrumbidgee, as well as Mount Tennant and the Tynderies, covered with snow. Indeed the whole upper country from S. and S.W. to W. was as white as Mont Blanc itself. Snow fell on the Gourock range on 11th October, and on the 13th and 14th, I saw masses of it in the rocky hollows west of Jineroo.

I was within sight of snow from October to the middle of May, 1852, whenever I ascended any considerable elevation; and though I noticed its decrease, day by day, during the warmer months, yet it never entirely disappeared, either along the Muniong Range, or at the head of the Murrumbidgee; though on the 8th May I observed, that there was but little on Kosciusco, except at the base of it. Tackingal (Table Top), and Jagungal (Big Bogong), and the ridges around Giandarra, were then free from it. The evaporation from the melting snows appeared to be one great source of the frequent thunderstorms and heavy rains, that were continually occurring; and the clouds that rose in dense masses from the summits of the Alps always took most wild and singular forms.

On 28th May, and again on the 31st, I was on Therolonong,* above Lake George with the Honorable T. A.

* The spot was marked by a stringy-bark tree, overgrown by saplings which I cleared away, bearing on a blaze in the wood the initials T. L. M. (Thomas Livingstone Mitchell,) and P. P. K. (Philip Parker King). Whilst I was at work with the theodolite, Mr. Murray very flatteringly, of his own accord, added W. B. C. to the letters on the tree. On my return I told Sir Thomas, who expressed his delight that the tree had survived the tomahawk of the Blacks and the bush fires. Captain King made this spot by barometer 3108 feet above the sea. My determination also, by barometer, was 3110 feet, which is a satisfactory agreement between two observations, by different observers, at different seasons and after a long interval of years. The tree is 842 feet above Winderreedeen House, on the Creek north of Lake George. (See next Report.)

Murray Esq., endeavouring to take angles on the mountains at the head of the Coodradigbee. On the 31st, the whole of the sky in that quarter was of a dense dark grey colour, and the summits of Mounts Marragural, Jallula, Tidbinbilly, &c., were under the influence of the most extraordinary refraction, perpetually rising, falling, and assuming the most fantastic shapes. The floods that were so soon to follow were occasioned by heavy rains draining into rivers already bank high, and from ground thoroughly saturated.

On the Southern end of the Muniong, I found the snow, upon which I lay at night, resting in patches, along the slopes and in the hollows of the mountains. It was dry, hard and powdery, capable of being blown away from the surface, and the horses that stood on it made no more impression than they would have done on a hard road. It did not melt on the surface, but from below the masses, which were from 16 to 40 feet thick; and where there was contact with the ground, it was wet and discharging moisture which gradually collected into innumerable little channels forming, at last, into streams and cataracts.

I thrust my hand at night under the blanket into the snowy substratum, and found it dry but intensely cold, and the north-west wind, notwithstanding the recorded height of the thermometer, was equally unpleasant.

The snow itself was not exactly in the condition of that which I saw on the glaciers of Mont Blanc, and which is called "névé," nor was it strictly "neige:" it partook of the characters of both, and, though not lying on ice but on the rocks, was certainly in a transition state, being partially consolidated. It had been, I doubt not, often partially thawed and re-congealed, the snows of many winters contributing to it. Hence its imperfect crystalline structure.

But it had nothing of the character of the *glacier* about it; and I believe the only ice which forms during the present epoch on the Australian Alps, on the pools and swamps, is not thicker than that of a pond in an ordinary English winter. Probably, in earlier times, glaciers did form; for I saw more than one unmistakeable "*bloc perchè*," a mass resting on upturned edges of strata. Everything led me to conclude, that the snow falls paroxysmally on the Muniong Range, and lies for years partially unmelted in the hollows and recesses, and down the slopes. In some winters, depending on the winds, the season is, no doubt, mild; it appeared to be extremely so in 1860, till the first snow-fall on the 13th June; and not till the end of July has there been any accumulation of more than ten feet; but in others, judging by the stunted and gnarled branches and stems of trees, which, at an elevation above the sea of about 6000 feet, form a greyish blue line as far as the eye can see along the mountains, and from the immense quantity of huge trees thrown down, with broken branches, on summits lower than that, I conceive that there are tremendous snow-storms, and that unprotected travellers or sojourners would perish. Nay, Yarrangobilly, and other stations have been abandoned on account of the depth of the sudden snow drifts. With the example of the convent of St. Bernard on the European Alps, at 9000 feet above the sea, in a latitude four or five degrees higher than that of Kosciusco, it is certain, that there is nothing to prevent any one *properly provided* from wintering on the Muniong: and my only surprise was to see perpetual snow at all, at a level so far below the calculated snow line. But the accident that befell the Blacks (whom I saw afterwards) in the month of March, shows how imprudent it would be for persons unprovided to brave the sudden and violent variations of climate. So sudden, indeed, are the changes of weather in the neighbourhood of the Muniong, that snow fell in the night of 8th December 1851, and whitened the range. It is in this way, that the old snow receives accession. [Seè the wood-cut.]

It seems strange to some, that perpetual snow of any kind, even in similar proportion to that which is found in the hollows of Ben Nevis in Scotland, should be met with so near the equator as 36°, at an elevation of only 6000 to 6500 feet, which is the fact at the south end of the Muniong; whereas on Mont Blanc, in the latitude of 45° N., the snow line is 8500 feet above the sea. But, it must be borne in mind that the southern hemisphere is peculiar in its relations to temperature; and in fact, there is a case in South America, which very much resembles that of the Muniong; viz., that of Antuco in the southern part of Chili, in lat. 37° 40′, on which snow lies at the height of 7960 feet, yet even this is far higher in proportion than the snow of Kosciusco. In Tasmania, I saw the summits of the high ranges about Mount Field in 42° 45′ S. covered by snow on 17th June, 1856, and the ranges between the Mitta Mitta and the

Ovens, on which snow rests nearly all the year, quite white with it so late in the season as 16th December, 1851, a few miles only to the south of Kosciusco, and at the head of Snowy Creek, one of the gold streams running into the Ovens. The Fainting Range in Gipp's Land, was seen covered by snow in May, 1842: and snow fell on Mount Alexander on 11th July, 1860.

In January, February, and March, 1857, at an elevation of 3400 feet above the sea on Mount Macedon, between the Alps and Mount Alexander, dense fog prevailed for 37 days: fog occurred 9 days in April, 20 in May, 15 in June, 15 in July, and 14 days in August. Snow fell occasionally from May until August, and on the 30th June it fell to the depth of 3 inches. *(See Mr. Brough Smyth's Third Meteorological Report*, 1858, p. 13, in which he pays a just tribute to the zeal and patience of Private Owen Egan, R.E., in charge of the men clearing the Mount as a Trigonometrical station, at that inclement position.*)*

It appears only reasonable to suppose, that though there are no glaciers in these latitudes, and the snow has permanent lodgment only in patches, yet, that when the paroxysms come on, the snow drifts and the consequent thaws must make travelling or camping out on the Snowy Plains very dangerous, for in that case the ground becomes a perfect bog. Moreover, as the snow prevents the growth or appearance of vegetation, there can be no food for cattle or horses; and, therefore, the stockmen draw their herds down to the low country generally about March. It is just what is done in the European Alps.

The sudden variations are probably the chief inconveniences of the weather all over the Highlands of the Southern Gold Fields. And even on Maneero Plains, cold and frost happen often unexpectedly. At p. 150, there is quoted one instance. Another occurred on 5th December, 1851, when after very heavy rain all day, preceded on previous days by violent thunder-storms, it quickly became clear, and this was followed by a sharp frost at night.

The following extracts from a letter written by my valued friend, T. S. Townsend, Esq., (late Deputy Surveyor-General,) during his survey of Maneero, dated "*Camp near Moamba,*" have been kindly placed at my disposal by the present Acting Surveyor-General. It will be found to confirm all that I have stated respecting the climate and the influence of meteorological agents on health in the Alpine districts. As the date is the 16th March, 1846, it shows what was the state of the season in the autumn of that year.

Camp near Moamba,
16th March, 1846.

"I found snow lying on them" (the Snowy Mountains) "in large patches, very deep in places, on the 10th of February, after the very warm summer that we have had. It was not, however, of sufficient importance to deter one from proceeding along the Snowy Chain, had not my instructions required me to go in a southerly direction. We had heavy falls of snow during the 11th, 12th, and 13th of February. Immediately after descending from this region of eternal snow, the main range forms a very deep gap, falling about (?) two thousand feet to the source of the Crack-em-back River; it is there covered with stunted gum trees—gnarled and twisted by the winds in such a manner as to resemble mangroves, than which they seldom attain a greater height.—The branches growing to the ground, it was impossible to get the pack animals through them in many places. About the sources of the Toonginbooka, the character of the timber alters. There are some small portions of forest in which grows the large Eucalyptus trée, known as "Black," but surrounded by thick scrubs of "tea tree," with occasional patches of bitter leaf or willow scrub, which presents an obstacle almost impassable to man. The summits of the peaks were generally more densely clad than any other part, making it impracticable to get a view whence I could make out the general run of the range, which forms in deep gaps, and in many instances is extremely difficult to follow, not only from the scrub, but because the lateral ranges are more prominent than the leading feature. Off this I got, in one instance, and had to retrace my steps nearly eight miles through a very dense scrub. From the most western source of the Toonginbooka to the Omeo road, the range runs in lofty peaks thickly covered with timber, except on the summits of the highest points which are formed of the bare granite rock. The whole tier is of granite formation, with the exception of a few miles where the prevailing rock on the surface is a clay stone, mixed with felspar and quartz." [Silurian schist. W. B. C.]

"The Blacks had visited the Snowy Mountains, a short time previously to us, for the purpose of getting "Bogongs,"* a species of moth, about an inch long, of which they are particularly fond; to obtain them they light large fires, and the consequence was, the country throughout the whole survey was burnt, leaving my bullocks destitute of food. During the time I was on the range the lower parts of the country were burning, and I was prevented, in almost every instance, from getting angles on any distant points, by the dense masses of smoke obscuring the horizon in all directions. It is also worthy of remark that not a single head of cattle, kangaroo, or emu, was seen during the whole journey along the range, and only a very few old hacks.—[See p. 139.]

[* These moths have obtained their name from their occurrence on the "Bogongs," or granite mountains. They were described by my friend Dr. Bennett, in his interesting work on "New South Wales," 1832-4, as abundant on the Bogong Mountain, Tumut River. I found them equally abundant, and in full vigour, in December, coming in clouds from the hollows in the granite peaks of the Muniong Range. The Blacks throw them on the fire and eat them. W. B. C.]

"I was fearful from the beginning of the work that the cattle would not be able to reach the Cobberas; and in order to relieve them, I commenced carrying our rations on our backs, and slept out for a night, a thing I have often done before with impunity; but here the change of climate was too great. The days being generally excessively hot, the nights severely cold, so much so, that the water was often frozen in the cooking utensils, which was the case the night we lay out, and one man was seized with strong symptoms of fever and ague,* and was so unwell that I became alarmed, and it was with great difficulty that we got him along. I had, therefore, no alternative but to keep the cattle on; and it was impossible for them to travel if they got any distance off the range. Whilst along it, we had to clear a road with axes, as we were prevented from going off by the precipitous gullies on either side. As your instructions were so urgent I of course determined never to turn my back on it, but pushed on in spite of everything, and have fulfilled your commands as far as regards the range, and ascertaining the nearest source of the Murray to Cape Howe. It has, however, been at a serious loss to myself, viz., the death of three pack bullocks, and the three others are now in such a state, that if they are ever useful again, it can only be after a very long rest, and my equipment is in a very mutilated state, much more damage having been done to it than might be expected during twelve months in an ordinary country."

As Mr. Townsend mentions the scarcity of kangaroos in the Alps, a fact I have also noticed above, I may also mention that he told me he had named one part of the Muniong Range "Snake Hill," from the abundance of that reptile. I also found brown snakes, of large size, very common in Alum Creek, in October, 1851; I was also often warned against entering the long grass on the banks of Creeks in the Alpine country, where they are said to abound. Scarcely any animals, but snakes and rats, are found in the interior desert of Australia; and rats are very plentiful at the head of the Eucumbene.

To the above interesting letter from Mr. Townsend, I have the pleasure of appending some observations on the state of the Muniong Range in January, 1855, made by my learned and esteemed friend Dr. Ferdinand Müeller, Botanist of Victoria, who explored the Alps in the summer of that year as well as in 1853, in the interest of that science of which he is such an ornament.

"On Mount Kosciusco," says Dr. Müeller, "the summit of which consists of granite boulders, I found in January, 1855, large glacier masses in the deep ravines towards the top and downwards about 500 feet. These ice masses, I am

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* [It was a similar illness from which I suffered in the same country. See p. 117 and p. 121.—W. B. C.]

convinced, do not melt completely at any time, unless in very dry and hot seasons; for the vaporous depositions during the night restore to a great extent what is wasted of the ice masses during sunny days, whilst, at any time in the summer snow-falls add to these glaciers when rain takes place in the low lands.

"There is, however, neither on the crest of this or of other equally high mountains of the Muniong Range, nor on the *tops* of Mount Latrobe and Mount Hotham any permanent ice during the midst of summer, since these mountains are not of sufficient elevation to come within the range of a permanent snow-line, which in these latitudes, taking other physical conditions of the country into consideration, would exist only at a height about 8000 feet.

"Nevertheless, I have seen huge masses of snow as low as 5000 feet in places, where so vast a quantity accumulates in valleys and ravines, that the heat during the summer is not of sufficient power and extent to dissolve them. On the summit of Mount Buller at an elevation of nearly 6000 feet, I found fresh ice towards the end of March 1853, not melting under the sunshine of a bright day. Mount Hotham and Mount Latrobe exceed 7000 feet" (see p. 130) "and the main system of the central Alps has many heights, between five and six thousand feet."

By Dr. Müeller's expressions "*glacier*" and "*ice masses*" he means, I presume, that condition of snow which I have explained above (at p. 225).

The snow, no doubt, freezes and becomes partly ice, but I doubt, if it now ever is really glacier ice, such as occurs on the flanks of Mont Blanc and other European Alps. But I am persuaded, that formerly true glacier ice was formed on the Muniong, and I have always thought that the effect of it may have produced a kind of *gold moraine* in places, where auriferous veins came into contact with ice.

Whilst these pages are passing through the press, I have received the following intelligence from a friend, the Rev. T. Druitt, in Maneero, under date of the 6th August, whom I had requested to report to me on the present state of the snow:—

"From Cootralantron (? Coolringdon) westward and northward all the ranges are covered with snow. In many places there are from ten to twelve inches, especially between Buckenderra and Bullenbalong," (the very heart of the County of Wallace, and between the Eucumbene and Jejedzeric.) "On the plains the sun has caused it to disappear. *All the high ranges are entirely covered.* At the Snowy Plain, there are but thirty inches; but further north, at the 'Nine Mile Rush,' five miles

W. of Cabramurra, the snow is upwards of forty inches, whilst on Giandarra, or Kiandra, there are only thirty-six inches. Last year, all the mountains were covered with snow, so much that people with cattle had to turn back in April. This year, it was past the middle of July before snow fell in any quantity. And whereas, it is generally brought by a south or *south-west wind*, this year it came direct from the sea—from the east and south-east. Consequently, to the east of Cooma, there was no snow, only rain. Notwithstanding every warning, people from Tasmania, Victoria, and South Australia, are flocking to the mountains, some, I fear, to perish miserably in the snow, and many to the utter ruin of their health and constitutions. It is of no use remonstrating. They are in a burning fever, and nothing but the snow will cure them."

II.—VEGETATION.

A few glimpses of the nature of the vegetation in the higher regions of Maneero and the Alps, have been obtained in the preceding account of the climate. Not satisfied, however, with so meagre a statement, and convinced by my own observations, that there are some striking peculiarities as well as singular conformities with the vegetation of the European Alps, which I had noticed more than thirty years ago, during my excursions in those regions and on other highland countries of Europe, I requested my friend Dr. Müeller to favor me with a list of plants observed by him, during his botanical excursions along the Muniong Range, and to the southward, and I have now the satisfaction of appending the following Catalogues of such plants, as have been already determined by him.

In connection with these Catalogues, the learned and amiable author makes the following remarks:—

"The Sub-Alpine Vegetation buried in frost during the winter months, stretches from 4000 to 5000 feet in elevation above the sea.

"The trees and shrubs which it produces are of diminutive growth, and with their cessation or with their reduction to a very stunted or prostrate condition, begins the truly Alpine Flora, which commences at an average elevation of 5000 feet, although, according to the position of the mountains and their isolation and approximation to other ranges, Alpine plants may be seen descending in some localities fully a thousand feet lower than in others. On the very crest of Mount Hotham, of Mount Latrobe, and on Mount Kosciusco, and several others of the Muniong Mountains, there exist, even, no shrubs of depressed growth, the cessation of which takes place at about 6000 feet of elevation."

ALPINE PLANTS COMMON TO AUSTRALIA AND TASMANIA,

Exclusive of those of the low lands ascending to Alpine summits.

Ranunculus *Gunnianus*	Antennaria *subigena*
Celmisia *longifolia*	Senecio *pectinatus*
Gentiana *Diemensis*	Gaultheria *hispida*
Podocarpus *alpina*	Leucopogon *Hookeri*
Trisetum *subspicatum*	L——— *Frazeri*
Hierochloe *antarctica*	Richea *Gunnii*
H——— *submutica*	Prostanthera *rotundifolia*
Agrostis *contracta*	Euphrasia *alpina*
Geranium *brevicaule*	Grevillea *australis*
Hovea *purpurea*	Exocarpus *humifusa*
Didiscus *humilis*	Juncus *falcatus*
Ozothamnus *Hookeri*	Oreobolus *pumilio*
O——— *cinereus*	Lomaria *alpina*

Caltha *introloba*	On gravelly snow-wet places on Hotham, Latrobe, and the Muniong Mountains.
Drosera *Arcturi*	
Stackhousia *pulvinaris*	Highest summits of Alps, 5,000 to 7,000 feet. Fragrant starry flowers.
Acacia *Stuartiana*	
Dichopetalum *ranunculaceum* ..	On wet gravelly places, Muniong Mountains, 5,000 to 6,000 feet.

Diplaspis	Pentachondra *pumila*
Hydrocotyle	Epacris *microphylla*
Coprosma *pumila*	Veronica *nivea*
Erigeron *pappochroma*	Drapetis *Tasmanica*
Velleja *montana*	Astelia *alpina*

Herpolirion *Tasmaniæ.*

(2.) Exclusively Australian Alpine Plants.

Eriostemon *alpinus*	Eriostemon *ovalifolius*
E——— *ozothamnoides*	E——— *trymalioides*
Oxylobium *alpestre* ..	Higher parts of the Alps.
Bossiœa *distichoclada* ..	From the Mitta Mitta to Snowy River; never below 4000 feet.
Gingidium *glaciale*	Not rare. 5000 to 7000 feet.
G——— *simplicifolium* ..	Sub-Alpine—Mount Wellington to the Muniongs. [Otherwise Mounong or Munyang, a name derived from a *grass*, so called by the Aborigines.]
Eurybia *megalophylla*	
E——— *alpicola*	
Ranunculus *anemoneus*	Next to *Grevillea Victoria*, the greatest ornament to the Snowy Mountains.
R——— *Millani*	On Mount Wellington.
Capsella *blennodina*	
Boronia *algida*	Mounts Hotham, Latrobe, and Kosciusco.

Kunzea *ericifolia*	.. ..	Highest part of the Muniongs, and thence to Mount Wellington.
Pozoa *fragosea* ..	.. ..	Rare. On highest shady tops of Muniong Range. 6,000 feet.
Seseli *Harveyanum*	.. ..	Cobberas to Muniongs. 4,000 to 5,000 feet.
S—— *algens* ..	.. ..	Muniongs. 5,000 to 6,000 feet.
Trineuron *nivigenum*	.. ..	Near melting snow; Muniongs, 5,000 to 6,000 feet.
Antennaria *uniceps*	.. ..	Springs and flooded parts, ditto ditto.
Leucopogon *Maccrœi*	.. ..	Sources of Mitta Mitta; Mounts Hotham and Latrobe; Cobberas, 5,000 to 6,000 feet.
Decaspora *Clarkei*	.. ..	Shady ravines; Mount Wellington.
Euphrasia *alsa* ..	.. ..	Highest stony summits of Muniong, 6,000 feet.
Pœderota *densifolia*	.. ..	Ditto, 6,000 to 6,500 feet.
Grevillea *Victoria*	.. ..	Summits of Mounts Buller, Tambo, Hotham, and Latrobe; sources of Mitta Mitta.
Orites *lancifolia* ..	.. ..	Muniongs. 5,000 to 6,000 feet.
Astelia *psychrocharis*	.. ..	Mossy sources of Hume and Snowy Rivers.
Oreobolus *distichus*	.. ..	In mosses; highest summits of Alps.
Carpha *nivicola* ..	.. ..	Near swamps. Highest summits.
Scleranthus *mniaroides*	.. ..	
Bossiœa *foliolosa*	.. ..	
Oschatzia *cuneifolia*	.. ..	
Andrœa *Australis*	.. ..	
Carex *cephalotes*	.. ..	Muniongs. Highest springs.

(3.) A few of the Alpine plants are identical with European species! For instance—

Alchemilla *vulgaris*	Carex *canescens*
Veronica *serpillifolia*	C—— *Buxbaumii*
Sagina *procumbens*	Lycopodium *Selago*
Carex *pyrenaica*	Botrychium *Lunaria*
C—— *echinata*	Turritis *glabra*

(4.) Very few are the same as New Zealand species, unless they are also found to be represented in Tasmania. One of the most remarkable amongst them is—

Veronica *tetragona*.

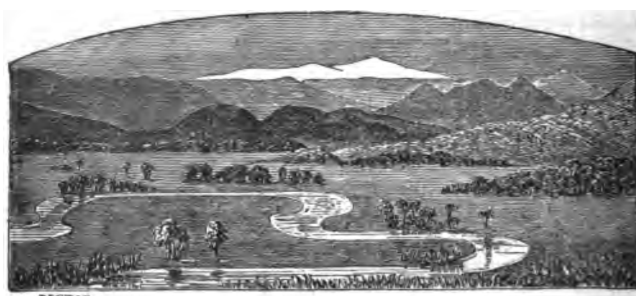
(5.) Plants found on the Alps,

Chiefly on the Victorian side of the Boundary, collected from Dr. Müeller's Memoirs in the Trans. Vict. Inst. and Phil. Soc., 1854 and 1855.

Brachycome *nivalis*	.. ..	Cobberas and other high summits of the Alps.
Westringia *senifolia*	.. ..	Summit of Mount Buller.
Phebalium *ovatifolium* ..	..	Sources of Hume and Snowy Rivers.
Eriostemon *trachyphyllus*	..	Mountains near the Pinch Range.

Blennodia *alpestris*	.. ..	Sources of Hume and Snowy Rivers. (Sub-Alpine.)
Pozoa *cuneifolia* ..	.. ..	Mount Wellington, Cobberas, &c., in turf moss. 5000 feet.
Erigeron *conyzoides*	.. ..	Sources of Hume and Snowy Rivers. 4000 to 5000 feet.
Scirpus *polystachus*	.. ..	Mount Leinster, Omeo, Buumba, Snowy River.
Carex *Polyantha*	.. ..	Valleys of Upper Mitta Mitta.

In connection with this subject, my friend, W. Woolls, Esq.. of Paramatta, who has been long and admirably employed in elucidating the botany of his own neighbourhood, tells me that *Crowea exalata*, a plant mentioned elsewhere by Dr. Müeller as an Australian Alpine plant (see *Transactions of Victorian Institute)*, is growing in the bush near the Convent, Paramatta. It is, therefore, not exclusively Alpine, and is rejected from the preceding lists.



Western View of Kosciusco from Welaragang. Hume River, in June, 1839.

From a Sketch by P. G. King, Esq.

CHAPTER XIII.

REPORT No. XVII.

ON THE METALLIFEROUS INDICATIONS OF THE COUNTY OF MURRAY; AND ON THE PHYSICAL HISTORY OF LAKE GEORGE.

Winderreedeen,

1st June 1852.

Since I had last the honor of addressing you, I have been employed in making some geological enquiries in the district west of Lake George, and between the Murrumbidgee and Lerida Creek, which is the southern head of the Lachlan River. I was desirous of seeing more of the western boundary of Lake George, than I was enabled to visit in the month of October, 1851; and I have by the assistance of my friend T. A. Murray, Esquire, M.L.C., (now Speaker of the Legislative Assembly,) whose devotion to all objects of scientific investigation renders him an able co-operator, been conducted to various points of interest and importance in his estates and neighbourhood. I have thus succeeded in obtaining approximate values of the elevation of many summits, not only in this district, but also on the high ranges between the Murrumbidgee and Coodradigbee Rivers, which connect my survey of the Alps with the country to the north-eastward of the heads of those rivers.

I have also examined the composition and structure of the formations within the area included between the before-named boundaries; and I have now the honor of reporting to you, for the information of His Excellency the Governor-General, that there is little doubt that the whole of this area is metalliferous, and that gold exists in numerous localities, some of which I will arrange in a tabular form at the close of this communication.

The country along the Murrumbidgee, about 149° E. and between 36° and 35° S., has been already partially described in previous Reports. That part which lies along the river and about Yass Plains has only been alluded to. It is chiefly there, that we find various beds of limestone and calcareous grits, which are charged with innumerable fossils, among which corals of Silurian genera, Pentameri, and various Trilobites are most prominent. Hills of porphyry and bands of porphyritic compounds also occur in the midst of the slate system, and owing to the former the latter has at various points been transmuted and disturbed.

Granite again appears in patches and intrusive ridges about Gundaroo, and forms the western portion of the range bounding Lake George, culminating about Carangal and Cullarin, whence the drainage runs to the Lachlan from the Breadalbane table land and the back of the country north of Lake George. At Carangal the boundaries of the Counties of Murray, King, and Argyle meet in a point about 3058 feet above the sea.

It is from this point that the waters of Lerida Creek take their rise, and form the main portion of that branch of the Lachlan which is commonly called the Fish River. Several of the creeks flowing into this branch are known to be auriferous. On two occasions I have been upon Carangal, and on both have been prevented making more than a partial investigation of its flanks by the inclemency of the weather; on the latter occasion I was only able to prospect at the head of Lerida Creek, about 200 feet below the summit; but I was obliged to desist without obtaining any proof that my opinion of the auriferous character of that creek is well founded.

Eventually, I think, not only gold but the equally important ores of lead, copper, and iron, of which there are abundant evidences, in lodes of the former, and sporadic masses of the latter, in various parts of the County of Murray, will be wrought to advantage.

The whole basin of the Murrumbidgee from near Bullanamang to the junction of the Queanbeyan River, and even as far as the junction of the Yass and Coodradigbee Rivers, (as for instance at "Good Hope") exhibits not only metalliferous formations, but in some places lodes of lead, copper, and iron, and there can be no question, that in some of these localities, metallurgical operations may be profitably conducted. The association of abundance of limestone with these deposits is quite in accordance with similar associations in the mining countries of the European and American continents. The quartz porphyry which occupies so large an area in the Murrumbidgee basin, is in Europe one of the most important and prolific sources of mineral wealth.

Judging from what I have formerly seen of the ores and vein stuff of the copper lodes about Pudmin Creek, on the Borrowa branch of the Lachlan, I presume that the Murrumbidgee deposits are continuous to the north, probably ranging at intervals along the 149th meridian to a junction with the copper and lead and iron districts of the Belubula and Macquarie.

The opinion which I expressed long ago on this subject, has been greatly confirmed by what I have lately seen in the County of Murray. A further confirmation of the metalliferous nature of the region along the 149th meridian, is shown by the lodes of copper and lead about Quedong, and the traces of similar ores on the M'Loughlan, mentioned in my Reports (p. 152). The whole of that area is, I am persuaded, destined to furnish New South Wales with the means of future rivalry with the manufacturing districts of England and Wales, and probably, when the gold fever shall have subsided, a more regular and perhaps more profitable system of mining will succeed to the present scramble for the more captivating metal.

Near the junction of the Queanbeyan and Murrumbidgee Rivers, the copper is found occasionally in the *native* state, *i. e.*, pure, in flakes adhering to the laminæ of the granitic rock which is traversed by the lodes. It is in this state, I presume, from the effect of galvanic forces which have, in the rock itself, reduced it from the original sulphuret. [Similar occurrence of native copper, but on a more extensive scale is met with near the Canobolas Mountain N.W. of Bathurst, which is also intersected by the 149th meridian, and as the copper lodes there are a discovery of the year 1859, it is a fresh confirmation of my views.]

Near Yarralumla, I saw somewhat similar examples. Reviewing, therefore, the whole of my observations, and the results of enquiries purposely made, I have no hesitation in calling your attention to the region in question, as a probable future source of much colonial wealth.

The following localities may be enumerated as the habitats of gold, in addition to those previously reported by me.

1. Brindabella on the Coodradigbee River, (in small particles.) Slate and granite country. [See Note below.]

2. Junction of Jugion Creek and Murrumbidgee.
3. Capabella near Bogolong, in quartz.
4. Ginninginninderry Creek, on granite.
5. Two miles north of the junction of the Queanbeyan and Murrumbidgee Rivers, schistose granitic rock.
6. Various parts of the Murrumbidgee, between that junction and Micaligo Creek.

Prevalent formation, slates, quartz, limestone, &c.,

7. Queanbeyan River, near "London Bridge," and between the junction with the Molonglo and Molonglo Plains.
8. Maloon Creek, (found since my visit to it in Oct.)
9. Butmaroo Creek near Currandoola.
10. Bywong, near head of Yass River.
11. Brook's Creek, flowing from the range dividing Yass River from Lake George.
12. Gundaroo Creek.
13. Yass River, at various points, for 10 or 14 miles down.
14. Deadman's Creek.
15. Blackeness Creek.
16. Creek near Tarago Lake.
17. The neighbourhood of Gunning.
18. Coven Creek, in ironstone.
19. Mutmutbilly Creek.
20. Diamond Creek.

I have been informed that a few particles have been also found near Colegdar in Stony Creek, and also in the Township: but I have no further authority for the statement.

There is an opinion amongst certain persons, that gold is not likely to be found in abundance where lead and copper abound; my own experience, however, teaches me that gold does occur in New South Wales, in the districts around Bathurst, in conjunction with copper, and I have reduced by amalgamation both copper and gold from quartz rocks in which there was no *visible* traces of either metal; I do not therefore pay much attention to the remark alluded to, but believe, that gold in profitable quantities will hereafter be found in some part of the district of which Bywong Hill is the centre.*

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* [It is curious to observe the slow progress that is made in the development of a country known to be auriferous from 1851, when I took

(2.) I wished before I quit the vicinity of Lake George, to carry into effect a design of ascertaining by actual experiment the nature of the deposits now filling up the ancient bed of the lake. But the ground is so saturated with water, and the rains have been so frequent and copious, that I am forced to abandon the enterprise.

The structure of the surrounding country, the accumulation of sand and pebbles, the lofty banks of shingle and boulders on the creeks falling to the lake, the beach fragments, and rolled blocks upon the shore of the lake, the numbers of smaller lakes and plains in nearly perfect continuation with the greater extent of Wirriwa, such as

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gold to *Sir Charles Fitz-Roy* from the Yass River, to 1860, fresh indications have been offering themselves, and yet no attempt has been made to turn them to account. The following extract from the *Yass Courier* of June, confirms my statement above, and it is appended here to show, that the statement was not premature.

GOLD DISCOVERIES NEAR YASS.—The opening up of diggings at Kiandra, and the traffic between them and Yass which it has caused, has every likelihood of developing still further auriferous riches much nearer home. Until very recently the country between the two points remained unexplored, except by those whose business was connected with stock, and consequently a comparison was never drawn between the appearance of that part of the country, and where gold has recently been found in such great abundance. The inclement weather has driven away vast numbers of diggers from "the regions of the thick-ribb'd ice" to localities liable to a less severe atmosphere; and in their rambles places have been discovered that, from their similarity to the sea slopes of the Snowy Mountains, hold out to them hopes that assiduous prospecting will not wholly be in vain. Amongst these places are many that trend this way, and we must confess that we are full of hopes, and reasonable ones too, for they are founded on many circumstances, that even before the spring of the year a large tract of auriferous country will be discovered within fifty miles of Yass, and stretching in the direction and meeting the golden lands of the Snowy Mountains. The gold brought from Broken Cart Creek, as mentioned in our last, is conclusive evidence that the metal not only exists there, but exists there in considerable quantities. The granular and angular character of the gold is unerring testimony of its abundance, for never has gold of that character been found but in places where it is procurable in large quantities. We say this advisedly. A few days since we were shown a sample found even nearer Yass, at Coolooman Creek, on Brindabella. This creek is a tributary of the Little River, and the spot where the metal was washed from the soil is reported to be within forty-five miles of this town. The sample—of a different character to that procured at Broken Cart Creek—was of a brighter colour, and much water-worn; indeed some portion of it was scaly in the extreme, and had evidently either been washed from a considerable distance, or had for a length of time been exposed to the action of a strong current. There was some shotty gold amongst it, but the whole sample was characterised by a washed appearance. It was pro-

Mutmutbilly, Wallagarang, Tarrago,* &c., and other physical facts, all lead to the conclusion that formerly, what is now nearly a dry lake bed, (though the late rains have covered a wide extent with shallow water,) was once the bottom of a channel or deep lake, probably a reservoir, whence in times of flood, the country at the base of the hills on either side, was inundated. Any gold existing in the rocks so broken up and denuded, must have been disturbed far and near. The conjecture leads to another, which is, that there may be gold in the alluvial detritus now forming the nearly level grassy plains from Breadalbane to Turallo Creek; but if such is the case, it must be very deep below the surface, for I had an excavation made on Turallo Creek to the depth of ten feet without penetrating to the bottom of the first deposit, and I have ascertained that the bottom of the ponds, (the relics of a river,) which flow past the locality whence I write, have their bottom twenty-one feet below the surface of the Lake, into which, there is no doubt, that river disembogued, as there is still a communication to be traced, and water during times of present floods discharged itself into the depressions, at this time flooded near Ondyong Point. The experiment I mention would be extremely interesting, and I hope there may be found sufficient inducement for some person to carry it out hereafter. Gold has been found in other spots of like kind in various parts of Murray and Argyle, and is known to exist near Breadalbane Plains.

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cured by three young men (Stocks and two M'Larens) returning from the Snowy, who fancying the appearance of the country about Brindabella, determined on prospecting it to some little extent, the scantiness of their rations precluding them from going into the work in an effective manner. In two days they washed out one ounce, and the sinking did not exceed four feet. The hurried mode of working they pursued would give 15s. a day to each, and it is fair and reasonable to suppose that had they been able to have remained longer on the ground, they would have found a lead by which they could have doubled these earnings. But they were compelled to quit as their rations were exhausted. At Micklelong Creek also, there are several parties at work, all finding gold, but it is a matter of considerable difficulty to discover the gains of persons who are testing new ground.]

* Tarrago Lake is much higher than Lake George, as I have ascertained by measurement. But this does not vitiate the conclusion, that formerly the whole tract bounded by the hills on each side of Lake George was occupied by water, which once extended further, so as to embrace the sites mentioned.

The (late) Surveyor-General, Sir T. L. Mitchell, in his very intelligent remarks upon Lake George,* suggested that it would be useful to discover at what point the Lake, if full, would overflow.

In my journey hither I obtained a measurement which, I think, may assist in solving the question.

At Geary's Gap, whence I descended upon the Lake, after having traversed the Dividing Range, the point whence the waters flow anticlinally to the Lake and to Yass River is ninety-six feet above the present surface of the alluvia filling the former. As I have now examined the borders of the Lake all round, I am inclined to believe there is no natural outlet lower than this anywhere between Turallo and Breadalbane, or at least in that portion of the country defined by the surface which is level with that of Lake George. If then the Lake were again to become full of water, the surface must have a level of more than ninety-six feet above the then bottom in order to overflow; and if this gap did not exist, the water must accumulate perhaps nearly three times that depth, in which case it would occupy many points now above the Lake, and connect other similar areas, such as some of those before named, before it could find a natural outlet.

Much has been written respecting the dead trees on various parts of the dry Lake, as indicating vicissitudes of season in some *alternating* order. But it is not necessary to imagine, that the Lake must be full to kill the trees. The principal dead timber is at the southern end; and the ground on which they stand is somewhat higher than the rest of the Lake. Probably a few seasons as wet as the present might produce sufficient water to kill trees that rejoice in dryness. The periods required to fill the Lake are far too long to be admitted into the problem as data, and, probably, there is nothing very extraordinary in the circumstances as they appear. In October, 1851, I saw a portion of the Lake covered by water, and now there is at least a surface of water from six to seven miles long and in places a mile or two wide. This would be sufficient at the present depth of less, probably, than two feet, to kill trees; and, on the other hand, trees that delight in moisture may perish by a single season of drought. And thus the belt of timber round the

* Expeditions, II, 313.

edge of the Lake may have died from the effect of a single flood, and those on the higher portion, at the south end of the Lake, may have died from the effect of a single drought. I do not think, therefore, the facts in question prove anything as to recurring cycles of wet and dry seasons, as some persons have imagined. But still the facts themselves, in combination with thousands of other evidences, induce the belief, that the climate of this country has its paroxysms of change, and that formerly it was infinitely more moist than now, when the earth is deprived of the ancient means of retaining moisture which it had, before cattle ate the grass and trod down the soil, and when man had not assisted elemental phenomena in producing permanent results.

REPORT XVIII.

ON GOLD AT "SHELLY'S FLAT."

Marulan, 3rd June, 1852.

I have the honor of reporting to you my arrival at this place, whence I started on my geological expedition on the 13th September, 1851, being on my way to Sydney, and having completed a journey of 2800 miles.

In my route from Lake George to this place, I have traversed little else than the members of the Silurian formation, with the exception of a patch of granite, one of trap, and a third of porphyry, the latter of which, as before reported, occurs not far from this spot. [The limestones and sandstones, associated with the slates, have been already so often illustrated, that there is no necessity again to treat of them; but I may be allowed to say that the extension of the formation up to Goulburn and thence till it disappears under the carboniferous beds on the Wollondilly, is distinct. Under Wombat Brush, on Paddy's River, the schistose beds may be seen supporting the sandstones, whilst at Arthursleigh, the conglomerates of Gibraltar rest on the porphyries that flank the syenitic granites on which the schistose beds repose.]

With the experience I have obtained of the character of the various members of the principal formation in this traverse, I was led to conclude that gold in small quantities might be expected in some of the localities passed over, and I have been informed to-day in Goulburn, that my conjectures have been confirmed by the fact, that gold had been already discovered in these localities. I allude principally to the "Run of water," and to a creek on the north-east of Goulburn. The banks of the Wollondilly have also furnished a few samples.

I am inclined to think that such examples will hereafter be multiplied, as there are considerable tracts of country covered by alluvial deposits and by accumulations of broken and partly rounded quartz gravel. But probably the gold is not abundant in any of these localities.

It is very satisfactory to me to be able to state, for the information of His Excellency the Governor-General, that in one locality, at least, I have had proof that gold exists amidst this detritus under very interesting circumstances.

At Shelly's Flat, about four miles from Marulan, (in which neighbourhood I reported, in one of my early communications, the existence of copper) I found Mr. Gale, to whom allusion is made in Report, No. 1 (as having expressed an opinion respecting the auriferous nature of the alluvia of the Shoalhaven gullies,) engaged in washing earth from a hole about 15 feet deep, dug in his garden. I, therefore, proceeded to inspect the soil, and had evidence of the *visible* existence of gold in the quartz pebbles of an ironstone conglomerate, resting in the surface soil covering the slate. This conglomerate is very abundant, and is derived, I think, from some not distant hills, bounding the little valley known as "Shelly's Flats." I learned upon enquiry, that Gale had actually procured gold from the loose earth of the "flats" and from the banks of the creek running through the valley. This gold was rounded, and, though small, heavier in character than the fine scales so common in the superficial soil of the rivers to the south. What may be the ultimate success of the persons who may work that locality, I do not venture to determine. But it is a satisfactory conclusion of my journey to this place, to find, that so near to the spot from which my labours commenced, there exists an auriferous locality till now undisclosed. It entitles me to say, that for nearly nine months, I have been travelling from day to day over fresh evidences of the general distribution of gold. Had I commenced by examining the locality in question, I might have considered the fact of seeing gold thereat, a good omen; I hope it is not the less propitious, because it opportunely enables me to end my journey, as it began, upon a "field of gold."

[P.S.—It may not be useless to state here, that this kind of ferruginous conglomerate is common in various portions of Australia. A careful comparison of it induces me to assert that it is identical with what the miners in Victoria call "cement." There is every reason to believe that it is of a late tertiary epoch, and such I am convinced it is in Victoria. It appears to be about the age of the Brighton beds on Port Phillip, and it is found extensively over the lower Silurian as well as upper Silurian rocks. At Bendigo and Ballaarat it is well known. The auriferous value there is considerable. It is crushed for gold, being highly auriferous at the Hard Hills, at Creswick; also at Sandhurst, Epsom, Castlemaine, where it yields from 1 to 1½ oz. per ton. At Tarrengower, four tons produced 5 oz. 13 dwts. per ton. At Inglewood, the yield, last May, was from 3 to 10 oz. A portion of a mass from Shelly's Flat was crushed and amalgamated for me in 1853, and the gold was found not only in the quartz, but in the ferruginous base as well.

Conglomerates of the carboniferous beds have been found by me also occasionally auriferous, that is, pebbles in the rock have contained visible gold. Such, I have before mentioned, at p. 44, as occurring on the North Shore of Sydney Harbour, where I have collected some dozen specimens. But I consider these to have *no commercial value*, and, therefore, to have no bearing except in a geological point of view: they merely tend to show, that the opinions of certain distinguished geologists in Europe, respecting the age of gold, are not always applicable. In the cases mentioned, and in the occurrence of gold at the base of the carboniferous beds, in pebbles of quartz conglomerate at Wingello and Paddy's River, the gold in quartz must have been older than the conglomerate beds, which contain pebbles of that quartz, and the beds are very low down in the coal-bearing series.

The late Sir Thomas L. Mitchell, whose intelligence and observation would have made him a first-rate geologist could he have dedicated his time to the necessary studies, often held conversations with me on the subject of his discoveries in the interior; and I had asked him to tell me the true character of the siliceous drift of the far west. I had told him my views respecting the age of the gold, and that I believed its first appearance in the rocks was of an epoch long anterior to that of its dispersion, that is that it is as old as the quartz that carries it. This may be a geological heresy, but I have had practical observations enough to believe it. I exhibited to him a specimen of a conglomerate containing gold, which he recognized as what he called his "old conglomerate," and, opportunely enough, he furnished me in 1855 with a document, which, for his sake as well as my own, I publish as a *souvenir* of the past, and as confirming the above.

"*Carthona 9th June*, 1855.

"MY DEAR SIR,—I have a difficulty in answering your question, as to whether I did not show to Sir R. Murchison some specimens of Australian gold, during one of my visits to England; if that refers to my visit *before the last only*, I cannot help thinking that my old and hospitable friend, Sir Roderick, was then absent in Russia, but I cannot say positively.

This I do remember on my late visit to have done—and even his asking me, in the presence and hearing of the Duke of Argyle, Professor E. Forbes, and the Earl of Inniskillen, whether the gold was not being exhausted at the diggings in Australia? and my having answered, No; that I considered the supply would prove inexhaustible, at least for many years to come, by the discovery of new diggings. I am also sure Sir Roderick Murchison saw my collection, which, while I was last in London, lay under a glass case in Sir H. de la Beche's room at the Museum of Economical Geology, in Jermyn-street, London.

"I made a discovery in my ride down the other day from Braidwood, which I have been anxious to tell you about and show you, as it is the only one that supports my own notions as to the 'rock of the interior,' as I called the old conglomerate, and its connection with the water-worn nuggets,—that I have made myself, and on horseback too.

"You will remember that this rock occurs extensively about Wingello, and that the road is made of it there and towards Paddy's River. Just after the late heavy rain first came down, on the 29th March, (well my rheumatic bones remember it, having been seven hours in a rain on the Coast Range Mountains that day; so drenched that my very watch rusted and stopped!) On the 4th April—to wit—I thought, "now is the time, as this gravel of the great conglomerate has been so well washed, to look whether any pebble has gold in it"; and, strange to say, the thought of looking scarcely occurred, when a twinkling speck in a smooth quartz pebble of the conglomerate afforded me a proof that the gold quartz was *older* than *these* pebbles! This I can show you, and if *(as I think you once showed me)* gold has occurred also *in* the matrix of the same conglomerate, two different conditions are at once thus established —of the occurrence of gold—which is so far suggestive.

"Yours very faithfully,

"T. L. MITCHELL.

"The Rev. W. B. Clarke, A.M., &c."]

CHAPTER XIV.

THE CARBONIFEROUS FORMATION BORDERING THE GOLD FIELDS.

The exploration of the Southern Territory described in my Reports to the Government having commenced and concluded at the same locality, viz., Marulan, it may be deemed advisable to give a short notice respecting the geology of the country between Marulan and Sydney. In the fulfilment of this object, we shall obtain a rough definition of the Northern boundary of the Southern Gold Fields. The basin of the Wollondilly, in which occur several localities where gold in very limited quantities is found, does not generally enter into the limits of the region in question, because it did not enter into my arrangements in 1851—1852 to include it in the country to be explored. Nevertheless, it may be said, that if we take that region now to include the Wollondilly, we shall find, that the geological description of the country along the Gourock, has application in that portion of the Wollondilly district, which is occupied by the older formations, amidst which granite makes its appearance as in other described tracts, and in which also all the other igneous rocks have similar relations to the older deposits and to the more recent Carboniferous formation, which obtain in the other portions of the boundary of the Auriferous territory. But I have preferred to range the Wollondilly in the Western district, as including the basin of the Hawkesbury and the rivers and creeks that flow from the Dividing Range to the westward of Sydney. It may, however, be mentioned here, that gold exists in small quantities about Mount Fitton; near Wayo; in the Breadalbane Plains country near Mutmutbilly; near Goulburn, and in some spots along the northern extension of the Wollondilly, as low down as Joorilan, and which is, probably, in the latter instance derived from the broken region between Collong and Cowmung; as in the vicinity of Cowmung River it has been detected.

Looking, however, to the immediate object of this Chapter, we must now revert to the vicinity of Marulan.

In Chapter I., (p. 11), porphyry is mentioned in association with slates, limestone, and syenitic granite, as underlying, in geological position, the conglomerates and sandstones of the Carboniferous formation. On the opposite side of the Shoalhaven (Chapter III., p. 42—44), in the Yalwal Peninsula, and about the head of the Clyde, the same relations exist, the auriferous rocks only making any demonstration in the deep creeks and along the bases of the slopes of that region. Further to the north-east of Marulan, on the Uringalla and Paddy's River, a similar superposition occurs in Wombat Brush, where from 200 to 300 feet of the sandstones and grits of the Hawkesbury division of the Carboniferous formation (which cover the coal seams of Meryla, those near the Hanging Rock, and on Black Bob's Creek), overlap and rest on the highly inclined older quartziferous schistose rocks at their junction with the syenites and granites of Arthursleigh, at a height of about 1900 feet above the sea. In that neighbourhood, also, the conglomerates of Wingello and Murrimba repose on porphyry at Jaoramin and at Gibraltar Rock on the Wollondilly, whilst about Greenwich Park and along the Cockbundoon Range (as between Tarlo and Murrang Creek) still lower beds of the Carboniferous system occur, either in natural condition, or exceedingly transmuted by the intrusion of the more recent igneous rocks.

These, in a continuous series of summits, come down from the Dividing Range, and developing themselves in great force on the Midway Rivulet and the Wingecarribee, about Sutton Forest, expand in a long trachytic ridge on the Mittagong Range, and in divers points of trap, traversing the sandstone region towards the escarpment above the ocean, and finally, sending out various ridges, dykes, and intruding masses, into the beds of sandstone, coal, and fossiliferous calcareous grits and conglomerates of the Illawarra.

In the course of this passage to seaward these igneous rocks have produced all kinds of derangements, dislocations, and metamorphic results; and it is to the decomposition of the trachyte on the Mittagong which is full of specular iron, that (probably by the agency of once hot springs, which in part still exist as mineral springs), the masses of iron ore are due, which occur at intervals along the slopes of the Mittagong, and especially on the northern side of it, from the western edge of the range to some distance eastwards towards the head of Macquarie Rivulet.

As we approach the junction of the carboniferous beds with the older formations, we find copper breaking out as in the vicinity of Arthursleigh, Ballarambija, and elsewhere; and as, probably, no copper exists anywhere without some gold, so, in some of these localities a little gold is found, and one of my first discoveries of its existence, in 1842, was not far from these localities. Gold also occurs in Bundanoon Creek. Some of the other peculiar transmutations of that district, I described* in 1845; and many of the localities of coal, from the region in question, were pointed out by me in 1847.†

The various divisions of the Carboniferous formation are represented by outliers across the country from the Wollondilly to Yass, where, as about Bowning Hill, they may be partially recognised by one thoroughly acquainted with the different portions of the series as they are developed in distant localities. All to the northward, between the meridian of Sydney and that of Marulan, and between the Shoalhaven and Wollondilly basins, may be said to be occupied by the Carboniferous formation and its associated igneous rocks. If any older rocks make their appearance, their position is too insignificant to require particular mention. We may, therefore, say that gold, as a commercial product, is not likely to be found in all that country. And a radius of about 80 miles to the south-west, as well as to the west, is probably the limit of the sweep between those directions within which any alluvial gold is to be met with, the localities of Cowmung River not being much less.

The exception in favour of chance gold in quartz conglomerates has been already noticed.

A comprehensive list of the divisions of the Carboniferous formation, as determined and named by myself (some details of which have only, at present, been published in occasional memoirs, the full history of them being reserved for a future occasion,) will, perhaps, be acceptable to those who, in exploring for gold, may fall in with insulated patches and small outliers of this formation over the Auriferous rocks. The divisions will be arranged in the descending order.

1. Wianamatta Beds.—These are the uppermost of the coal

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* On Dykes of Marble and Quartz in connection with Plutonic Rock on the Upper Wollondilly.—Quarterly Journal of the Geological Society, vol. I., p. 342.

† Report on "Coal Inquiry," before a Committee of the Legislative Council. Ordered to be printed, 16th September, 1847.

bearing rocks, but the coal in them is too partial and too insignificant to be commercially useful. They consist of brownish, greenish or grey, and yellowish nodular or ferruginous shales; light or dark coloured grits and sandstones, very calcareous and charged with ironstone nodules. Several species of heterocercal fishes, fern leaves and stalks; an Amorphozoon, and one or two species of Mytiloidean shells, and abundance of Entomostraca distinguish these beds, which seem, chiefly, to be derived from volcanic ash or regenerated igneous detritus, of similar kind to many modern deposits in the ocean about the volcanic islands of the Pacific. At Waimalee on Prospect Hill, W. of Paramatta, the magnetic diorite which there occurs, and which is, probably, the summit of a concealed mass submerged during the Carboniferous period and belonging to the Auriferous epoch, has furnished the material of fern-bearing beds of this division, that rest upon the diorite, and have since been intruded into and altered by basalt which, in another part of the Hill, exhibits a columnar structure. I had the pleasure of conducting to this locality in 1840, my friend Mr. Dana, of Connecticut, who describes the columnar basalt;* and in 1844 my lamented friend Leichhardt, whom I convinced on the spot, that the origin of many of our Australian carboniferous beds was the destruction and sedimentary deposit of the materials of igneous rocks. The Wianamatta beds occupy the middle, or elliptical trough, of the county of Cumberland, through which the Wianamatta, or South Creek runs along the major axis. In the Bulbunmutta, or Razor Back ranges, they attain an elevation of 1100 feet above the sea, and a thickness of at least 800 feet: and at the height of 2300 feet on the south edge of the Mittagong and about Sutton Forest at a height of 2000 feet, outliers and drift patches of them are to be met with. Standing on the summit of the Razor Back, looking east, west and north, these beds are seen to occupy a trough or hollow between the denuded and sloping, or scarped frame work of the Hawkesbury or Great sandstone and conglomerate rocks of the next division.

The igneous rocks in this division are occasional porphyries (Irish Town) diorites (Bell's Hill; Prospect, &c.,) amygdaloids (W. of Campbelltown) basalts, *(passim)*.

2. HAWKESBURY ROCKS, so called from the Hawkesbury Estuary, on each side of which they are well developed. Mr. Dana calls them "Sydney" rocks, because they form the cliffs of that locality; but I adhere to my original designation, to prevent confusion with the Sydney rocks of the "Sydney Coal Field" in Cape Breton. Besides, my own nomenclature has now been adopted by others.

The upper beds of this series, when undisturbed, are nearly everywhere of a bluish black shale, occasionally very schistose and jointed, elsewhere compact, very hard, and brittle, occasionally containing thin seams of calcareous matter, and ferruginous nodules, with Fishes, Amorphorzoa, Plants, &c. Below these come in the quartzose grits and sandstones. Sir Thomas Mitchell well described them as producing a "world of sterility and stone-quarries" Probably, Sydney itself would be in a desert, were it not for the proximity to the sea, and the shale beds next above. Mr. Gregory, after his return from the interior, recognised surface pebbles of these beds on the North Shore, as identical in their smooth

(*) United States Exploring Expedition in 1838—1842. Geology by James D. Dana, A.M., p. 515.

ferruginous coating and internal texture, with those of the edge of Sturt's desert. This series is from 800 to 1000 feet thick, and consists of poikilitic beds of sandstones of various coarseness, charged with quartz pebbles, and occasional lumps of porphyry, lydian stone, quartzite and great flakes of mica, and passing into regular conglomerate. Much of the sand consists of crystalline quartz with facets that reflect the sun-light very brilliantly, making the ground full of sparkling points. Concretionary action has frequently produced singular orbicular markings in the rocks, the joints of which are persistent and have one general trend about N. 10° E. In some places the rock becomes very hard, and it is frequently columnar, as near the north head of Botany, near Coogee, and at the head of Lane Cove. It contains many highly ferruginous beds, and seams of hematite; and, as before named, masses of very valuable hydrated iron ore occur on the surface near Mittagong and elsewhere. After rain, also, the ground is often covered by fine particles of titaniferous iron washed from the rocks. Casts of ligneous matter, impressions of ferns, and heterocercal fishes occasionally occur in thin beds of brownish shale. The Pigeon House summit is formed of an outlier of these beds; another occurs at the Hanging Rock on the southern road. Very thin seams of coal, of very limited extent, are sometimes met with. The physical characteristic of these rocks is their arrangement in nearly horizontal or gently undulating beds, which have been fissured and broken through so as to form enormous ravines with very narrow ridges, widely extended vertical escarpments, and great plateaux of indefinitely varied surfaces. The valley of the Grose to the westward, and the Kangaroo valley to the southward, are good examples of such ravines. King's Table Land (2,500 feet) is equally illustrative of a plateau; and the Illawarra escarpment and the coast line to the North Head of Sydney exhibit, in striking contrast to the smooth slopes of the Wianamatta beds, the manner in which the Hawkesbury beds have been cut through by faults, so as to display precipitous walls, twice and thrice the generally assumed normal height of a possible escarpment.* Many of the sand-stones of this division, in addition to mica have a considerable quantity of graphite in their composition; the latter sometimes occurs in thin flaky layers. The surfaces of the beds, even in the interior, are worked into deep pot-holes and gigantic cauldrons, especially where in old times (as now under the falls of the Cataract River,) water falling from a height, or the sea, has acted vigorously. This feature I have traced at all elevations from the sea level to 2000 feet, and what is, perhaps, equally striking, on the summit of the Mittagong Range, which is of a hard trachytic rock, at the height of about 2700 feet above the sea, the surface is excavated in a similar way. Aqueous forces of such a kind must have been wonderfully instrumental in the production and scattering of drift. And it ought not therefore, to be considered anomalous if in the drifts of these very rocks and of granites, quartzites, &c., which lie on the surface of various parts of the Wianamatta beds, and on the flanks of the Blue Mountains, as on and above Emu Plains; on Lapstone Hill; above the junction of the

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* The notion that no vertical wall of rock is known to exist of more then 500 feet in height or depth is an erroneous one. In New South Wales there are escarpments in succession down the face of many ravines which range from 1000 to 1500 feet. And on the west coast of New Zealand, at Milford Haven, Captain Stokes found a succession of such inaccessible cliffs rising to the height of nearly 6000 feet, with very deep water at the base. The stages in that ascent must have been more than 2000 feet. The west coast of Ireland furnishes similar examples.

Warragamba and the Nepean; and, in a direct line from the mouth of the Grose, at Penrith where the accumulation is several feet in thickness, a few minute particles of gold should be occasionally found, especially where quartz pebbles of conglomerates as at Wingello form part of the drift. The igneous rocks that pierce this formation are basalts; and at Mount Broughton, S. E. of Bong Bong, it surrounds porphyry.

3. COAL BEDS.—Below the Hawkesbury beds, or at their base, come in the workable coal seams of the Colony, as along the coast north of Illawarra; south of Newcastle; on the Hunter and Karua; near Berrima, &c., where they outcrop from below the last series. The thickness of this division may be 1000 feet or more, as coal seams have been pierced 400 feet down on the Hunter, and the cliffs of the coast are from 200 to 300 feet high, and there are other beds which are not seen in the neighbourhood but which belong to the series. In the greyish grits with plants occur fishes, one of which *Urosthenes australis* is described by Mr. Dana.* A *spirifer* was also detected in the Newcastle coal beds. Abundance of ferns and boles of trees, partly converted into iron occur. Dykes of basalt cutting N.E. and of greenstone cutting N. W. intersect the coal seams.

4. LOWER CARBONIFEROUS ROCKS.—Still descending, we come to beds of sandstone and grit, entangling numerous fragments of porphyry, granite, and slate, &c., and charged with molluscs, corals, entomostraca, zoophytes, radiata, &c., which in some of the upper portions contain seams of coal and lumps of fossilized wood, and below occasionally pass into imperfect limestones. The whole division is considered to be a representative of the lower carboniferous beds of Ireland. These beds are, in many instances, composed of detrital igneous matter, sometimes, under the metamorphic action they have undergone, scarcely distinguishable from porphyry itself, but at once recognised as sedimentary by the pebbles and fossils they contain. In the southern district, such rocks occur on Cooloomgatta at the mouth of the Shoalhaven, and on Bowning Hill, near Yass. In the northern, they form high ranges South of Mount Royal and along the rivers flowing to the Hunter from that neighbourhood. The origin of the trappean or volcanic detritus, similar in kind though not precisely the same as the Wianamatta ash beds is exhibited on the coast about Kiama in the Illawarra, where dykes of basalt and amygdaloid are seen cutting into and bedded with the fossiliferous rocks, alternations of both sedimentary and igneous rocks showing that there must have been two, if not three such eruptions, during the progress of the deposits. This is like what took place afterwards at Waimalee in the Wianamatta deposits: for in some parts of the Illawarra, the bottom beds in this division appear to pass into a dark grey altered arenaceous rock, which is charged with sulphuret of iron, and occasionally is fossiliferous. Entomostraca abound in some parts of it. In the Yalwal Peninsula, as on Dangera Creek, the same rock appears associated with Silurian shales and other members of the series, but all of which have been so transmuted by the trappean rocks, as to have become quartzites, or silicified into chalcedony, or traversed by thin veins of quartz. This part of the Carboniferous formation, has, therefore, undergone the same kind of metamorphosis which distinguishes the lower Palæozoic formation, on which it rests. (See Chapter III.)

In many parts of the Carboniferous districts, the lowest of the above

* Geology of U. S. Exploring Expedition, p. 681.

beds rest on porphyry, from which the pebbles of that rock were derived, and below, or next in succession to the porphyry, there follow beds of a somewhat different character as respects the rocks and fossils, the whole evidencing an approach to the Devonian system, which, if we may judge from some of the limestone beds about Yass has its representatives, as well as the Silurian formation, in that vicinity. With these lowest beds are associated plants more allied to those of the old Carboniferous period of Europe than the plants of the Wianamatta, Hawkesbury, or Wollongong series; but at Harpur's Hill one specimen of a sagenopteris was found. During many years I have been engaged in studying these rocks, and I have had the satisfaction of working occasionally among them in company with my friends Dr. Leichhardt, Professor Dana, of America, Professor Jukes, and other geologists. The references to our already published statements are too numerous to allude to in this place, save as in the note below.*

A controversy has sprung up relating to the geological age of the Carboniferous formation in Australia. My friend, Professor M'Coy, judging from the plants in the first three divisions of the series, considered that they are Jurassic, and the beds below, "Lower Carboniferous;"† more recent discoveries of plants belonging to the fourth division have caused him to admit that there are *two* coal formations. The views I have adopted have hitherto been recognised as correct by Mr. Jukes,‡ the late Mr. Stutchbury,§ the late Professor E. Forbes,‖ and by Dr. Höchstetter, of Vienna, who examined our sections in 1858, and by other

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* J. D. Dana - - -	*Geology of U. S. Expl. Exp.* (*Chapter* IX.)
J. B. Jukes & W. B. Clarke.	*Notes on Palæozoic formation of N S. W. and V.D.L. Q. J. Geological Society*, p. 41. (1847).
J. B. Jukes - - -	*Sketch of Physical Structure of Australia as far as known in* 1850 (*quoting W. B. Clarke*), *p.* 19.
W. B. Clarke - - -	*On fossil forest of Kurrur-Kurran.* (*Proceedings of Geol. Soc.*, 1843, *p.* 161.)
	—*On plants of the Carboniferous System of New South Wales.* (*Quarterly Journal Geol. Soc.* 1848. *Vol. IV.*, *p.* 60.)
	—*On the Carboniferous Formation of New South Wales.* (*Tasmanian Journal, vol. III.*, *p.* 459.)
	—*Comparison of Geology of Russia and Australia.* (*Ditto, IV.*, 365.)
See also—F. M'Coy - -	*Botany and Zoology of Rocks associated with Coal in Australia.* (*Annals of Nat. History, vol. XX.* 1847.) *Account of collection sent to Cambridge by W. B. Clarke.*
P. E. de Strzelecki - -	*Physical Description.* (*Morris on Fossil Flora*). 1845.
T. L. Mitchell - - -	*Expeditions. Vol. I. and II.*
W. Keene - - - -	*Report on Mittagong Range.*
E. Forbes - - - -	*Knowledge of Australian Rocks, &c.* (*Lectures on Gold. p.* 42. 1853.)
Stutchbury - - - -	*Reports to Government of N.S.W.* 1851–5.
J. B. Jukes - - -	*Remarks on Rock formations in new countries.* (*Tasmanian Journal. II.*, 1.)
W. B. Clarke - - -	*Evidence.* (*Committee on Coal Inquiry.* 1847.)
	—*On the Coal Fields of N.S.W.* (*Products of N.S.W. Sydney*, 1854, *p.* 68.) (*Exposition Universelle. Paris,* 1855.) (*British Catalogue, p.* 108.)
	—*Catalogue of Specimens illustrating order and succession of deposits.* (*id.*)

† See last note. ‡ Sketch, &c., p. 22.

§ Report to Colonial Secretary, from Durandur August 1st, 1854.

‖ Lectures on Gold. p. 54.

geologists. Mr. Dana thinks the age of the beds is intermediate between Mr. M'Coy's period and mine.* The whole controversy (excepting Mr. Dana's views) has been ably re-produced by Viscomte d'Archiac, in his able work, *Progrès de la Géologie*,† in which he comes to a conclusion, after reading the published statements of Mr. Morris, myself, and Mr. M'Coy, akin to those now maintained by the latter authority.

The discovery of a Tæniopteris in the Coal beds of Cape Paterson in Victoria, has given fresh colour to Mr. M'Coy's opinion. Nothing but a very careful and extensive measurement of all the sections in both colonies will establish the actual truth: but it is a singular fact, that whilst the Coal beds overlie, and are interpolated by, beds full of "Mountain limestone" fossils, no one has ever detected a single zoological fossil of Jurassic age in any portion of Australia!

This question of age has little bearing on the gold, except in relation to the age of the gold itself, of which mention has previously been made; nor is it of any importance to our present subject what are the minute details of the coal beds. My friend Mr. Keene, Inspector of Coal-fields, who has now had several years' experience in this Colony, and whose power of observation is acute, has been recently engaged in investigating the stratigraphical succession of the carboniferous beds in the region between Sydney and Goulburn, and I doubt not, when his Report has been made, data corroborative of those which I have already published or which I yet retain in my old field books and in M.S. will be exhibited for the satisfaction of such as may require more minute particulars than this, necessarily brief, summary contains.

All I have now to do, is to add, that wherever any of the above divisions of the carboniferous beds are found as *outliers* in the auriferous regions, no gold will be detected in them, except as it occurs in the conglomerate at Wingello; but that this may be a more important fact than at first sight appears, I may mention, that it is surmised by a member of the Geological Survey of Victoria, that some of the gold-bearing quartz drifts above the Lower Silurian rocks at the White Hills, Bendigo, have been originally derived from the conglomerates of the Carboniferous formation. I see no *primâ facie* objection to this view: but as there are beds like quartz conglomerate in the Silurian rocks,

* Geology of U. S. Exp. Exped. p. 495. † Appendice, tom VII. p. 689—692. (1857.)

the drift pebbles may, in part, be derivative from broken up conglomerates of that age as well as from destroyed and attrited portions of once solid, but invisibly jointed, reefs.

The thickness of this division I have not pretended to calculate; but it must be enormous; sections of it exist of more than 1000 feet, without including the dip. And under the more fossiliferous beds there are others, as on the Shoalhaven westward of Cooloomgatta, in which are only traces of fossils, and which extend to a great depth, and pass on-wards into red beds that apparently still belong to this formation. The whole formation is probably not less than 10,000 feet thick.

CHAPTER XV.

QUARTZ MINING.

Although our space is limited, this important subject must not be omitted. To save trouble I quote here a passage from one of my Reports to the "Gold Committee" of Tasmania, dated 28th July, 1856.

"The subject of quartz crushing has always been a favorite with me. I believe my letter of 8th July, 1851, to the Editor of the *Sydney Morning Herald*, afterwards referred to at a meeting of the Royal Society of Van Dieman's Land,* was the very first statement bearing on that subject ever published in any of these colonies, and I think I may conclude, that my experiments were the first that were here undertaken.† Since then, experience has led me to believe, that a vast amount of gold has been neglected in consequence of the natural preference of gold seekers for surface or deep alluvial deposits; for many veins—or "reefs," as some call them—of quartz, which are not visibly auriferous, have been treated with contempt, because no great amount of alluvial gold has been found in their vicinity, the popular mind not realising the possibility of a hard crystalline rock being saturated, as it were, with gold, without any appearance of it in a tangible form. Doubts, even, were

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* Extract from a letter by Ronald C. Gunn, Esq., to the Secretary, read at a meeting of the Royal Society of Van Dieman's Land, 13th August, 1851:—"Have you read W. B. Clarke's paper on the fact of gold and copper being found in quartz rocks when no indications of metals appeared to the eye, even when armed with a strong magnifier? It is curious and most interesting." (Proceedings, &c., in vol. II., p. 157.) See also my papers on Gold Mining and Quartz Crushing. *Sydney Morning Herald*, December, 1849.

† This letter and another on the same subject are printed in the appendix. (A.)

expressed by an eminent geologist at the time as to that possibility: e.g. 'I must confess, notwithstanding I may be accused of great ignorance, that I do not understand how gold can be contained in quartz so minute as not to be discovered microscopically.' (Report of the late S. Stutchbury, Esq., Geological Surveyor, Burrendong, 18th October, 1851.)"*

Whether I exaggerated or not the deductions from the first experiments that were made, may be determined by the following extract from one of those most valuable Reports communicated to the *Sydney Morning Herald* (No. 2, Sept. 19, 1859) by Mr. Dalton, in which he says:—"It is remarkable that, *in quartz yielding*" (at Adelong) "*from 7 to 8 ozs. to the ton, the gold is often barely perceptible, and in much that produces as high as five ounces, it cannot be observed even by the aid of a powerful lens.*"

In another letter dated 2nd May, 1859, addressed by me to the Hon. T. C. Chapman, Esq., Chairman of the Tasmanian Gold Committee, occur these words: "You must bear in mind, that all along I have been the advocate for seeking gold in the rock, and that the first suggestion respecting crushing and amalgamation in these Colonies came from my pen. I have never considered *Gold in deposits* except as in subordination to Gold in the matrix, knowing that the latter must be, or has been, the origin of the produce from the former."†

My distinguished friend, Sir R. I. Murchison, was originally as much opposed to such ideas as these, as possible, and, I presume, he argued from the small success met with in Russia.

As it appears that the whole amount of Gold produced in Russia, between 1704 and 1855, amounted to only ‡ 441,147 kilo-grammes (about 14,184,737 English Troy ozs.) which is about the amount of one year's produce at the beginning of the Gold production in California and Australia, and that of this amount the *annual* produce from mining was only § 33 kilo-grs. (about 923 English Troy oz.,) it is not surprising, that doubts should exist on the subject.

Those however, who have had experience in California or Australia, view the matter in a different light. Thus, M. de Tegoborski || says: "M. Martial Chevalier, who has very

* Parliamentary Blue Book, 25th August, 1857. p. 88.

† *Hobart Town Gazette (Extraordinary)* vol. XLIV. p. 745.

‡ *De l'Or et de l'argent par Tarassenko Otreschkoff*, 1856. p. 177.

§ *id. p.* 186.

|| *Essai sur les consequences eventuelles de la découverte des gîtes aurifères en Californie et en Australie par M. L. de Tegoborski, Membre du conseil de l'empire de Russie.* 1853. p. 90.

recently resided in California for the purpose of scientific exploration, believes, that when the alluvia which now almost exclusively occupy the emigrant population, on account of the facility with which they can be worked, shall begin to be exhausted, the production of gold, so far from diminishing will even become more considerable by the exclusive working of the quartz mines, which are capable, in his opinion, of occupying thousands of companies for ages to come.* This opinion has some opponents, and among them M. Murchison, who is one of the principal authorities on this subject. In his opinion quartz mining cannot produce great results; but if the richness of auriferous quartz veins had been a sufficiently determined fact, it would, in our opinion, be of great importance in the question of precious metals; for the experience of all times has proved, that alluvial mines in proportion as they are richer are commonly the sooner exhausted. . . . The richness of the Australian mines appears much to surpass that of the Californian mines."

In the third edition of his invaluable work on Siluria (1859) Sir Roderick has modified his views, and it is a duty to him to state this, especially as he appears to have done so on the evidence chiefly of Mr. Selwyn; but, he still maintains to a certain degree his prejudices against the idea that gold will be found at considerable depths;† in other words, he denies, that auriferous quartz veins are as rich below as they are near the surface.

It is not easy to satisfy either opinion, for, as suggested by Mr. Brough Smyth, unless a given level of depth be assumed, it is impossible to decide from individual experiences what answer is to be given to the dubitant. "The question, whether or not veins become poorer as the depth increases, is one which could have no practical value, unless we could refer our measurements to a datum line parallel to the surface of the schist rocks before that surface was altered by denudation. The subject is one full of interest to the geologist; but it is questionable whether it is of any practical importance in gold mining questions; and until the mode of filling metallic veins is better understood, it is difficult to say in what manner enquiries should be conducted."‡

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* *La Californie et l'emigration Europêene par M. Martial Chevalier. Revue des Deux mondes*, 1 *Sept*, 1852.

† Siluria, p. 567

‡ Victorian Board of Science. Second Annual Report, 1859–60, p. 8.

It seems to me that the question admits of a kind of comparative solution. Regarding the gold bearing schists in Australia as having undergone vertical or highly inclined elevation, which has been different in different localities, it would appear that where this elevation has been the greatest, there is the greatest probable evidence to be obtained upon the subject. The vast Gold Fields of Ballaarat, Bendigo, Castlemaine, &c., are on comparatively low horizons; the former much under 2000 feet, the latter much under 1000 feet. There, undoubtedly, the alluvial gold is likeliest to be abundant; but the argument respecting quartz veins is different. On the Eucumbene, &c., on the contrary, the quartz veins that occur there are at a height of nearly 6000 feet above the sea. We may, then, imagine that the latter, now very high in vertical position, were once as low as those of Bendigo, or lower still. If we suppose that the auriferous veins near Giandarra, and about the heads of the Tumut were auriferous at the time of their elevation, (and here comes in another question which has elicited strong unfavourable opinions from Sir Roderick Murchison, who believes that the Silurian rocks were impregnated during a late tertiary period—an opinion which my own experience does not lead me to adopt as certain), then we may suppose that the Bendigo and Ballaarat reefs are not prolific at what was once a very great depth below their original surfaces, or that the Eucumbene veins which are auriferous at the present summits, 6000 feet above the sea, are (judging from the Victorian examples) likely to be auriferous for 5000 feet below, and at present the greatest depth in which gold has been worked in Australia from the rock is not a tenth part of that depth. Whilst, therefore, I would pay all respect to the judgment and opinions of Sir Roderick, I still think that there is more to be said in favour of those from which he dissents. The whole judgment against gold in depth is deduced from *negative arguments*. A few years will, however, settle the question so far as it can be settled; but that can only be when labour and capital are sufficiently available to enable the reefs to be wrought at depths which will be admitted to be sufficient to test the decision. In California, gold has been procured at a depth of 2000 feet.

The following instances of the increase of produce in depth on the reef at Tarrengower, may be cited as proofs of the correctness of the opinion expressed, so far as the individual locality is concerned.

CLAIM.	DEPTH IN FEET.	YIELD OF GOLD PER TON OF QUARTZ.
Fenteman's	180	4 to 8 ozs.
"	220	12 "
Wilson and Co.	230	£8 per man.
"		
Hutton and Co.	150	not payable.
"	220	6 ozs.
Miller and Co.	130	not payable.
"	235	payable
Brewer's	185	2 to 6 ozs.
	Below this.	17 ozs.

In the mean time, quartz mining, as an industrial pursuit will increase in importance, and will, eventually, occupy the intelligence and skill of a more scientific class of workmen, than the generality of those who find digging in the alluvia a profitable employment. The day, of course, must come, when the alluvial gold will all have been cleared out; but that day is, probably, *very distant*, because there are hundreds of square miles of territory within the two colonies of Victoria and New South Wales that have never been touched. And, if quartz mining and crushing are as profitable, generally, as they have been found locally turning out well,* the gold-producing population will be transferred

* Mr. Dalton reports that of 80 companies who worked the Great Adelong Reef, between June, 1857, and September, 1859, though 39 cleared nothing, and 20 hardly paid their expenses, yet 21 did well, some retiring with an independence.

That my opinions are held by others also, is apparent from the following passage by a well-informed writer in the *Melbourne Argus*, of 26th March, 1860, who, at the close of an analysis of the Report of the Mining Board, says:—

"*All apprehension of the quartz ceasing to be auriferous at considerable depth appears to have died away—not that it was ever very prevalent with practical miners*—and the Report states that a shaft at Clunes was being carried down to the depth of 600 feet. Notwithstanding that the large companies which were formed during the past year, have not had time to get their machinery into working order, yet the quantity of work accomplished by private companies has been immense. Mr. Woolgrove, reporting from Steiglitz, a comparatively small gold-field, states:—'The value of time, labour, and money expended on this field is almost incredible—not less than £3000 to £5000 per shaft can be calculated on.

from one class of labourers to another: but the product will be equally great, perhaps, and more inexhaustible, and the pursuit of gold seeking will gradually become a scientific business.

In New South Wales, and especially in the Southern Gold Fields, quartz crushing has not won the favour it enjoys in Victoria. Probably, the companies are not so wealthy, and perhaps the Colonists of N.S.W. are not altogether so full of enterprise as those across the border. But the chief obstacle is, undoubtedly, the high price of labour and the cost of the operations; and there have, hitherto, been a great indifference on the subject, and a want of encouragement on the part of the Government. There are hundreds of reefs at this time lying idle and untested. There are numbers of them in the Araluen country; in the vicinity of Turallo Creek, west of the Gourock Range; in different parts of Maneero as, for instance, about the Bendoc River; along the Berudba; near Cooma; along the Murrumbidgee; in the heart of the County of Wellesley; along the Alps: and especially east of the Adelong and the Tumut, and in the high slate ridges, at the heads of the four great rivers.

Some of these are known to contain visible gold; and that which I have seen from the vicinity of Giandarra appears to me to be in as great proportion as in many others that have turned out well. Believing, as we must, that the enormous wealth of alluvial gold in Australia has been chiefly derived originally from similar veins and reefs, and looking to the fact, that the higher reefs have not been subjected to so great an amount of degradation as those in the lower regions, all seems to encourage the hope that in these higher reefs there will be found no trifling addition

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In the Invincibles claim, a sum of £2280 has been expended up to October last on labour alone, and gold has only been obtained lately in payable quantities. If to this sum be added the money for materials, &c., the whole will fall little short of £3000. There have been 350 shafts sunk on this field, to an average depth of 140 feet, so that the amount of money and labour expended will exceed in value half a million sterling."

"In conclusion, we may remark, that the practical researches of the mining surveyors are likely to be productive of great benefit. Already, we think, they have satisfactorily answered two questions of importance to the miner and to the colony. The older ground, with suitable machinery, affords more certain remuneration than newer fields; the auriferous deposits in the colony are practically inexhaustible, and their remunerative working may be continued to any, the most remote period, simply by successive improvements in machinery."

to the future production of our Gold Fields. I do not, by this admission, ignore what I have said of granite gold.

It is, however, true, that there is no positive certainty that any given reef will be found equally rich throughout, or even auriferous all through; the facts elicited on Adelong Creek, and in the neighbouring region, prove, that though to a depth of 130 feet even, gold, in some reefs, is richer than near the surface, yet in others no gold exists at all at any depth yet reached. Moreover, it appears, that where the gold is most abundant, there the quartz is in a peculiar condition; and although the difficulty of separating the gold from the mundic and ores of iron is very great, yet it is in the vicinity of these ores, and in association with them, that the greatest amount of gold is frequently found. We are indebted for this information to the laborious and admirably directed efforts of the gentleman before alluded to, who has contributed such an amount of valuable knowledge respecting the country in question to the columns of the *Sydney Morning Herald*, and who is now officially employed by the Government.

Respecting the occurrence of mundic and other minerals, and the mode of freeing them from the gold, a local inspection and enquiry have been recently undertaken by Captain Ward, R.E., Deputy Master of the Royal Mint, and by Professor J. Smith, M.D., of the University of Sydney; the Report on the results of their labour and investigation, is not complete, but another paper read before the Philosophical Society of New South Wales, in November, 1859, will be found in the Appendix. Here may be mentioned, however, that the mundic consists of three varieties: "(1) copper-red, consisting of nickel, iron, copper, lead, arsenic, sulphur and cobalt; (2) lighter in colour, a compound of nickel, iron, antimony and sulphuret of lead; (3) a silver-white combination of nickel, iron, cobalt, and arsenic, the latter constituting three-fourths of the whole."

I have myself had submitted to me all these varieties; and they exist elsewhere in similarly constituted country, as for instance, about Mudgee, and in other parts of the Western Gold Fields. In a reef recently opened (July 1859) near the Cudgegong, called Bromby's Reef, the gold occurs as at Adelong, associated with masses of crystalline compound minerals, some of them white and glistening, others yellow or dark, and, probably, there will arise the same difficulty as has been experienced at the latter place in separating the gold. The process by which this shall be easily done will be a great boon to gold producers.

The occurrence of nickel in the Fingal gold from Tasmania, was proved by Robert Hunt Esq., of the Sydney Mint, in a sample submitted by me in November, 1856. "On further examination," he says, "the gold from the Black Boy, after melting gave 0·08 per cent. of iron, and traces of copper, tin, lead and nickel, while that from the Nook gave 0·17 per cent. of iron and traces of copper and tin. In neither case was nickel or cobalt found in the metallic iron." (*Blue Book. p.* 101.) This, be it noticed, is alluvial gold.

There is one fact elicited at Adelong that may be mentioned here as justifying what I have said in Chapter IV. In one part of the Great Reef, particles of gold were found both in the slate and the granite.

Having inspected several quartz-crushing localities in Victoria, between Anderson's Creek and Mount Alexander, and having collected a considerable amount of information from this Colony and Tasmania, from which I have at different times received numerous collections of quartz, for the purpose of testing their auriferous value, I might here content myself with quoting my own experience alone: but it will be more advisable to refer, as well, to the evidence afforded by the Reports on Adelong and to the statements made in the Mining Surveyor's Reports in Victoria, because my desire is to supply as complete an amount of ascertained knowledge as is practicable on this subject, so likely, some future day, to be of importance beyond the present limits of research; and, as convenient for reference, I will place the matter, as much as possible, in a tabular form.

By this means an opinion can be formed as to the probable success that will attend any experiments on any newly discovered reefs. At the same time, it should be remembered, that though an experiment may succeed so far as a small individual mass of quartz is concerned, within a short distance of it, the quartz may be found barren. Some of the quartz, for instance, in Tasmania, seemed to promise success; but, on the whole, the quartz-crushing establishments there have not succeeded, and have been, in great measure, abandoned, owing, probably, to the difficulties of production, which do not, however, contradict the facts elicited by previous analyses.

TABLE I.

SAMPLES OF QUARTZ FROM TASMANIA,

Subjected to analysis by C. J. Hodgson, Esq., Assayer, of Sydney and Melbourne, and reported to the Gold Fields Committee, Hobart Town. *See Further Papers relating to Gold in Australia, presented by command of Her Majesty to both Houses of Parliament, 25th August,* 1857.

Date.	No.	Locality.	Weight of Quartz.	Proportion of Gold, per ton.	Remarks.
1856.			oz. A.	oz. d. gr.	
July 28	1	In yellow Slate, Specimen Hill, Fingal.	16	15 3 19	Found in situ by W. B. Clarke.
	2	Slope of Granite, South Esk, near Avoca.	10	3 8 14	
				ozs.	
Sept. 27	3	Frenchman's Cap.	16	1.610	Collected by F. Calder, Esq., Surveyor-General.
	4	Base of Mt. Arrowsmith.	12	4.180	
	5	Between Nos. 3 and 4.	39	4.180	
	6	Vein from S.W. slope of Mt. Arrowsmith.	15	8.012	
			lbs.oz.	grains	
Nov. 11	7	Behind Specimen Hill.	4.0	33.60	
	8	Burnt Tree Reef.	4.0	42.0	
	9	Cameron's Reef, St. Mary's Pass.	4.0	39.20	
	10	(Collection of drift siliceous rocks) from Swanport.	4.0	106.40	
	11	(Quartz & Quartzite) from Swanport.	4.0	11.20	
Nov. 12	12	Quartzite, Pt. Davey.	2.0	134.40	Mixed with metallic iron.
	13	Micaceous Schist, Port Davey.	1.6	300.98	
	14	Clerk's Reef, Fingal.	2.0	134.40	
		Ditto ditto.	6.0	7.460	Ditto.
1859. June 18	15	Eastern Slope of Mount Arrowsmith.	37.1	291.300	These were brought down by Mr. Tully, from the Western Highlands of Tasmania, during his expedition in search of Gold in the neighbourhood of Frenchman's Cap, January to March, 1859; sent to me from Hobart Town, and forwarded by me to Mr. Hodgson in Melbourne. The results, with the gold produced, I forwarded with a Report to the Gold Committee, 18th June, 1859. (For Mr. Tully's Report, and my remarks thereon, see Hobart Town Gazette, No. 4098.)*
	16	Shaft under Frenchman's Cap.	7.0	353.920	
	17	Grotto Reef.	4.10	665.280	
	18	Calder's Reef.	44.6	64.500	
	19	High Reef.	23.6	20.180	
	20	Point Hibbs.	22.2	71.680	
				ozs.	
	21	Pebbles of quartz from Macquarie Harbour.	4.0	2,566	

* Notwithstanding the proofs of the existence of gold in the quartz of the localities cited in the above table, according to the testimony of Mr. Hodgson, whose Reports as received by me I handed to the Gold Committee, it seems great doubt has been thrown on the auriferous value of the high western regions of

In some parts of New South Wales, quartz is much richer than any named in the above table. For instance, two samples of 13 oz. and 14 oz. from Boonoo Boonoo, in New England, were analysed for me by Mr. Hodgson, and produced respectively 179 grains, and 1 oz. 14 dwts. of gold.

At Iron Bark Crushing establishment, the Orange and Sydney Company, according to the Report of their manager, Mr. E. Combes, produced, between 15th May and

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Tasmania, if I may judge by the Report of Mr. Tully in 1859, and more recently by that of Mr. Gould, the Geological Surveyor. I have only seen, at present, an extract from the latter document. By it, I learn that Mr. Gould considers, that in that part of Tasmania, the quartz is not in reefs, but belongs to the structure of the azoic mica schists (which, however, in some countries are very auriferous,) that Silurian formations are rare, and that granite is scarce. To this he, in part, attributes the paucity of gold. His view, therefore, agrees with my own, so far as the absence of the granite and certain trappean rocks is concerned ; for I have especially mentioned this in my remarks on Mr. Tully's Report, addressed to the Chairman of the Gold Committee.

My last visit to Tasmania, in 1860, has enabled me to conclude, that the gold in that country is generally held in sulphuret of iron, and as that is the most difficult matrix for the separation of gold, whilst quartz is the easiest, this may account in some degree for the alleged poverty of the very slight alluvial soil in the higher regions, where the rocks are very ferruginous and appear to have been thrown up along a narrow axis; but my impression still is, that though no extensive alluvial gold field can exist in Tasmania, yet there are localities in which gold exists in the rock. Mr. Gould says: "While pointing out the dissimilarity of these formations, I must observe that the metamorphic rocks throughout the world are frequently metalliferous, and even gold-bearing; and that it was therefore perfectly reasonable to speculate upon the possibility of their being so in this instance also."

* * * * * *

"Since the greater or less abundance of the gold existing in *alluvial deposits* may be assumed as a fair test of the average auriferous value of the *rocks* from which they have been derived, I think it improbable that rich, or even merely payable, quartz veins can exist in the vicinity of spots so carefully examined and without the slightest success,—unless indeed the gold should, as has been suggested by the Rev. Mr. Clarke, be present in a microscopic state of subdivision, *saturating* the quartz, and inseparable from its matrix by the ordinary mechanical appliances, when recourse would be necessitated to the expensive process of reducing the quartz by chemical re-agents."

This view I submit is a reasonable one, and that which I have always advocated; and it is impossible to believe that any mistake to a serious extent, can have taken place in collecting or forwarding the quartz to be analysed, or in the assay.

The *Hobart Town Advertiser* of the 3rd August 1860, adverting to the publication of the Report by Mr. Gould, states that "it most fully justifies the extreme caution with which the Rev. W. B. Clarke has always spoken of the auriferous character of the Colony." Mr. Gould "feels convinced from the uniform want of success which attended his efforts, that there is no chance whatever of discovering gold in remunerative quantities in the district visited by him :" and "Mr. Clarke will not at all be surprised to learn that such is the case. Arguing by indication from *scientific data* respecting a portion of the island which he *had never* visited, the latter geologist has stated, that *if* a payable gold-field is discovered in Tasmania it will be in such and such localities; and judging also from places which he *had* visited, he has affirmed publicly and privately that he is not sanguine in his expectations of any great yield of the precious metal in any locality whatsoever. As to the specimens of quartz forwarded to him and assayed, it will be remembered, not by himself, but scrupulously apart from his own operations, he simply reported the relative amount obtained from each respectively with such remarks and suggestions as the simple facts elicited. Doubtless he believes from inductive reasoning that the colony is auriferous ; but he believes that to obtain gold in appreciable quantities, chemical agency will be required to effect its separation from the matrix."

15th June, 1860, 14 oz. 14 dwts. 17 grs. of gold from 40 tons 6 cwt. 17 lbs. of the Beehive Reef, which in one place has been found payable to a depth of 90 feet. This is at the average rate of 2 oz. 10 dwts. $1\frac{3}{5}$ grs. of gold per ton.

The produce at Adelong is far greater than this. From the Great Reef there, between June, 1857, and September, 1859, 12,000 tons of quartz produced 60,000 oz. of gold, or an average of 5 oz. to the ton of quartz. In some instances, in other lodes the amount has been as high as 8 oz. 15 dwts. to the ton; in the Currajong Reef, some of the quartz produced 17 to 20 oz. to the ton. But these are exceptions. Of course, this is not all profit; for the production of 51 oz. of gold from 173 tons of quartz on the Victoria Reef cost £670, or £13 6s. 3d. per oz.

On the Great Reef, between June, 1857, and September, 1859, 750 men produced 60,000 ozs. of gold: deducting from the value at 70 shillings per oz., £14,500 for crushing expenses, and £20,000 for powder, tools, and cartage, the result is only £2 per week per man.

The process of sinking is very difficult, two feet a week for three men is considered good work; and £5 per foot is thought reasonable pay. One may judge from this, how unlikely it is that labourers, without capital, will ever be able to produce gold except from alluvium. But, the fact of the existence of the gold in the reefs is not affected by the difficulties of obtaining it. Yet, under such conditions, the phenomenon of alluvial gold is invested with a higher interest; it is an evidence of design for the benefit of man, in enabling him to obtain easily the means of peopling new countries.

In Victoria, quartz crushing has become an industrial pursuit of immense importance. Out of a mining population of male adults, amounting to 125,764 persons, there were in February, 1860, 85,249 Europeans, and 25,149 Chinese employed in alluvial mining; and 15,342 Europeans with 24 Chinese occupied in quartz mining; and the value of the "plant" was no less than £1,155,923 sterling, an average of £8 17s. 5½d. to each miner; and this is exclusive of labour of all kinds.* About an eighth, therefore, of the mining population are engaged on quartz reefs.

* Second Annual Report of Board of Science, Victoria, 1859–60.

The Mining Board report, that the alluvia "are not exhausted, and in many places are untouched. The oldest gold fields continue to yield a fair return, as improved methods are introduced, and perhaps none of the gullies, often as they have been turned over, can yet be considered exhausted. The quartz reefs have scarcely been opened in many parts of the oldest districts, and vast areas of new ground are being discovered, from time to time, which promise abundant work for years to come." (p. 9.)

So rich are some of the reefs, that in the Ballaarat division, on the Black Hill the quartz miners using only hand hammers, frequently earn from £6 to £10 a week: and the "tailings" have produced, when crushed, 15 dwts. per ton. (p. 12.)

At Clunes, the Port Phillip Company obtained 39,034 tons of quartz producing on the average 1 oz. 4 dwts. 8·41 grs. nearly, per ton. (p. 13). At Blackwood, 114¼ tons. of quartz from Johnson's reef produced 11 ozs. 16 dwts. (p. 14.)

At Indigo, in the Beechworth division, which includes Omeo, the quartz veins yield from 1 to 5 ozs. per ton. (p. 16.) At Kilmore on the Goulburn, in the Sandhurst division, where the reefs have, it is said, not received a fair trial, 188¾ tons of quartz have yielded more than an average of 13 ozs. 19 dwts. per ton. At Rushworth the reef, at Chinaman's Hill, has averaged 7 ozs. to the ton from the beginning. (p. 18.)

At Dunnolly, in the Marlborough division, the yields per ton are from 2 ozs. to 25 ozs.; and many of the shafts are very deep. One reef at a depth of 200 feet yields 600 ozs. weekly. (p. 20.) About Castlemaine, pieces of gold weighing from 1 oz. to 5 ozs. are frequently taken. From 365 tons, the average yield was 1 oz. 11 dwts. 14 grs. (p. 22.) From the Eagle Hawk Reef at Maldon, 360 tons gave 305 ozs. 11 dwts. 18 grs. (p. 22.) At Hepburn, as much as 70 ozs. per ton has been obtained. (p. 23.) At St. Andrew's, 90 lbs. of quartz yielded 144 ozs. of gold; and 60 lbs. of quartz 15 lbs of gold. One reef, 2 inches thick, yields 2 ozs. per ton. (p. 24.)

After perusing the above, it is probable, that quartz crushing will rise in estimation: but there is need of this warning, again given, that neither all reefs, nor all parts of any reef, are equally rich, and where some make their fortunes many others are beggared. In travelling between Taradale and Castlemaine, I was much struck with the fact, that the roads are being made with auriferous quartz that is considered too poor to crush except by wheels; and yet the finds by the road-makers are sometimes great.

The following table gives examples from the Mining Surveyor's Reports, in April and May, 1860, and I would call attention to the appended remarks. It will be seen, that whilst one reef that produced 13 ozs. 13 dwts. per ton, is not payable, others, of which one yields only 3 dwts. 6 grs. per ton, are payable. The expense of working and the instrumental aids vary in different localities.

TABLE II.

EXAMPLES OF QUARTZ CRUSHING IN VICTORIA.

District.	Division, &c.	Tons of Quartz crush'd	Gold per Ton. oz. dwts. gr.	Remarks.
Ballaarat	Black Hill Co - -	—	0 10 0	Remunerative.
	Independent Co. - -	—	0 15 0	
	Band of Hope - -	24	20 7 0	On Victoria Reef.
	Golden Point Lode -	—	0 3 6	Low as this is, Mr. Cowan, the Mining Surveyor, reports that it pays owing to the method of working.
	Last Chance Creek -	—	0 6 18	"The work is now done at a lower rate than was deemed possible; and there is a probability of a further decrease."
	Staffordshire Reef -	3369	0 15 0	From Aug. 15, 1859, to May 19, 1860,—2548 ozs. gold.
	Perseverance Creek -	100	0 10 0	Depth 145 feet; breadth of reef 25 feet.
	Creswick.			
	P. P. Company - -	2115	0 11 5	From 3rd May to 31st May, 1860.
	Clunes, Q. M. Co. -	8350	0 19 12¾	From 20th October, 1859, to 20th April, 1860.
	Gordon.			
	Hick's Reef - - -	—	0 9 6	20 feet down.
	Egerton Reef - - -	50	2 0 0	70 feet down.
Beechworth	Indigo.			
	Cornish Town - - -	—	7 0 0	
	" "	—	2 0 0	
	Buckland.			
	Alta Reef - - -	—	1 5 0	On the cap of the reef, 13 ozs. to the ton.
	Nelson Reef - - -	—	0 10 0	
	Pioneer Reef (small vein) - - -	1	13 13 0	Abandoned.
	Oriental Reef - - -	824	4 0 0	Improving.
	No. 1, North - - -	120	1 10 0	
	No. 2, South - - -	24	1 10 0	
	" "	14	7 5 0	
	" "	—	10 0 0	60 feet down.
	Mead's Reef - - -	95	3 0 0	
	Gander's Reef - -	—	4 10 0	

District.	Division. &c.	Tons of Quartz crush'd	Gold per Ton. oz. dwts. gr.	Remarks.
	Elgin Reef	210	44 5 0 to 15 0 0	Run out.
	Richardson's	—	—	Smothered in gold.
Sandhurst	KANGAROO FLAT.			
	Bendigo, Fagg & Co.	—	5 0 0	75 feet deep; worked out.
	,, Ross & Co.	14	3 10 0	
	Golden Gully Co.	—	1 0 0	
	Silverlock & Co.	—	1 10 0	
	Thistle Reef	—	2 10 0	
	Eastern Victoria Reef	—	50 0 0	
	KILMORE.			
	King Parrot Creek	—	—	
	Triangle Line (1)	—	2 0 0	
	,, (2)	—	12 10 0	
	Hannigan's Line	—	1 0 0	
	Muddy Creek	—	13 10 0	
	,, ,, ,,	—	7 0 0	
Maryborough	MARYBOROUGH	1160	1 9 0	Monthly.
	DUNOLLY.			
	Perseverance	—	0 8 0 to 1 0 0	Five claims.
	KORONG.			
	Bonaccord Reef	20	1 0 0	Not paying.
	Jericho	—	1 5 0	
Castlemaine	TARADALE.			
	Humboldt Reef	7½	42 0 0	
	,, ,,	2	4 8 0	
	,, ,,	20	1 10 0	
	,, ,,	4	64 16 0	Refuse quartz gold.
	,, ,,	18	0 9 10	23 carats fine.
	Frenchman's Reef	1	3 0 0	Abandoned. Did not pay at that!
	,, ,,	—	11 0 0	
	Reef in Barfold Ranges	90	125 16 0	
	,, ,,	15	20 5 0	
	,, ,,	16	36 10 0	
	,, ,,	5	3 3 0	
	CASTLEMAINE.			
	Specimen Gully Gold Mining Association	6	1 0 0	Nearest to Mount Alexander.
		464	6 7 18½	
	Bolivia Reef Creek	250	0 5 0	
	27 Reefs	727	5 0 19	Mean of the whole.
	ST. ANDREW'S.			
	Oram's Reef	—	6 0 0	Average of all the quartz; depth 40 feet, thickness 1 foot. The ground near it is intersected by quartz in every direction.
	HEPBURN.			
	Old Reefs	—	1 0 0 to 1 10 0	Average of all.
	Gray's Reef	—	1 0 0 to 1 10 0	
	New Nuggetty Reef	—	3 0 0	Usual amount.
	Melvin's Reef	—	1 0 0 to 1 10 0	
Ararat	PLEASANT CREEK.			
	Cross Reef	—	127 0 0	These are individual cases, not the average.
	,, ,,	160	600 0 0	
	Glen Dhu Reef	—	1 10 0	

The above particulars are detailed here, in order to give the New South Wales gold seeker an idea of what is going on in the Colony of Victoria.

In the threatened invasion of gold hunters next spring to the heights of the Muniong, where, perhaps, many thousands may be destined to disappointment and vexation—arising from climate, want of supplies and exaggerated hopes—the necessity will be felt of spreading eastward and westward along the flanks of the Alps; and then they will, probably, discover reefs as rich as those in Victoria, if alluvial diggings not so rich are all that await them. Whatever may be the result of the Golden Crusade, I hope I may take to myself the consolation, that whilst endeavouring, to the best of my judgment, to lay the truth (as I believe it) before the public, I have carefully guarded myself against all tendency to exaggeration.

That the probable future of the Southern Gold Fields, will be a successful one, may be fairly surmised from the official Mint and Escort returns of the Gold produced from them. During the period from 1st January, 1857, to 30th June, 1860, that produce was 305,605 ounces.

The "next to worthless" Araluen field produced very nearly 66,000 ozs. from 1st July, 1859, to 17th July, 1860, verifying Mr. Hardy's opinion, as well as mine (see p. 36); and from January to 30th June, 1860, the small field of Giandarra (corrupted into Kiandra) sent down 42,000 ozs., and one nugget has been found weighing 27 lbs.

These figures speak for themselves.

APPENDIX.

(A.)

FIRST NOTICE OF GOLD INVISIBLY DIFFUSED IN AUSTRALIAN QUARTZ, ALLUDED TO AT PAGE 253.

METALLIFEROUS QUARTZ AND ITS COMMERCIAL VALUE.

(*To the Editors of the Sydney Morning Herald.*)

July 8th, 1851.

GENTLEMEN.—In page 23 of a pamphlet recently published by me, respecting "The Discovery and Working of Gold," I have stated that there is no reason to doubt, that gold occurs *invisibly* in quartz rock, and that it is worthy of experiment how far the working of quartz may be profitable in this Colony.

I am indebted to the kindness of Mr. Hale, of George Street, for an opportunity of proving that gold exists in this way in the quartz of California. Mr. Hale supplied me with some powdered quartz, and from an ounce of it, though exhibiting *no trace to the eye armed with a powerful lens, of any metallic or other foreign substance*, I have been able, even by a very rude process, to obtain between two and three grains of pure gold, and a portion of a grain of pure silver.

From an ounce of pounded quartz, obtained from a fragment sent to me from Ophir by Mr. Hardy, I have, as well as Mr. Hale, whom I supplied with an equal quantity from the same specimen, obtained two grains of *pure copper*. Mr. Hale, in my presence, reduced from his share of the powder, upwards of two grains of copper alloyed with one grain of gold. He has been also good enough to furnish me with specimens of gold from Californian quartz; and with two grains of copper from one ounce of quartz from Wellington Valley, reduced by himself. I have also obtained three grains of copper and gold from an ounce of *quartz rock of the Murrumbidgee, not far from Mount Tennant*. These experiments are sufficiently successful to justify all that I have said respecting the value of pure quartz as a metalliferous substance, and my previous experiments have been thus verified, not only by myself, but by an independent and skilful assayer. The importance of these facts is so great, that I deem it a duty to the Colony to give them publicity. The only process employed has been that alluded to in the first complete paragraph of p. 23 of the pamphlet, omitting the vessel to distil the quicksilver. And, although I merely reduced the amalgam incompletely in a common table spoon over a candle, when it was afterwards subjected to the heat of the blow-pipe, it was found, that the result was proportionate to that Mr. Hale obtained by means of a better process, with a larger quantity of powder.

It is somewhat remarkable, that copper should be produced not only from the Ophir, but also from the Wellington quartz. Yet, when we know, that gold exists perceptibly in the copper ore at Carcoar, and that it has been found abundantly in the copper at Chessy in France, it is not altogether surprising, that it should be detected as existing *invisibly* in the quartz in which both gold and copper also visibly occur. I may add further, that I obtained copper from a portion of a crystalline quartz dyke brought to me by Mr. Hill from Antonio's Creek, a branch of Solitary Creek. The probability is that all the Australian quartz is more or less metalliferous. Now, at the rate of production by the above mentioned experiment, taking gold at 76 shillings per oz. (American value) a ton of Californian quartz, such as that used in our experiments, would be worth £1,140 sterling. Worked for copper the Ophir and Wellington quartz would be worth (at £75 per ton of copper) 6s. 3d.—And, allowing for gold at the rate of a grain to the ounce of the same auriferous quartz, the value of quartz per ton, producing both copper and gold, would be (at 64 shillings per oz. for gold,) £160 6s. 3d. It is very certain, that this, even allowing for the cost of production, indicates a new source of Colonial wealth, only one, perhaps, of many connected with the previous discovery of gold.

W. B. CLARKE.

St. Leonard's, July 3rd. 1851.

To the Editors of the Sydney Morning Herald.

Gentlemen,—If you deem the following remarks worthy of insertion, you will oblige.

Through a suggestion of the Rev. Mr. Clarke, as to trying pure quartz for gold, I broke up and reduced to powder some milk-white quartz, a "water worn stone" from California, and some crystallized quartz that I brought from Wellington; before and after breaking, there was no metalliferous appearance, even with a magnifying lens. I treated an ounce weight of each with quicksilver, and after evaporating the mercury and melting the residue, I obtained *six grains of fine gold* from the ounce of Californian stone, and three grains of copper alloy from the other. I should be very glad if your intelligent Special Correspondent at Ophir, would send me some waterworn quartz stones from that locality to test; for, if they prove of the same value as those from the gold diggings of California, it would be a most important discovery for Australia. I may add, that I supplied the Rev. Mr. Clarke with some quartz for testing, and the same result followed.

I remain, &c.,

496, George Street, THOMAS HALE.
8th July, 1851.

P.S.—Since penning the above, Mr. Clarke has had some of the quartz stone from the Summerhill Creek: it produced a gold and copper alloy, with sufficient gold to make the crushing of gold a most profitable employment.

Note.—About the same period, Mr. Rudder of the Macleay River tried an experiment of similar kind. Under date of 13th July, 1851, writing from Summerhill Creek, he says: "I have observed, that the quartz which is found with the gold is all thrown away. This quartz contains gold in very minute particles. I detached some from a specimen which

I obtained; this I reduced to powder, and adopted the process of amalgamation with mercury, and the result was that 1/77th part was gold. I have since tried two other pieces in which no gold was visible to the eye, and again obtained gold. My experiments are from necessity very imperfect, not having facilities for their performance; still however, they satisfactorily prove the existence of gold in such minute particles as are imperceptible to the eye."

P.S.—Since writing the above, Mr. Commissioner Green has informed me of the Rev. Mr. Clarke's letter about the quartz.

To G. Oakes Esq., M.C., Paramatta."

B.

GOLD WORKING.—ASSOCIATED MINERALS, &c.

To the Editors of the Sydney Morning Herald.

GENTLEMEN,—In examining the refuse matters from the washings of cradles, which have been placed in my hands, I find amidst the titaniferous iron sand, oxydulated or magnetic iron sand, (which are wrongly called Emery) and in some cases minute fragments of hornblende, small crystals of zircon and hyacinth and rosy quartz, (these three being all improperly denominated Ruby, which, like Emery, is an *aluminous* mineral), together with minute rounded particles of a white malleable sectile metal, having the appearance of silver, and the specific gravity of tin (6·64), but which I have not had in sufficient quantity to determine. It is this, I believe, which some persons have, in ignorance of the Sp. Gr., called platinum and palladium (a metal never, I think, found unalloyed). From some specimens of a white metal among the grains and flakes of gold from the Turon, exhibited to me by Mr. Hale, which, when subjected to heat, became as yellow as the other particles of gold, it is certain there are alloys of mercury in the alluvium, though in minute quantities; for the evidence of the finders and their proceedings in separating the white from the yellow metal, establish the probability of the existence of quicksilver somewhere in the neighbourhood, unless these particles have been washed accidentally from a quicksilver machine, which, however possible, is unlikely to be frequent. I have in one instance found a thin plate of flexible silver, crystallized, having a Sp. Gr. of 10.

In taking the specific gravity of some specimens of gold from the creeks, I found, that it comes out often as low as between 12 and 13. This is quite in accordance with facts known to metallurgists, and in Beudant's work on the subject, there will be found mention of cases in which *unmelted* native gold had a Sp. Gr. 3 and 4 units below the Sp. Gr. after fusion. It is, therefore, not possible to value native gold by the Sp. Gr. till it has been fused.

In obtaining gold by amalgamation it has, I believe, been found, that the amalgam is incomplete in some instances, and that the gold is spongy. The latter is a fact well known in gold manufactories. The former, probably, depends on temperature, which requires to be above 50° F. before the process is completed. The low temperature of the Turon and Ophir country during the winter prevents, I have no doubt, the complete amalgamation in many instances. Even in the silver workings of Mexico the perfect amalgamation of the mercury and silver requires *six weeks in winter,* though in *summer four* will suffice. This is the reason why, in Virginia, the gold mills are supplied with *hot* water as well as cold. (*Plain Statements,* p. 24.)

In your paper of Monday last, there is an allusion to some experiments made in crushing quartz by Mr. Rudder, as "independent" of mine. His results appear to justify my previous statement, that I did not "overrate" the value of quartz: but Mr. Rudder's experiments were not altogether tried upon quartz in which *no gold is visible;* when it is visible, of course the value is very much higher. But that your readers may not think it impossible for rock with or without visible gold to be infinitely more productive than either Mr. Rudder or your other correspondent supposes, I quote here a passage from Ward's Mexico: "I have myself seen ores from Guarisamey, at the mint of Durango, which contained 2100 grains to the Marc. (There are 576 grains in the ounce). The mine of Rayas has produced ores containing 2700 grains; and 550 grains per Marc is by no means an uncommon *ley de oro* (proportion of gold) in the mine Villalpando at Guanajuato." (ii. 11). The Marc is 3550·5 grains.

W. B. CLARKE.

St. Leonard's, July 22nd, 1851.

ADDITIONAL NOTE ON

GEMS, METALS, AND OTHER MINERALS ASSOCIATED WITH GOLD ALLUVIA.

The occurrence of crystals, either perfect or much abraded, of sapphire, corundum, ruby, topaz, hyacinth, emerald, and amethyst in the gold alluvia of the Southern as well as the Northern Gold Fields, together with oxide of tin in the former, is now so common, as to need little remark.

None of these however, at present, except tin, have been found of any commercial value.

Small particles of a white mineral, extremely hard and of a very high specific gravity, frequently occur in the same alluvia. Some of them I have found to be *platinum*, others are, undoubtedly, *native iridium*, the colour, gravity, hardness, crystallisation, lustre, &c., all agreeing with the known composition of that mineral.

Hitherto, these minerals have been found in no profitable quantities.

Silver has been found in two or three instances in the same way, in arborescent crystals or small fragments. Strzelecki had found traces of silver in the western country as early as 1839. The crystals now mentioned belong to the Southern districts, and have been found since 1852.

Sulphuret of antimony, nickel, native lead, native iron, minute crystalline particles of native copper, titanium, and where serpentine occurs, chromate of iron, are also occasionally found. I have had specimens of all of them.

Cairngorm and other rock crystals, cymophane, olivine, epidote, opal, zircon, garnet, titaniferous iron, oxydulated iron, &c., are very common, and sometimes, abundant.

The occurrence of schorl, or black tourmaline in granite, is a good indication of *tin*, that of hornblende and cubic iron pyrites is a good indication of gun-powder gold.

17th August, 1860.

C.

NEW SOUTH WALES A DIAMOND COUNTRY.

During several years I have had submitted to me an immense number of minerals for inspection and examination; and, on various occasions, varieties of *rock crystal*, of *topaz*, and of *white zircon*, have been sent to me, under the idea that they were diamond. Some of these were sufficiently curious, but, of course, I was obliged to disappoint the expectations of my correspondents. The white zircons, which sometimes assume the form of a double four-sided pyramid, terminating an extremely narrow four-sided prism, have readily deceived the persons who have found them, especially as such stones are often used by jewellers, as "rough diamonds."

The topazes, which are extremely common in gold alluvia of many Australian districts, have also puzzled the finders; and so much have they the look of diamonds, that a dispute was carried on about those which are so abundant in Flinders Island.

Within the last and present year I have been more fortunate; and as setting at rest any contrary opinion on the subject, and establishing the fact that has been surmised, but not, hitherto, proved, I will here mention the characteristics of *five* crystals, respecting which there can be no doubt.

Four of them were obtained in the bed of the Macquarie, near Suttor's Bar.

They were all of that peculiar form of crystal called *Trigonal Trisoctahedron*, having twenty-four facets, the primary form being octahedron, and the triangular facets of the pyramids being replaced by three planes with curvilinear faces, having also a slightly hollow bevelled edge at the junction of the pyramids. It is very nearly the figure of No. 20, given by Dana in his Mineralogy. The ultimate atoms of these were octahedral; and one was lamellar. The colour was pure white and translucent, with thick yellow patches not incorporated, but merely partially covering the surface, an effect of diffracted light. Under the microscope, the apparent roughness, which some jewellers in Sydney mistook for the effect of abrasion, appeared to be occasioned by the edges of the structural atoms, and, I presume, this would much hinder the cutting and polishing of such a crystal. All were electric by friction, which I think no other gem besides diamond is; but they were not electric by heat. The hardness was fully 10. The specific gravity of one was 3·40, after the correction to 62 degrees F. was applied to the temperature of the water used, which was at 56 degrees F. The weight in air of that individual was 1·70 grains troy, or 1·76 carat grains—so that it was less than half a carat or 0·44.

It was brought to me by Mr. Travis on 21st September, 1859.

Another was brought to me by Mr. Horne, from Burrendong, on 29th December, 1859. It had all the properties of the last mentioned, but it was a little heavier, and came out, at a corrected temperature of 68 degrees, as having a specific gravity of 3·50; the weight being a quarter of a carat. The axis of Mr. Travis' crystal measured 5/24 inch. Mr. Horne's measured one quarter inch. Being so small, I imagine others may have easily passed unnoticed through the cradle or other washing apparatus. The other two crystals exhibited the same characters, and require no further mention.

On the 30th July, 1860, Mr. Hand and two other persons brought me a *fifth* crystal, of a larger size than the former; and they gave as its locality the mouth of Pyramul Creek. It weighs in air 9·44 grains, equal to 9·78 carat grains, or about 2·446 carats. It has every characteristic of the others, except it is yellow at the summit of the pyramids, owing to flaws which diffract the light. The centre is transparent, and highly refractive. It is brilliant under the light. Under the microscope, it exhibits some curious scratches and cracks; these will injure its value as a gem. The scratches can hardly have been occasioned except by other diamonds in the creek, as we know nothing harder than diamond. The structure within is homogeneous, and on the whole it is a beautiful specimen, though the facets are irregular. Its specific gravity is 3·49 at a temperature of 52 degrees properly corrected. And to show how well this specific gravity agrees with predetermined calculation, its weight in water is 6·74 which it ought to be according to the tables in "Mitchell's Manual of Practical Assaying," which assign 0·715 as the water weight of a grain of diamond in air. The form of Mr. Hand's crystal is rather different from the preceding four. It is a *Hexoctahedron*, and would, if they were perfect, have forty-eight facets. The hardness is greater than any mineral I subjected to the test, and is much above topaz, corundum, and sapphire. Its axis is 17/48 of an inch.

On the 11th August, 1860, a *sixth* crystal, weighing 1/64 carat, *minus* a grain, was sent to me by Messrs. Brush and Macdonald; it was found by a gold digger on Calula Creek, in 1852. It is very clear and perfect, and of the second form mentioned above.

I consider these examinations perfectly satisfactory, as to the fact of this colony being a diamond-producing country. I suggested to diggers in the localities mentioned, to look out for beds of chloritic sandstone, or quartzite of the Silurian rocks in the neighbourhood, or for beds of quartz conglomerate, from one of which these diamonds are probably derived.

I am aware that it has been stated that diamond was not unknown as a mineral belonging to New South Wales; but I believe no previous examination has ever proved it, or, at any rate, been published.

A pale green diamond was lately found at Yackandanda Creek, in Victoria; and Sir T. L. Mitchell took one to England. Diamonds have been supposed to exist in the alluvia of other parts of the Ovens district, and at Omeo; and, by an article opportunely published in the *Melbourne Argus*, of 25th July, 1860, it would appear, that they are not uncommon.

Four are announced by Mr. Crisp, a jeweller in Melbourne, who gives, however, only the weight and colours. The *six* announced by me, make the number *ten* for Australia up to this date, of which, if we assume Mr. Crisp's locality, No. 2, to be correct, viz., Bathurst, N.S.W., this colony has produced *seven*, and as Mr. Hale says, Sir T. Mitchell's came from the same district, this colony claims *eight* out of *eleven* individuals. I only vouch, however, for *six*.

Whether diamond-hunting be worth the trouble, is a matter for those to decide who have nothing better to do. But as people will ask, what is the value of diamonds in the rough, I will add, in conclusion, a rule, by which this may be determined.

The proportion of troy grains to carat grains is as 72 to 74·625. Four carat grains make a carat. The rough diamond is to be reckoned as half the weight of wrought diamond, in order to allow for the cost of cutting and polishing. Then, taking the square of double the weight, and multiplying by two, the value comes out in pounds. But flaws and discoloration will reduce that value considerably.

D.

DETECTION OF SPURIOUS GOLD.

THE following passages are extracts from a valuable paper read before the Philosophical Society of New South Wales, on 18th July, 1860, by F. B. Miller, Government Assayer to the Royal Mint:—

"At a time like the present, when new gold fields are daily occupying the public attention, and an unusual influx of strangers from all quarters is anticipated, a few practical observations on the detection of spurious gold, for the manufacture of which new temptations and facilities will probably arise, may not be unacceptable.

"The Chinese residents on the gold-fields have of late become so skilful in the manufacture of this article that an easy method of at once recognising its presence, or absence, in any sample offered for sale by these ingenious but unscrupulous foreigners, has become a serious desideratum to all persons having business transactions with them.

"In compliance with the request of the Deputy-Master of the Royal Mint, I have examined several parcels of adulterated gold dust, received at the Sydney branch of that establishment, from Braidwood, with a view to a practical solution of this problem. The means of detection, though simple, may not on that account be less interesting or useful. They are as follows:—

"1. THE GENERAL APPEARANCE.—To an observant person, accustomed to the handling and examination of gold, the peculiar dull granular appearance of an adulterated sample is sufficient to excite suspicion. At the Mint half a dozen parcels were at a glance discerned and set aside from amongst thirty or forty importations: none escaped this scrutiny. A common pocket lens is of much assistance in this preliminary examination: numerous coppery-looking grains are readily distinguished when the gold dust is thus viewed. These are the portions of the adulteration not so skilfully manufactured as the rest, and impart the peculiar dulness alluded to.

"2. THE ACTION OF NITRIC ACID.—Strong cold nitric acid has but slight effect upon the spurious article, so cleverly is it proportioned that the real gold it contains is sufficient to afford protection to the copper forming the greater bulk of the adulteration. If, however, the acid is boiled upon the gold dust, in a test tube or other convenient vessel, a very decided chemical action is at once seen, and the acid acquires a greenish hue. To confirm the presence of copper, the ordinary test of ammonia is all that is required. Add ammonia until the solution smells of it distinctly, when, if the gold is spurious, a bright blue coloured solution is the result. It may be asked whether this would not be the case with any gold containing copper. The answer is, no. A gold alloy containing as much as 10 per cent. of copper may be boiled with strong nitric acid (sp. gr. 13.60) without dissolving any appreciable quantity of the poorer metal. The gold is sufficient thoroughly to protect the copper from the acid. No *natural alloy* hitherto received at the Sydney Mint contains an approach to this quantity of copper.

"The produce of the amalgamating mills cannot, of course, be considered as a natural alloy, and is not likely to mislead gold buyers; though the "cakes" produced from this source often, as is well known, contain much copper. It is in gold dust that deception is most likely to be attempted, and most readily effected.

"3. THE SPECIFIC GRAVITY.—Where the means are at hand for its determination, the specific gravity of the sample would indicate any extensive attempt at fraud on the part of sellers of gold dust. The specific gravity of a sample of adulterated gold is given below, as well as that of average gold from the same locality, which is added for the sake of comparison:—

	Specific gravity.	Proportion of gold in 1000 parts.
Adulterated gold	13.48 ..	676.0
Genuine Braidwood gold ..	18.28 ..	925.0

This method is, however, scarcely sufficiently practical for the object desired.

4. But the simplest method, and one which is ready of application everywhere, is to *heat a small quantity of the suspected gold-dust to redness*. Any spurious gold present will at once turn black, owing to a coating of oxide of copper forming over the surface. This operation can be effectively performed by placing a small quantity of the gold upon the blade of a dinner knife and heating it over the flame of a lamp. By this simple test, where good gold has been mixed with bad, some idea even of the proportion of each may be obtained, as the genuine gold will remain bright and shining amid the black baser grains. It is true that gold even of standard fineness, when alloyed with copper, will be covered with a black coating of oxide if heated to redness; but, as has been already stated, no natural alloy has ever been received at the Mint (and hence it may be inferred has not hitherto been found in the colony) containing copper at all approaching this proportion, or in sufficient amount to produce the slightest change in gold submitted to this operation. The quantity of copper in thirty-one specimens from as many different localities in no case is as much even as ½ per cent. The standard alloy of gold and copper contains 8.334 per cent. of the latter metal.

It has been before remarked that gold containing as much as 10 per cent. of copper is quite unacted upon by boiling nitric acid. It might therefore be possible, with a little ingenuity, to produce a spurious article which should totally escape detection by the acid test. But the plan of heating to redness is not open to this objection. Gold, if the alloy be copper, must be much better than standard not to become black when thus treated.

An artificial alloy of gold and copper in which the gold was in the proportion of 960 to 40 of copper was decidedly blackened when thus heated * * * * * * * *

A few further experiments are in progress, but, from the samples only having been in my possession a few days, I have not yet been able to complete the examination.

F. B. Miller, Assayer to Royal Mint.

Royal Mint, Sydney, 18th July, 1860.

E.

ASSAYS OF GOLD.

I am under great obligations to the Master of the Mint, Captain E. W. Ward, R.E., for the following Assays, which give a clear idea of the real value of the gold of the Southern Districts of New South Wales.

ASSAYS OF GOLD FROM THE SOUTHERN DISTRICTS

Made at the Sydney Branch of the Royal Mint.

Locality.	Gold in 1000 parts.	Silver.	Copper (with trace of Iron.)	Remarks.
Araluen.	934.90	65.1	0.0	
	895.50	104.3	0.2	
	915.20	84.8	0.0	
	935.10	—	—	Bright granular gold.
	949.20	50.80	—	Dark coloured grains.
	895.90	105.10	—	Dull, granular, and rough nuggets.
In broken granite 10 feet below surface.	915.05	—	—	Bright granular gold.
Adelong.	936.70	62.3	1.0	
	946.40	53.1	0.5	
	931.70	65.6	2.7	
	936.85		—	Rough nuggetty.
	946.45	—	—	Smaller; more water-worn, nuggetty.
	945.20	—	—	
	948.60	—	—	Light coloured, fine, granular.
	932.00	—	—	Fine bright scaly gold.
	941.00	58.18	—	
Mitta Mitta.	895.70	104.30	—	
Omeo.	852.25	147.75	—	

ASSAYS OF TASMANIAN GOLD

Made for me at the Sydney Mint. (See my Reports to the Hobart Town Gold Committee. Blue Book, 1856–57.)

Locality.	Gold in 100 parts.	Silver.	Iron.	Copper	Tin, Lead, Cobalt, Nickel.	Remarks.
Black Boy Flat.	94.76	5.04	—	—	—	Bright granular.
,, ,,	94.95	4.66	0.08	Trace	Traces T. L. N.	Granular.
Nook, Fingal.	92.55	7.10	0.17	Trace	Traces T.	Rough and fine.
Fingal.	90.89	8.02	—	Trace	1.009	Water-worn nuggets.

ASSAY OF SEVEN SAMPLES OF GOLD FROM GIANDARRA (KIANDRA),

Taken as they were received into the Mint, and made expressly for me by Captain Ward, R.E., 9th August, 1860.

No. of samples.	Weight of gold dust in ounces.	Loss per cent. in melting.	Gold in 10,000 parts.	Silver.	Copper, &c.	Net value per ounce.	Remarks.
						£ s. d.	
1	200.00	5.345	9277	723	—	3 11 5–465	Rough nuggetty.
2	215 08	5.375	9258	734	8	1 11 3–347	Ditto ditto.
3	63.94	11.307	9335	656	9	3 7 4–647	Ditto ditto.
4	92.48	4.520	9264	717	19	3 11 11–367	Ditto ditto.
5	67.59	4.348	9247	731	22	3 11 11–692	Ditto ditto.
6	42.17	5.620	9377	623	—	3 12 0–192	Coarse dull granular.
7	31.88	4.925	9262	727	11	3 11 8–320	Mixed granular.
Mean.	101.877	5.920	9288	701.5	9.85	3 11 1–290	

As this Assay extended over upwards of seven hundred ounces, it may be supposed perfectly satisfactory as to the value of the gold from the upper part of the Eucumbene. The loss in melting is a phenomenon not yet fully explained; but at p. 58–60 I have proposed one possible cause.

An attempt has been made to show, that the gold now derived from rock is of less value than that from alluvial sources. This, also, is a question which requires further consideration. But, I can only in this place, refer to a memoir "*On the Geological distribution of Gold,*" by Pedro Nisser, Esq.* The author of that memoir has collected a great deal of useful information, and chiefly from his experience in South America. I do not doubt, that gold has been set free at different epochs. Mr. Nisser thinks it was first deposited from the matrix during the Pleistocene period. But I have already given reasons, for believing with Mr. Selwyn, that it was first set free as early as, if not earlier, than the Pliocene epoch, (see p. 173). If so, there may have been purer gold at one epoch than at another: and, therefore, it may be quite true, that alluvial gold of a pure quality, may be found over veinstones bearing gold less pure, without any connection between them. In my Northern explorations, I found at one spot on the Hookanvil Creek, (see *Report on the Hanging Rock Gold Field, 15th November,* 1852,) two kinds of gold in the same pan of earth, which had been set free at two different epochs. Mr. Nisser's observations, therefore, are explicable on the same grounds as my own. I repeat, however, that I am not altogether convinced, that in Australia, which contains gold of the richest kind, in greater abundance, perhaps, than in any other part of the world, any general rule can be admitted assigning to alluvial gold, under all circumstances, a less proportion of silver or other alloy, than is found in gold in the matrix.

Mr. Nisser particularly mentions (p. 18,) the Valle de Osos of Antioquia, at a height of 9,150 feet above the sea, in which, 100 square miles of auriferous alluvia, 150 feet thick, cover granite bearing auriferous quartz veins. The assays were as follows:—

	Gold	Silver
Alluvial	(1) 88.31.	11.79
	(2) 83.00.	17.00
Vein Gold	(1) 70.84.	29.16
	(2) 68.76.	31.24

He says the greater amount of alloy in California is found in the vein gold (p. 19).

On referring to the report of my friend, Dr. John B. Trask, "*On the Geology of the Coast Mountains and part of the Sierra Nevada,*" presented to the Senate and State of California in 1854, I find a statement so corresponding with my own quoted above, that I here append it. "It is not unfrequent to find the recent metal associated with that which has been much worn by attrition, and the two qualities thus appearing in the same placer range, can be regarded only as having different origins and ages. It would scarcely appear reasonable to suppose, that two pieces of metal, derived from the same source, and subjected to the same action, should present a smooth and a rounded surface in the one, while its fellow beside it shall retain all its angularities, as though detached from its original matrix." (p. 72.) This is almost identical with my own statement in 1852. It occurs to me to suggest, that as such is

* Philosoph. Trans. of the Institute of Victoria, 1859, re-printed for circulation.

the case both in Australia and California, though two, at least, of such epochs of distribution are acknowledged, yet the probability is, that in each these epochs extended to the recent or Postpleiocene period.

It is, moreover, a very well known fact, that a heap of detritus, from which all the gold has been apparently taken out, will yet supply gold after it has been exposed some time to atmospheric action; proving by examples, which many persons at the gold fields could furnish, that the separation of gold from the matrix still goes on in the present day. It has, therefore, so far as preceding statements teach us, been set free from the rocks during the whole of the tertiary epochs, and up to the present time. Under such a conviction, it is not rash to hazard an opinion, that gold will be found, in deposits as well as in the rock, for an indefinite period of time to come; and as pointing out a new source of gold, but one quite in agreement with my own statement, in Chapter IV. of this book, I may add here, that portions of *granite* separating two veins of quartz in the Kurrajong Reef, on the Lower Adelong, produced, on crushing, *nearly an ounce of gold per ton.* (*Professor Smith's paper, read before the Phil. Soc. N. S. W.*, 15th August, 1860.)

F.

SEPARATION OF GOLD FROM MUNDIC QUARTZ.

The following paper (referred to at p. 259) was read in November, 1859, before the Philosophical Society of New South Wales, by John Smith, Esq., M.D., Professor of Chemistry in the University of Sydney, to which are appended some remarks by the Master of the Mint, and Mr. Watt, made during the subsequent discussion.

"I lay the following observations before the Society, merely to elicit discussion on the topic, and not because what I have to communicate is of much importance. My attention was called to this subject last year under the following circumstances; A quantity of "mundic quartz" (amounting to fifteen tons) from the Lower Adelong Quartz Reef, had been crushed along with eighty lbs. of mercury. There was reason to believe that the yield of gold would be about ten ounces to the ton. At the conclusion of the operation only forty lbs. of amalgam could be found, and this yielded sixty ounces of gold, being an average of four ounces per ton. What then had become of the remaining quicksilver (more than forty lbs.)? and was this all the gold that existed in the quartz? To aid in solving these important questions various samples where sent to me by Mr. Lynch, the Gold Commissioner of the district. These samples represented (1) the quartz as obtained from the reef; (2) the same when burned, and ready for crushing; (3) a brown deposit taken from the inside of the amalgamating basin near the water level,—the deposit partially choked up the holes in the perforated plates forming the upper part of the sides of the basin; (4) a solid amalgam obtained from the brown deposit by repeated washings with water; and (5) a portion of the deposit (or "tailings") from the outer trough, or "sluice box." The crushing machine used was described as consisting of a battery of stampers, and of a cast iron basin in which two larger rollers worked. In this basin the amalgamation was effected. As a continuation of the sides of the basin there was fixed a rim of sheet iron, about a foot deep, having spaces to permit the crushed quartz to escape, these spaces being covered by perforated plates of sheet iron. A careful examination of the various samples gave the following results:—1. The quartz as taken from the reef contained a large proportion of iron and copper pyrites, the former predominating together with specks of visible gold. The iron pyrites (white variety) had a specific gravity of 4·4; a minute proportion of quartz probably adhered to it. It is to iron pyrites that miners give the name "mundic." 2. Burned quartz. Part of the sulphur of the pyrites had been driven off in the roasting, leaving magnetic oxide and sulphide of iron, with sulphide of copper. Exposure to air had oxidised portions of the sulphides, and converted them into sulphates; so that maceration in water gave an amber-coloured solution, of acid reaction, containing sulphate of iron, with a small proportion of sulphate of copper. (3) Brown deposit. Specific gravity 4·3. When heated this yielded mercury (without sulphide) to the extent of nearly half its weight. 100 grains fused with borax and nitre gave 17·4 grains of gold alloy; and this when cupelled with lead, yielded 16·4 grains of gold. In addition to this, a small globule of gold and copper was obtained by remelting the slag with more borax. A portion of the brown deposit being rubbed in an iron mortar with some water and mercury yielded a fluid amalgam, containing apparently all the gold and mercury previously in the substance, and separating readily from the earthy residue. This residue consisted chiefly of magnetic oxide of iron, with shining particles, apparently of undecomposed pyrites, and white quartz, all in fine powder. A little of this mixture being strongly heated in a closed tube gave a minute sublimate of mercury, and then a black non-crystalline ring, which was probably sulphide of mercury. The powder in the tube had, at first, the colour of umber, but after heating it was quite black. I am at a loss to account for the low specific gravity of the brown deposit, unless by supposing that, in spite of the care I took to free it from air, a little must still have adhered when the powder was mixed with water. 4. Solid amalgam. A lens showed this to be full of specks of pyrites and oxide of iron. When rubbed with a little mercury a quantity of these matters readily separated. The solid amalgam yielded 32 per cent. of gold alloy, or 24·3 per cent. of gold. 5. "Tailings." This consisted chiefly of fine quartz sand, with a large proportion of magnetic iron, and a small quantity of amalgam. When rubbed with a little additional mercury, the amalgam separated easily from the mineral portion. The minute quantity of gold in it was not weighed."

"From these results, I infer that the oxides and sulphides present in the roasted quartz had been the means of so comminuting and enveloping the gold amalgam as to prevent its agglutination in the usual manner; and, as the pulverulent earthy-looking mixture has a density no higher than that of the pyrites in the quartz, the whole had got carried away by the water. Being washed out of the levigating trough, the amalgam ought still to have settled along with the ground pyrites in the "sluice box;" but that part of the machinery seemed (judging from a description I obtained of it) to be ill-adapted for retaining matters that were not much heavier than the general mass of the tailings. I see no reason for believing that any of the mercury had been oxidised, or combined with sulphur. It is true that, in subliming out the mercury from the brown deposit, I obtained a minute quantity of sulphide of mercury, but this

I believe to have been formed during the sublimation. To extract gold from mundic quartz efficiently and economically it is clear that the existing process needs modification; and it would be of great public utility if experiments on this and similar questions could be performed at the Mint. I feel pretty sure that, if the necessary machinery were supplied to that establishment, a speedy solution of the problem under consideration would be arrived at. In the particular case to which my attention was called, I recommended that a larger proportion of quicksilver should be used; and that the amalgamation should be completed in a Berdan's machine attached to the Chilian mill. I think by these means the production of the brown deposit might in a great measure be prevented. I have had no opportunities, however, of experimenting on a sufficient scale, otherwise I should have been inclined to try several other modes of operating. For example, after roasting the quartz in the usual way it might be pounded by stampers, and as much of the gold as possible, might be separated by merely mechanical means, as at the Clunes Reef in Victoria. The pounded quartz might then be mixed with common salt (or probably lime might be found to answer), and roasted on the hearth of a reverberatory furnace. The pyrites would thus be thoroughly decomposed, and the iron left probably in the state of peroxide. The mass might then be amalgamated in the usual way, in a Chilian mill or Berdan's machine, and it ought to present no more difficulties than ordinary ferruginous quartz, which, so far as I have heard, can be worked up with mercury as easily as pure quartz. The question is a very important one, as on the Lower Adelong there are hundreds of tons of mundic quartz, believed to be rich in gold, but only a small portion can be got out of it. If some economical plan of extracting the gold could be devised, it would be a source of immense profit to the miner."

"Captain Ward would give an instance to show the blundering manner in which quartz was being crushed. Somewhere in the Western district a crushing machine was at work, which was supposed to extract gold very perfectly, almost without the aid of mercury. The person who had the machine, talked largely about its success, and by way of showing how well it worked, handed him (Captain Ward) a small quantity of tailings, which he was quite sure contained no gold at all. He (Captain Ward) undertook to examine these tailings, and found that they contained gold to the proportion of a thousand ounces to the ton. So that every ton of these tailings that was thrown away, was worth about £4000! Besides other metals, that machine left behind a great deal of silver. This was, he supposed, only a sample of what was going on in all parts of the country, and ought to be put a stop to."

"Mr. Watt stated, in reference to a remark on the low specific gravity of the brown deposit, in the paper just read, that he had no doubt that it was caused by the adhesion of the atmospheric air. On washing certain samples with water, he found under a magnifying-glass that some of the specks of gold would not sink. There appeared to be such an adhesion of the air to these fine particles that they floated for a long time. He found in some experiments, after having submerged the mundic quartz without allowing atmospheric air to come into contact, that he could by that means wash away the whole of the pyrites. The plan he adopted consisted in the use of a screw similar to that used for propelling boats, which he found had the power of lifting up the mass underneath. The only plan of carrying out the operation successfully was to keep the air from it entirely."

"Professor Smith asked Mr. Watt if he thought that the same action would occur in the case of peroxyde of iron in the ordinary ferruginous quartz?

Mr. Watt said it would not, as the division did not require to be so fine.

G.

NOTE ON THE ALTITUDES OF GOLD-BEARING ROCKS.

In reference to the opinions expressed by me respecting the less likelihood of finding deposits of gold at very great elevations above the sea, (see p.p. 130 and 153-4) than at a moderate level, and which I also expressed to the Government in 1851, when it had been alleged that our Australian mountains were not high enough for much gold, I might refer to the heights assigned by the authors of the "Geology of Russia in Europe and the Ural Mountains" for the gold localities of that country, (which I did at the time alluded to without having the work to refer to). In that work * we have numerous gold localities mentioned as occurring from 500 to 1000 and 1600 feet, which agree very well with Bendigo and Ballaarat, with the Hanging Rock, Araluen, &c., in Australia; but there are, undoubtedly, as I have mentioned, others, such as those along the Alps at from 3000 to 5000 feet, especially on the Eucumbene, which is now attracting the attention of the various Colonies. Gold, on the other hand, has been found in some quantity not many fathoms above the sea level.

There is nothing, therefore, exceptional, if in some parts of the world, gold is found even higher than in any places yet mentioned.

Mr. Nisser (work quoted under letter E, (p. 277), mentions gold in vegetable soil in South America, at from 9000 to 10,000 feet above the sea; and says, that in Peru fluvial (alluvial) gold is found at 13,500 feet; and on the slope of the Paramo de Ruiz in New Granada, at 12,500 feet, the drift being moved by melted ice and snow. He says also, that auriferous quartz veins in granite occur at a height of 10,100 feet, on the Paramo de Sanzon;—as well as elsewhere in the same country at the sea level.

But, since Mr. Darwin has shown that the Andes have undergone a great elevation during the Tertiary epoch, it is not improbable, that in comparison with many localities in Australia, the height at which the gold is now found in South America must be diminished, in which case the difference would not be so observable.

It is, certainly, remarkable, that in California, according to Barometrical altitudes taken by Dr. Trask, *(see Appendix Doc. 9, p. 91 to Report, quoted,)* there is no locality named, above 2,780 feet; whereas, the Nevada gold field is cited as under 2,000 feet; and the Yuba country as varying from 76 to 1120 feet.

Dr. Trask has much interesting conjecture respecting changes of level in California, which he has satisfactorily determined. He mentions one terrace on the Sacramento, 212 miles above Suisun Bay, through which a shaft at Weaver Creek, Trinity County, has been sunk 800 feet in alluvial deposit; the different strata of which, clay, gravel, and sand, contained gold nearly throughout. (p. 41.)

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* See *Map of the Ural.* Pl. VII and p. 20, where Sir Roderick Murchison gives his authorities.

H.

FOSSILS OF THE SOUTHERN DISTRICTS.

The comparison of the Australian Gold Fields with those of California and Russia has elicited a great deal of very interesting geological information; and has, as has been seen, engaged my attention as well as that of Sir Roderick Murchison, who, of course, having been in the Ural, brought to his examination of Strzelecki's collection of Australian rocks a great amount of personal knowledge of the rocks of Russia. Still, I imagine, so long as there was no fossiliferous evidence of the age of the Australian rocks, the determination must have been attended with considerable uncertainty.

Having ascertained that Silurian rocks did exist here, and that by the discovery of their fossils, as early as 1846, I was enabled to make the comparison in 1847, so soon as I obtained a compact digest of the geology of Russia. Afterwards, I obtained by personal exploration, and by the assistance of collections made in the neighbourhood of Yass, by W. Hardy, Esq., who very generously placed them at my disposal in 1851, a more perfect knowledge of the distribution of Silurian genera.

There are various reasons which induce me to quote in this place some satisfactory remarks of Sir Roderick respecting this discovery, which, I am able to show, has been one of the fruits of numerous successful investigations which I have made during my residence in New South Wales.

I had also, in 1850, a correspondence with Mr. Burr, late Surveyor-General of South Australia, and in that correspondence I pointed out to him the existence of the Silurian formation in Australia. The letters have passed from my own observation: but my friend, R. Brough Smyth, Esq., has seen them. It is satisfactory to me to have the credit of *completing* the *parallel between the "Australian Cordillera" and the Ural.*

The difficulty of determining new genera and species in a country like New South Wales, where neither geologists, nor collections for comparison abound, renders it almost impossible in the Colony to define accurately the occurrence of known, or the distinctive characters of new fossils. And the immense amount of labour thrown upon the officers of the "Museum of Practical Geology" in London, makes any friendly co-operation on their part, a work of time. I am, therefore, able now to publish only the names of those few of the many species of Silurian age in my collections, which were determined for me by my kind co-adjutors, Mr. Lonsdale and Mr. Salter, whom I have mentioned at p. 163. But these, with the other genera named by myself (but to many of which at present I am unable to assign the species) will still be sufficient to justify the assertion respecting the extent to which rocks of the Silurian epoch, especially of the upper beds, are developed in the gold-bearing regions to the southward.

(1.)

"In referring to geology, I must express my thanks to Mr. Clarke for having first elicited the fact of the presence of true fossils of Silurian age in some of the less metamorphosed limestones of the S. W. tracts of New South Wales and the adjacent region of Victoria Land; and also, for the indication of intersection of certain rocks, near to which metallic ores prevailed; since these are phenomena which have been observed in other auriferous regions."

From "*Sir R. I. Murchison's address at the Anniversary meeting of the Royal Geographical Society*, 23rd May, 1853. p. 70. See, also, Siluria, 1st ed., p. 14., 3rd ed., p. 10.

(2.)

"The author spoke of a geological discovery recently communicated to him by the Rev. W. B. Clarke F.G.S., viz., the existence of many fossils of known Silurian species including *Pentamerus Knightii*, and many shells and corals, on the flanks of the Dividing Range in New South Wales. *This discovery is important, because it completes the resemblance of the "Australian Cordillera* (along which Devonian and Carboniferous fossils had been found,) *with the Ural Mountains*, the two chains being *thus shown to be zoologically, as well as lithologically, similar, and both to possess the same auriferous "constants*."

From "abstract" of a paper "by Sir R. I. Murchison," read before the Geological Society of London, 4th February, 1852. (in Quarterly Journal of that Society, vol. VIII., p. 135.)

(3.)

16, Belgrave Square,
February 10, 1852.

My dear Sir,—In the course of reading of the Memoirs presented, yours on the Gold of Australia was read on Wednesday last, at the Geological Society. It was followed by a brief *resumé* of my own publications on the same subject, and of which you seem to have been ignorant. Of course, I stated that I was quite sure you would have made allusion to my published views of 1846 on Australia, as auriferous *in futuro*, if you had seen them as printed in Cornish papers, and repeated in the Transactions of the Geological Society, Cornwall, of that year. I then detailed the various other occasions (to say nothing of the first, in 1845, when I named your range, the Cordillera of Australia), and lastly, avowed myself, in my communication, to be what was indeed generally known, the author of Siberia and California, in the *Quarterly Review*, the article to which you allude.

In *giving you the highest credit for your discovery of Silurian fossils, which completes the original parallel with the Ural Mountains*, and in speaking of you as an exploring geologist worthy of every praise and encouragement, I do not subscribe to your *theory* (for such it is) as to the outbursts of auriferous chains having any definite relation to the quadrature of the circle. You are in error in supposing that the N. and S. ridge of the Ural mountains has produced 3½ millions sterling of gold. On the contrary, this produce results from the ridges of Siberia, spread over 80° of longitude; the Ural producing only half a million sterling. Hence you see that the theory vanishes. It is not even applicable to your own continent, various ridges of which, between its eastern Cordillera and its west coast, may prove to be auriferous. But *your Silurian discovery rejoices me, and will enable me to introduce you with flying colours in a little general work on the primordial rocks, which I am preparing.*

I have incorporated all that is new which you have written as coming directly from yourself, and as being most important additions to what Strzelecki, Jukes, and others have written.

Mr. Evelyn Denison sends me information about the extension of the gold fields, and Lord Grey has communicated to me all the documents printed for the use of the Cabinet, in return for my letter of November, 1848, in which I warned him of what was coming, and which he has acknowledged in a flattering manner.

Such anticipations are of no great value in the eyes of scientific men, but they have great weight among statists and politicians. Thus I have as much credit here as you can have in Australia, without having any more than yourself profited by the golden riches.

The N. and S. theory has gone much out of fashion, for according to Erman's maps the exceptions prevail. Still I hold to the value of the great meridian chains, such as the Ural and its *parallels*, the Cordillera of America, and that of Australia.

I am very anxious to know if any of the original sites of the ore have been discovered—to what extent—and if the people are fools enough to work into the solid rock, when they can do every thing most profitably in "the drift." Although you have trodden on my toe, *I shall always say that you have done very much indeed for the geology of Australia.*

Yours, very sincerely,

ROD. I. MURCHISON.

Rev. W. B. Clarke.

The following list of 269 fossils contains some of those just alluded to I have ventured to arrange some species under the head of Devonian, after the perusal of communications with which I have been favoured by Mr. Salter and Mr. Lonsdale. But I have not made mention of many others which, probably, belong to the Lower Silurian, and which cannot, at present, be decidedly fixed.

The Carboniferous fossils in the list are chiefly those described by Mr. Danà, Mr. Morris, and Professor M'Coy (see p. 197). There is not, however, one species of that age named which I have not myself found. For the present, it will suffice to refer to the works to which reference is given in the note at p. 251. The circumstance which enabled me to profit by the kind assistance of my friends in England, was the sending home of a collection of Palæozoic fossils below the Carboniferous formation to the Woodwardian Museum, for which I have been gratified by the expression of the thanks of my friend Professor Sedgwick, and of "the University of Cambridge," as recorded in 1855 in the "Introduction to the Synopsis of the British Palæozoic rocks and fossils in the Geological Museum of the University of Cambridge," (p. xciii.)

At present, as relates to the older fossils of New South Wales, I can only state, that the *species* nearly all, as well as many of the *genera*, are *new*: and of those Mr. Salter was kind enough to examine in 1856, he tells me he can only recognise the three following as undoubted British species, viz. Atrypa *reticularis;* Favosites *polymorpha;* and Alveolites *oculata*. Perhaps, F. *Gothlandica* may be added. This is a great contrast with the fact, that in the fossils of the overlying lower Carboniferous beds, described by Professor M'Coy, (Annals of Mag. N. H. vol. XX) "we find," says that able critic "so extraordinary and unexpected an amount of agreement between those beds and the similar shales, sandstones and impure limestones forming the base of the Carboniferous system in Ireland, that it is impossible not to believe them on the same parallel, and there is equal difficulty in imagining them to be either younger or older than those deposits."

LIST OF CERTAIN GENERA AND SPECIES OF FOSSILS FROM THE SOUTHERN DISTRICTS OF NEW SOUTH WALES.

GENERA AND SPECIES.	No. of unnamed species	Carboniferous.	Devonian or Passage Beds.	Silurian.
PLANTÆ.				
Anarthrocana - - - - -	1	*		
Coniferæ - - - - - -	3	*		
Clasteria australis - - - -		*		
Gleichenites odontopteroides - - -		*		
Lepidodendron - - - - -	1	*		
Noeggerathia spatulata - - - -		*		
Odontopteris microphylla - - -		*		
Pecopteris tenuifolia - - - -		*		
Phyllotheca australis - - - -		*		
,, ramosa - - - -		*		
,, Hookeri - - - -		*		
,, ,, - - - -	2	*		
Sagenopteris linearis - - - -		*		
Sphenopteris flexuosa - - - -		*		
Vertebraria australis - - - -		*		
AMORPHOZOA.				
Verticillipora spongioides (C) - - -		*		
ZOOPHYTA.				
Acervularia - - - - -	2	...	...	*
Alveolites oculata (Lonsdale) - - -		...	...	*
,, ,, - - - - -	2	...	...	*
Amplexus arundinaceus - - -		*		
Arachnophyllum - - - - -	1	...	...	*
Cænites (L) - - - - -	1	...	...	*
,, - - - - -	2	...	...	*
Cyathophyllum - - - - -	4	...	...	*
Cystophyllum (L) - - - -	1	...	...	*
Calamopora (L) - - - -	1	...	...	*
Cladopora (L) - - - -	1	...	...	*
Clisiophyllum (L) - - - -	1	...	...	*
Emmonsia (L) - - - -	2	...	...	*
Endophyllum (L) - - - -	1	...	...	*
Favosites Gothlandica (L) - - -		...	...	*
,, polymorpha (L) - - -		...	...	*
,, fibrosa - - - -		...	...	*
,, ,, - - - - -	3	...	...	*
Goniophyllum - - - - -	1	...	...	*
Heliolites - - - - - -	2	...	...	*
Heterophyllia (L) - - - -	1	...	...	*
Lithostrotion - - - - -	2	*		
Michellina - - - - - -	1	*		
Monticulipora - - - - -	1	...	...	*
Nebulipora - - - - -	1	...	...	*
Palœocyclus - - - - -	1	...	...	*
Petraia - - - - - -	4	...	...	*
Ptychophyllum plicatum (L) - - -		...	...	*
,, ,, ,, - -	1			
Stenopora crinita - - - -		*		
,, Tasmaniensis - - -		*		
,, ,, ,, - - -	1			
Strephodes - - - - -	2	*		
Stromatopora - - - - -	1	...	...	*
Syringopora (L) - - - - -	3	...	...	*
,, ,, - - - -	2	...	*	

Genera and Species.	No. of unnamed Species.	Carbo-niferous.	Devonian or Passage Beds.	Silurian.
Strombodes - - - - -	2	...	...	•
Trochophyllum (L) - - - -	1	...	...	•
(Several new genera and species)				
Echinodermata.				
Crinoidal columns - - - -		...	•	
Actinocrinus - - - - -	2	•		
Cyathocrinus - - - - -	2	•		
Platycrinus - - - - -	1	•		
Receptaculites Clarkii (Salter) - -		...	...	•
Tribrachyocrinus Clarkii (M'Coy) - -		•		
(Two new genera) - - - -		•		
Annelida.				
Crossopodia - - - - -	2	...	...	•
Serpulites - - - - -	1	•		
Trachyderma - - - - -	1	...	...	•
Tentaculites ornatus (Salter) - - -		...	...	•
,, ?annulatus - - - -		...	..	•
,, ?tenuis - - - -		...	...	•
Crustacea.				
Beyrichia (Salter) - - - -	2	...	...	•
Bronteus - - - - -	1	...	...	•
Calymene Macleayii (Salter) - - -		...	...	•
,, ,, ,, - -	1	...	...	•
Cheirurus Murrayi - - - -		...	...	•
Cythere - - - - - -	4	•		
Bairdia - - - - - -	2	•		
Encrinurus australis (Salter) - - -		...	...	•
,, ,, ,, - - -	1	...	...	•
Harpes - - - - - -	1	...	...	•
Bryozoa.				
Fenestella ampla - - - -		•		
,, internata - - - -		•		
,, fossula - - - -		•		
,, antiqua - - - -		•		
,, plebeia - - - -		•		
,, ,, - - - -	1	•		
Glauconome pluma - - - -		•		
Retepora - - - - -	1	•		
Brachiopoda.				
Atrypa reticularis (Salter) - - -		...	•	
,, cymbœformis - - - -		•		
,, biundata - - - -		•		
Leptæna - - - - -	1	•		
,, - - - - -	1	...	...	•
Orthis australis - - - -		•		
,, resupinata - - - -		...	•	
,, ,, (Salter) - - -	2	...	..	•
Pentamerus australis (Salter) - - -		...	...	•
,, ,, ,, - -	3	...	...	•
Chonetes - - - - -		...	•	
Productus fragilis - - - -		•		
,, brachythœrus - - - -		•		
,, antiquatus - - - -		•		
,, subquadratus - - - -		•		
Spirifer vespertilio - - - -		•		
,, subradiatus - - - -		•		
,, glaber - - - -		•		
,, avicula - - - -		•		
,, Darwinii - - - -		•		

Genera and Species.	No. of unnamed Species.	Carboniferous.	Devonian or Passage Beds.	Silurian.
Spirifer attenuatus		•		
,, duodecimcostatus		•		
,, phalæna		•		
,, ,,	7	•		
,, ,,	3	...	•	
Strophomena	2	•		
,, (Salter)	2	...	•	
Terebratula amygdala		•		
,, elongata		•		
,, hastata		•		
,, ,,		•		
Pecten squamuliferus	2	•		
,, Illawarensis		•		
,, limæformis		•		
,, Fittoni		•		
,, ,,	3	•		
Avicula ?volgensis		•		
,, ,,	2	•		
,, ,,	3	...	...	•
Pterinea macroptera		•		
Inoceramus Mitchellii		•		
,, ,,	2	•		
Eurydesma cordatum		•		
,, globosum		•		
Pholadomya audax		•		
,, undata		•		
,, curvata		•		
Cardium ferox		•		
Pleurorhyncus australis		•		
Allorisma audax		•		
Orthonota costata		•		
,, ,,	1	•		
Mytilus	1	•		
Cardinia exilis		•		
,, cuneata		•		
Solecurtus ellipticus		•		
Astarte gemma		•		
Astartila intrepida		•		
,, cyprina		•		
,, cytherea		•		
,, polita		•		
,, cyclas		•		
,, transversa		•		
,, corpulenta		•		
Pachydomus carinatus		•		
,, globosus		•		
,, gigas		•		
,, sacculus		•		
,, ovalis		•		
,, pusillus		•		
,, cuneatus		•		
,, lævis		•		
Mæonia elongata		•		
,, valida		•		
,, eximia		•		
,, carinata		•		
,, myiformis		•		
,, elliptica		•		
,, grandis		•		
,, gracilis		•		
,, recta		•		
Notomya clavata		•		
Venus gregaria		•		
Nucula abrupta		•		

Genera and Species.	No. of unnamed Species.	Carboniferous.	Devonian or Passage Beds.	Silurian.
Cypricardia rugolosa		•		
" sinuosa		•		
" simplex		•		
" siliqua		•		
" prœrupta		•		
" acutifrons		•		
Gasteropoda.				
Capulus	1	•		
Dentalium	2	...		•
Euomphalus minimus		•		
" "		...	•	
" "	2	...	•	
" ? alatus (Salter)		...	...	•
Phanerotinus (Salter)	2		•	
Patella tenella		•		
Loxonema ?rugifera (Salter)		...	•	
" "	2	...	•	
Murchisonia ?angulata (Salter)		...	•	
" " "	3	...	•	
Pleurotomaria Morrisiana		•		
" "	2	•		
Platyschisma rotundatum		•		
" "	2	•		
Heteropoda.				
Bellerophon striatus		•		
" micromphalus		•		
" undulatus		•		
" compressus (C)		...		
Cephalopoda.				
Goniatites	1	•		
Orthoceras	2	•		
"	3	...	•	
Poterioceras	1	•		
Pteropoda.				
Conularia lœvigata		•		
" "	2	•		
Theca lanceolata		•		
" ?Forbesii		•		
" "	2	•		
Pisces.				
? Glyptolepis (scale)	1	...	•	
Leptacanthus (spine)	1	•		
Palæoniscus Kingii		•		
Platysomus	1	•		
Pygopterus	1	•		

In conclusion, I venture to remark, that there are certain resemblances in some of the Carboniferous fossils to those of the Silurian epoch, which are very striking. Theca *lanceolata*, which is common in the Illawarra, is named by M. de Verneuil and M. Barrande, as identical with a fossil in the *Lower Silurian rocks* near Ciudad-Real in Spain (see *Bulletin de la Soc. Géol. de France. 2de Serie. XII.* 985). The same fossil, as they observe is figured in Col. Portlock's Report on Londonderry (pl. XXVIII. A,.3) and they say, that "*the Australian species scarcely differs from that of Ireland and Spain.*" This is, at any rate, curious.

APPENDIX.

I.
SYNOPSIS
OF FACTS AND SERVICES CONNECTED WITH THE DISCOVERY OF GOLD IN AUSTRALIA.
FROM 1839 TO 1860.

SEVERAL persons have laid claim to the merit of being "first" discoverers of gold in Australia, and there has been a great discussion, not always conducted with fairness, both in England and in this Colony, respecting this "priority" in an important work. Want of time and space on this occasion, as the printers warn me, does not permit a detailed critical history of these circumstances; but, as the subject is too imperative to be entirely omitted, it seems advisable to arrange the particulars of a synoptical account under the respective names of the most prominent persons who, at one time or another, have taken part in the first discovery and development of the gold fields. This brief abstract will, however, sufficiently meet, for the present, all that is referred to in this volume at p. 9.

COUNT P. E. DE STRZELECKI, C.B.

1839.

This gentleman made an extensive exploration of the Colonies from 1838 to 1840, chiefly for the purpose of mineralogical research, and published a very interesting work in the year 1845.* In this work, there is *no mention of any discovery of gold, nor of its occurrence.* But, in a Report sent in to the Government of New South Wales, 20th September, 1840, he mentions that he had found, in the Vale of Clwydd, "*an auriferous sulphuret of iron*, partly decomposed, yielding a *very small quantity or proportion of gold, sufficient to attest its presence, insufficient to repay its extraction.*"

He stated also, in 1855, to Sir Roderick Murchison, that "*he never mentioned his discovery, or supposed discovery, of Australian gold*" to that gentleman, "*prior to his papers on the subject, nor after their publication.*"† In a Supplement to his work, published in April, 1856, the Count shows, however, that he had, in his correspondence with Mr. T. Walker, and Mr. Macarthur, of Camden, mentioned the existence of gold to them, and this is testified, also, in a letter in the *Sydney Morning Herald*, in May, 1851, by Mr. Walker; and in a debate in the Legislative Council, by Mr. Macarthur, on 5th October, 1853. ‡ The Count explains in the Supplement the cause of his silence in 1845 and afterwards to have been the *request of Sir George Gipps* "*to keep the matter secret*, for fear of the serious consequences which, considering the condition and population of the Colony, were to be apprehended. Of course," he adds,

* Physical description of New South Wales and Van Diemen's Land. London 1845.

† Siluria, 3rd ed., p. 490.

‡ "Gold and Silver," a Supplement to the Physical Description, p. 9.

"*I complied with this request; and I deemed it my duty, whether right or wrong, to be silent on the subject in my book, and in any formal communication with learned bodies in Europe;* although I did not conceive myself restricted from mentioning what had occurred to the private friends of Sir George Gipps and myself in Sydney." *

I think it right to add, that I have never seen any portion of the collections of rocks or minerals made by the Count, nor have I ever seen his large map and sections of the Colonies. Nor have I ever had the honor of any intercourse with the distinguished author of the "Physical Description," save by a few minutes' conversation, in December, 1839, at a festival given by Captain Wilkes and the officers of the United States Exploring Expedition, and by an interchange of one letter since 1853.

REV. W. B. CLARKE.

1841 to 1844.

Arriving in the Colony in May, 1839, I made my first journey to the southward in January, 1840, and to the westward in February, 1841, on which occasion, on the 13th and 14th of that month, I discovered gold in the granite and quartziferous slates west of Hartley, near the heads of Cox's River and Winburndale Rivulet. In 1842, I again discovered gold on the Wollondilly. In 1843 and the beginning of 1844, I communicated these facts to James Macarthur, Esq., His Honor Mr. Justice Therry, Mr. Blakefield, and to various members of the Legislature. In 1841, and afterwards, I had also communicated the fact of the first discovery to friends in England, my letters to whom were seen by the editor of the *Illustrated Australian Magazine*, in Melbourne, in 1850, as testified by him Vol. iii. p. 211.† On 9th April, 1844, I also made the subject a matter of communication to the then Governor, Sir George Gipps, exhibiting the gold, and was met with the decision, that it would

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* Preface to Supplement, page 4.

† See letters from Mr. JUSTICE THERRY, Mr. BLAKEFIELD, Mr. MANNING (p. 135 of this volume), Mr. MACARTHUR, Mr. JAMES, Captain P. P. KING, Mr. GILL, Rev. W. SOWERBY, and extracts from the *Goulburn Herald, Maitland Mercury*, &c. —testifying to the above facts, and appended to my "*Evidence before the Gold Committee of the Legislative Council of New South Wales, 24th September*, 1852;" also published in British Parliamentary Papers on the "*Recent Discovery of Gold in Australia, Presented to both Houses of Parliament, by Command of Her Majesty. December*, 1854, *p.* 21—26, *and July*, 1855, *p.* 17—21."

In Siluria, 3rd ed. p. 489, it is stated that the communication in 1841 was made to a friend in the *Colony*. That is a mistake; and it is alleged, in the same work, that the circumstance was unknown to "*all* European men of science." I have only to add, that in 1841 my letters were directed to my brother-in-law, a beneficed clergyman in *England*, and to a noble Lord now deceased, who was a Fellow of the Geological and Geographical Societies; and that I made known my opinions of the auriferous conditions of this colony to a Fellow of the Geological Society on a visit to this colony in 1843; to members of other European Societies, who, whether British subjects or foreigners, have had interviews with me in the Colony, and who had knowledge of what I had ascertained. It is quite true that I did keep a great reserve—which has exposed me to insults from such persons as had an interest in keeping me out of view—as to "public announcement with trumpets and kettle drums," because I had the fear of the contemplated effects on colonial society in my mind, and because I was so situated in ecclesiastical matters, that I was not master of my own time, to make a re-exploration. And to such an extent was the latter difficulty carried, that when, in 1851, I was requested by the Governor to go out into the field, I was compelled to consider myself as vacating my ecclesiastical position, and did not go, till I had completed an arrangement by which (my own incumbency having passed into other hands) I obtained *license* to officiate all over the diocese of Sydney. As Mr. Macarthur has testified in his letter mentioned above, my only objects were the good of the Colony; and, therefore, I carried my scruples too far, as it has turned out, to save me from the jealousies or detraction of those whose claims are, perhaps, not so respectable as my own.

be better to "put it away," as it would lead to dangerous consequences. I did all I could, by private communications to leading members of society, and to the people generally, of whom hundreds now living can testify, if they will, to the fact, that, in the early part of 1844 it was generally known that I had arrived at definite conclusions as to probable amount of gold in defined localities, south, west, and north. In 1844, I became convinced (as testified by Mr. Gill, in his letter of 22nd January, 1852,) that, north of Murrurundi, gold would be found, as it was afterwards, on the head waters of the Peel River.

Opportunely I have received a letter, bearing date Muswellbrook, 14th August, 1860, from a highly intelligent professional gentleman, who is an entire stranger to me, in which he seeks information from me, on account of the following words reported to him to have been used by me at Muswellbrook in January, 1844, (respecting the convictions which I had come to after my return to Muswellbrook from the head of the Peel): "If you, good people of Muswellbrook, knew what a mine of riches is under your feet you would not rest quiet in your beds." I remember the occasion, but I was not alluding to Muswellbrook itself, but to the country north of the Dividing Range, and to the Colony generally.

As I left Muswellbrook on 21st February, 1844, it is certain, that I had completed my views before I spoke to Sir George Gipps on the 9th March following, and before Sir Roderick Murchison had seen the specimens collected by Strzelecki, on which Sir Roderick instituted his first comparison between Australia and the Ural.

1844 to 1851.

In 1845 I again visited the Liverpool (Dividing) Range and made further explorations on its flanks, convincing myself, that my former opinions were correct. And in that year, I obtained evidence of the existence of gold in the quartz of Meadow Flat in the Bathurst district, (of which I exhibited a specimen, in my collection at Paris, in 1855, and previously, at Sydney, in 1854, marked with the date of discovery in the Catalogue,)*; at Stony Range; at Slapdash Creek, and other places, all of which I pointed out to Mr Stutchbury in 1850 on the Map, before he started to what I called the Australian "Siberia," whither I requested he might be sent on his arrival, not for banishment, but to seek for gold.

In 1846, Dr. Leichhardt testified to my services and named a river after me, in order to commemorate them.—See "*Overland Expedition,*" (p.p. 211, and 225.)

In 1847, having obtained from a foreign publication, an admirable abstract, well arranged, of the Geology of Russia as explored by Sir R. I. Murchison, M.E. de Verneuil and Count A. Von. Keyserling, I published in the *Sydney Herald* (with the signature ⊕) a comparison of the Geology of Russia and Australia, in which the latter was illustrated from my personal knowledge and that of other explorers, with the intention of giving information to my fellow-colonists. The signature proves, that I had no other object than what I state; because, had I wished to claim for myself any credit respecting the Geology of Russia, or any other credit, I would have printed my own name or initials instead. My friend R. C. Gunn, Esq., then Editor of the *Tasmanian Journal*, transferred the article to the pages of that Journal, stating that he did not know the author's name.

In that article, I alluded expressly to what I had just learned from

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* Products of New South Wales, No. 327, p. 48.

an English periodical, of Sir R. I. Murchison's views respecting Australia, (the memoir by Sir Roderick, I have never yet seen), and I added these words (Sept. 22nd, 1847) "gold occurs *not only in the veins of quartz which traverse the schist, but in the black striated cubes of pyrites so common in the Bathurst country*. Nor ought there to be any astonishment, if, hereafter, it be discovered that *platinum* exists in New South Wales. * * * *New South Wales will, probably, on some future day, be found wonderfully rich in metals*."

In 1848, I was, as Chapter VI of this work will prove, engaged with the geology and auriferous character of the Murrumbidgee country: and but for accidental circumstances (see p. 85), the discovery of gold would have been formally announced to the public.

In 1849, I continued to excite an interest in the gold question, by contributing to the Colonial press, a series of articles on the structure of California, on the geology of the Gold islands north of Australia, and on "*Gold Mining*", in which I gave information as to the method of *quartz crushing and amalgamation*, using these words *: "*the particulars will, it is hoped, afford information to persons in this Colony, who are anxious to work auriferous quartz or any other gold ore*. But it would be impossible to state more distinctly what the actual outlay would be; for, of course, the expenses must vary with the supply of labour and the cost of the machinery and establishment." Surely, this is like a foreshadowing of what is detailed, as existing in 1859, in Chapter XV. of the present work.

In the same year, 1849, in February, I addressed a letter to the *Sydney Morning Herald*, on the subject of an alleged gold field in the Pyrenees, and in that letter warned the people of this Colony not to be led away to Victoria, because we had gold nearer home and plenty of it.

In the same year, 1849, having occasion to write to my distinguished friend, Sir Roderick Murchison, I made a brief statement respecting the then condition of progress in this Colony in mining matters, believing that a great development was not far off, and which I was proposing to make myself (could I but obtain leave of absence from my professional duties, which I could not); and that statement was, by Sir Roderick Murchison, published in his article on Siberia and California in the *Quarterly Review*, of March, 1850; afterwards re-published in the *London Spectator* of April, 1850, and again re-published in the same journal in Sept., 1851, for the purpose of proving that the so called first discovery of 1851 at Lewis Ponds by Mr. Hargraves, was no new discovery at all. These are the words of the *Spectator*: "*Indeed, it was already known, that gold existed: more than a year ago, in April*, 1850, we published a letter from a good practical geologist in New South Wales, which may be now repeated."

"*This Colony is becoming a mining Country, as well as South Australia. Copper, lead, and gold are in considerable abundance in the schists and quartzites of the Cordillera (Blue Mountains, &c.) Vast numbers of the population are going to California, but some day, I think, we shall have to recall them.*"

"California is the parallel which immediately occurs to us all, not without satisfaction."

Moreover, in 1849, I urged, in the public journals, the necessity of a Geological survey of the Colony, and gave an account of the way in which the survey of England is conducted.

In 1850, I was engaged in a correspondence with Thomas Burr, Esq.,

* *S. M. H.*, 21st December, 1849.

Surveyor-General of South Australia, in which I laid before him my views of the Geology of Australia, and indicated to him, the Silurian as well as other formations in these Colonies.

As Mr. Burr is about to proceed to Europe, for the purpose of publication of his own researches, he will, I have no doubt, bear testimony to what was then my state of knowledge respecting this country, and so far amply bear out my assertion, that up to May, 1850, I had been continually at work, from 1839, in the investigation and elucidation of the geological and mineralogical constitution of Australia. (See this Appendix, letter H., p. 282; and Leichhardt's Expedition, p. 212.)

1851 to 1860.

After the first cradle washing at Lewis Ponds, the excitement and expectation of abundance of gold were much damped by a letter inserted by Mr. Hargraves, in the *Sydney Morning Herald*, to the effect, that he had little confidence in the prospects of the gold washers;—an opinion also expressed by him in his private letters, and by statements to the Government, on the part of others, that the mountains of Australia were not high enough for much gold. To meet the circumstances of the case, I published, at the request of a respectable firm in Sydney, a pamphlet, entitled, "*Plain Statements and Practical Hints* respecting the Discovery and working of Gold in Australia," of which I believe at least one thousand copies were sold. References to that publication, as giving distinct statements respecting definite localities (which have since been verified), may be found at p. 6-7 of this volume. About the same time, I forwarded by the Bishop elect of Lyttleton, a memoir on "The Discovery of Gold," to Sir R. I. Murchison, for publication before the Geological Society; and I also sent to him a paper, written *currente calamo*, at a moment's warning, in which I quoted from memory the heights of gold localities in the Ural, which I had a few days before quoted in the pamphlet with references given to the authority ("Russia and the Ural"), but not having the work by me at the time, I did not requote the references; *nor was there a necessity for it*, because it was a paper written one day for publication on the next (viz., the Queen's birthday), and was written merely to meet the objections then urged against the heights of the mountains, and other supposed unsuitable conditions of New South Wales. This paper was sent home by the Governor-General, and found its way into the Blue Book and the *Times*, and brought down on me attacks, of a very unphilosophical kind, from certain friends of Sir Roderick Murchison, who *fancied*, that because I did not illustrate my paper *with all the formalities of a set treatise*, I either intended to ignore Sir Roderick, or to claim his account of the Ural as my own! So strangely do people judge of each other with half the world between them! As if such an attempt was a likely thing for a gentleman to make, or, indeed, any one with any regard for his own reputation. Judging this to be a *popular theme* in England, the author of a book to be alluded to further on, viz., "Australia and its Gold Fields," made it the staple of some impertinent criticism, hoping, by bringing me, as he thought, into contempt, and upholding the sole claim of Sir Roderick, he would advance his own special objects, and get me set down, instead, as a pretender and charlatan. There is no doubt this scheme succeeded, in some quarters, in exalting the author of it at my expense. But I regard the much-abused paper in question, hastily composed as it was, as having done very much to counteract the ill-advised proceedings of those who would throw cold water on the first exertions of the diggers. And as such it was a service, not in the discovery, but in the *development of gold.*

This volume details much that I have done in the same cause during 1851 and 1852, and since, as will be seen in the perusal of the book; during the remainder of 1852, and part of 1853, I was engaged in exploring the Northern Districts, the account of which was published in my Reports to the Government.

From 1853 to 1860, I have occupied my leisure with examinations of rocks and minerals sent to me from all quarters, and in a correspondence with persons in all the Colonies.

I have also contributed several Reports on the geology and auriferous prospects of Tasmania, to the Government of that Colony, in the years 1856 and 1859; which, with other collateral notices and public letters, bring me to the date of the present volume.

SIR RODERICK IMPEY MURCHISON, G.C. ST. S.; D.C.L.; M.A.; V.P.R.S.; V.P.G.S., ETC.

1844–50.

This illustrious philosopher, to whom the Science of Geology owes so great a debt of thanks for his unlimited attachment to its interests, and the devotion of a princely fortune to its advancement, has added fresh laurels to his already acquired fame, by the skilful and fortunate judgment passed by him on the collections brought from Australia by Count de Strzelecki; from which he was led to declare, in the year 1844, after his return from the Ural, that the rocks of Australia, when compared with those of the Ural, indicated the same epoch.

"Having," he says, "in the year 1844, recently returned from the auriferous Ural Mountains, I had the advantage of examining the numerous specimens collected by my friend, Count Strzelecki, along the eastern chain of Australia. Seeing the great similarity of the *rocks* of these two distant countries, I had little difficulty in drawing a parallel between them; in doing which, I was naturally struck by the circumstance, that no gold "had *yet* been found" in the meridional Australian Ridge, which, I termed, in anticipation, the "Cordillera."*

In order to give every publicity to the proceedings of Sir Roderick I print the following letter:

"My Lord Duke, 16, Belgrave Square, July 8, 1853.

Having perused the papers relating to the recent discovery of gold in Australia, which have been published by command of Her Majesty, and presented to both Houses of Parliament, and not seeing in them any allusion to the part I took in that discovery, I beg to make the following statement, accompanied by a request with which I hope your Grace will comply.

In the year 1844, I instituted a comparison between the rocks of Eastern Australia, numerous specimens of which had been brought home by my friend Count Strzelecki, and those of the auriferous Ural Mountains, with which I was personally well acquainted. This comparative view was printed in the same year (1844) in the Journal of the Royal Geographical Society.

In the year 1846, I addressed Sir Charles Lemon, the president of

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* Siluria. 3rd ed., p. 489.

the Royal Geological Society of Cornwall, at the anniversary meeting of that body, held at Penzance, and incited the superabundant Cornish tin miners to emigrate to the colony of New South Wales, and there obtain gold from ancient alluvia in the same manner as they extracted tin from the gravel of their native country.

This communication,* in which I alluded to some specimens of gold having been found (distinctly auguring that much more would be discovered), was dated, as your Grace will perceive, in the year previous to that in which the Californian gold was detected.

Returning from the continent, after a long absence, in the year 1848, and finding that specimens of Australian gold ore had been sent to me as an authority on the subject, I deemed it to be my duty to state my views to Her Majesty's Government in a letter dated 5th November, 1848, addressed to Her Majesty's Secretary of State, Earl Grey.

And here I take the liberty of mentioning that as my memoirs of 1844 and 1846, are anterior to any other printed documents relating to Australian gold, so I was, from all I can learn, the first person who wrote to Her Majesty's Government on the actual discovery of specimens of native ore, and who urged the well regulated search for it, not as a crude speculation or guess, based merely on theory, but as the direct result of inductive reasoning, founded on facts and extensive geological observation.

It is now, indeed, certain, that if my suggestion of 1848 had then been acted upon, gold would have been largely and profitably extracted, under the direction of the Government, three years before the truth was publicly developed by extensive diggings.

Excuse me if I further observe that I did not abandon the subject in 1848, but endeavoured, on the contrary, on various occasions during the two following years, to rouse national attention to the known existence of gold in Australia, adverting strongly to the desirableness of opening out gold works in the colonies of that continent. †

In making this statement I would in no way detract from the merits of gentlemen resident in the Australian colonies who, although their publications were posterior to my own, have done signal service to their country, and have scientifically as well as practically explored the auriferous tract with great ability. But I may be allowed to remark, that the earliest printed document relating to gold in Australia which is referred to in the parliamentary papers is by the Rev. W. B. Clarke, and bears the date of Sydney, 1847, whilst the first profitable extraction of any notable quantity of ore was made by Mr. Hargraves in 1851.

Under these circumstances, and believing that the above-mentioned parliamentary papers will naturally be consulted by future authors, as comprising the materials for the compilation of a true history of the development of Australian gold, I am impelled, in honour of the science which I cultivate, to request your Grace to make known the share I have had in this important national matter, by simply directing that the letter which I addressed to Earl Grey in 1848, and which is registered in the Colonial Office, be printed so as to form part of the papers respecting the recent discovery of gold in Australia.

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* See Trans. Royal Geol. Soc. Cornwall, 1846.

† Trans. Brit. Assoc. Adv. of Science, 1849. Trans. of Sections, p. 60. Proceedings Royal Institution, March, 1850.

Quarterly Review article, Siberia and California, vol. 87, p. 396.

A letter from Earl Grey, dated November 24, 1851, and addressed to me, is enclosed, to indicate how distinctly his Lordship referred to my anticipations as having been completely fulfilled by the opening out in that year of profitable mines.

Leaving this subject in your Grace's hands to deal with as you may think fit,

I have, &c.

RODERICK I. MURCHISON."

His Grace the Duke of Newcastle.

The above letter forms part of a correspondence between the Government and myself, respecting the discovery of gold, and which, with my replies and extracts from evidence, and the letters referred to at p. 290, were published in the Parliamentary Blue Books, in 1854.

The statements contained in that letter, and repeated in Siluria, in the Quarterly Review and numerous other publications, I never disputed, and do not now dispute. But, if it is necessary for so eminent a Geologist as the Director-General of the Geological Survey of Britain, to state his services so frequently, how much more necessary is it for a humble "Geologist of the Antipodes," as I was termed by a friend of Sir Roderick, in the "*Examiner*," to show, as I have done, that before Sir Roderick had become aware, that gold had really been found, I had already found it and had come to the conclusions described in the preceding section, and had, in fact, *completed*, what was necessary for a geologist in the Antipodes to do.

The President of the Geological Society, W. Hopkins, Esq., in his review of the matter, in 1852, freely admitted, that up to 1847, both Sir Roderick and myself, had come to the same conclusions on two different courses of enquiry.*

And, although he dealt *ex cathedrâ* a heavy blow with his Presidential hammer at one of his brethren 13,000 miles beyond hearing of the address that accompanied it, and went a little out of his way, to point out that, a "generalisation" is more creditable than the "inference of the observer," which must be heresy, if the motto on the Transactions of our Society is to be credited,† I have some hope, that the pages of this book will make my friend, the President, think, that he might have waited for further information, before he set down his Antipodean *correspondent*, as aiming at a position which was not his. The Editor of the Quarterly Review, who, probably, without knowing it, allowed a cruel and unjustifiable note, to slip into No. 185, in an article on the "*Bohemian* Embassy," did me the honour to recall the offensive expressions, and to offer a kind apology, which would have been all the more welcome, if it had not ended with the seemingly unconquerable idea, that all I had been doing, from 1841 to 1847 was, "*recognising a piece of auriferous rock*."‡

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* Quarterly Journal, vol. VIII. lv.

† "*Non belle et probabiliter opinari, sed ostensive scire.*" The motto on the title page of "Siluria" is "*The men who begin with speculation, and end with facts, begin at the wrong end.*" Most unquestionably, I never speculated on the abundance of gold, till I had found, that gold existed. But it is for this, I am called a mere "observer," as if Geologists were anything else but "observers"! Nor could Sir Roderick have speculated about Australia if he had not been an "observer" in Russia.

‡ Quarterly Review, March, 1854, vol. xciv, p. 606.

Notwithstanding these, and a number of other attacks on me, in numerous places and ways, by persons, who evidently have mistaken the motives by which I have been actuated, and the circumstances which have occurred; and although I see my name quoted under various *aliases* in publications which prove, by the carefulness of quotations of other names, that there is no design, so far as respects them, to conceal their identity, I shall not shrink from the avowal, that I have never depreciated any of the inductions, speculations, labours, or generalisations, of the illustrious author of "Siluria," who, in the midst of the harsh judgments of others, appears, in his correspondence with me, and, generally, in his mention of me, to give me that credit which I always desire to give him: the credit of having contributed, so far as means have allowed, to throw light upon the discovery and development of gold in Australia. Whilst, then, I readily admit all that Sir Roderick has written and published since 1844; at the same time, it is equally on record what I had been doing from 1841 to 1844, and that, not only in 1847, but in 1851, I spoke of the probable abundance of gold in Australia, from convictions attained by my own researches, observations, and discoveries, as something "wonderful:" "*it may be safely concluded, that Australia will be found one of the richest gold-bearing regions on the face of the globe.*"* And this was written when, as yet, only £5,000 worth of gold had been obtained, and doubts had been expressed as to the continuance of the supply, and that, too, by the reputed discoverer of the Lewis Ponds locality himself.

MR. W. T. SMITH.

1848.

In a letter addressed by Sir R. I. Murchison to the Right Hon. the Earl Grey, dated Coolhurst, near Horsham, November 5, 1848 (alluded to in the preceding division), the writer says: "I have now received a letter from Mr. W. T. Smith, of Sydney, who, in consequence of my opinion, has been led to make researches, and who has sent home to me a good specimen of gold ore, found on the western slopes of the Blue Mountains, which lies in a matrix of quartz rock, and is exactly similar to the prevailing auriferous masses of the Ural Mountains. Mr. Smith, who has forwarded samples of silver and other ores, further states, that one specimen of gold ore recently obtained weighs four ounces troy, and another two ounces troy."†

Sir Charles Fitz Roy, in his despatch to Earl Grey, dated June 11, 1851, states: "About two years ago a Mr. Smith, who was engaged in some iron works in the vicinity of Berrima, produced to the Colonial Secretary a lump of gold imbedded in quartz, which he said he had picked up at a certain place, which he offered to make known to the Government upon being previously rewarded for the intelligence by the payment of a large sum. The obvious reply to this offer was, 'that the Government could enter into no blind bargain on such a subject, but that, if Mr. Smith thought proper to trust to the liberality of the Government, he might rely on being rewarded in proportion to the value of the alleged discovery, when that was ascertained.'"

"Mr. Smith refused to accede to this proposal, and there the matter rested." ‡

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* On the Discovery of Gold in Australia. By Rev. W. B. Clarke, M.A., F.G.S. Proceedings of the Geological Society. (Feb. 4, 1852.) Vol. viii. p. 133.

† Blue Book, August 16, 1853, p. 43. ‡ Blue Book, February 3rd, 1852, p. 8.

We find, further, that on 27th February, 1852, Mr. Smith applied, through Sir R. I. Murchison, to the Secretary of State, for "compensation as having been the first to call the attention of the Government of N. S. W. to the existence of gold in that colony." * This was repulsed. Whether Mr. Smith found the gold himself or procured it from Mr. Trappit, who lived on *Lewis Ponds*, and who brought to me, at St. Leonard's, in 1850, a specimen of gold found by himself at the former locality, is not known.

But the following document, to which I would invite particular attention, proves that numbers of persons before 1850 had found gold in *that* and the neighbouring creeks, and that Mr. Smith had collected the particulars. The document was given to me in the autumn of 1854, by Mr. Korff, of Sydney, in the presence of Mr. Sawkins, brother-in-law of Sir Benjamin Brodie, and now engaged in a survey of Jamaica, who went home by the Panama route with Mr. Hargraves. As Mr. Sawkins received a copy made by myself, the document can be verified.

Care has been taken to print in appropriate type, the words which in the original are marked, and by it, it will be seen, that in April, 1850, *Frederick's Valley*, *Emu Swamp*, and LEWIS PONDS, were known to contain gold both in quartz rock and in alluvia.

It is further clear from the facts mentioned in it, and from its very existence, that a community of gold seekers existed in Sydney, who at that time were prosecuting researches in the neighbourhood of those creeks, and who found it necessary to exercise extreme caution.

This brings the "discovery" of gold up to the middle of 1850, and in a letter published in the Sydney *Empire* of April 3rd, 1856, by Mr. Simpson Davison, the writer mentions that it was probably by myself, as having written in the public Journals, that the general impulse was given.

> "Memorandum on the County of Bathurst, on the 19th April, 1850, received from a friend, Mr. T. W. Smith."
>
> "You will start from Sydney to the town of Bathurst, which is about 121 miles from Sydney, is in 33° 24′ 30″ S. latitude, and 149° 29′ 30″ E. longitude, 27½ miles north of Government House (Sydney) and 94½ West bearing W. 18° 20′ 20″ North, 83 geographical or 95½ statute miles and by the road distant (as above 121 miles)
>
> The chief rivers are——Macquarie, Campbell, Belubula, Abercrombie, and Lachlan.——The creeks are Rocky Bridge, *Frederick's Valley*, *Emu Swamp*, Peppers, Queen Charlotte's vale, Princess Charlotte's vale, Swallow, Coombul, Coombing, LEWIS PONDS, Cadiaugullong, Muramur, Mundoraman Ponds, Milburn, Grubbanburn, Muringulla, Limestone, Wangola, and Pannara.——
>
> The Plains are——Bathurst, Warwick, King's, Dunn's, and Pretty Plains,
>
> The most conspicuous mountains are——Canobolas, and the Three Brothers.
>
> On your arrival you will be scrutinously watched, they look on strangers with a suspicious eye; you go on to Summer's Hill to a small INN kept by McKillup, and from

* Despatch from Sir J. Pakington to Sir C. Fitz-Roy. Blue Book. Febr. 28th. 1853. p. 149.

thence to a Sheep Station held by Mr. W. Lane, but before you arrive at the Station you come to Dosey Bills Hut, he is a shrude fellow; Lewis Ponds Creek and Yorke's Corner, these are very deep in which is the Quartz Rock which contains the G..d. Mem°. the large piece was found at Lane's Station by his Shepherd (Mr. Donnald) and the other which Mr. Holmes had, was found on the adjoining station, has no doubt from the appearance of the country the same metal extends some sixty miles away into the Wellington district. Mem°. Mr. Trappit knows Mr. W. T. Smith, he stoped at his place. Yorkey's corner is near Mr. Perrier's station—

Summer Hill is about 144 miles from Sydney.

Lewis Ponds creek empties itself into the Macquarie River.

Frederick's Valley is about 153 miles from Sydney.

Emu Swamp in the County of Bathurst near Lewis Pond Creek.

May 30, 1850.

Scotch Harry is at Mr. Perrier's, this, the place were the yellow stuff was found at the root of a tree which was blown down, there is a quantity of iron stone near the spot and the quartz rock is very steep—there is yellow stuff in Lewis Ponds.

There is copper ore on Mr. Perrier's station at the back of Scotch Harry's Hut on a mound: he will point out the place and will point out Yorkey's corner— —

Mr. Green is in charge of Mr. Perrier's sheep, at the station.

Mem°.—This information is from Mr. H. Perrier & Mr. David Perrier also to ask Scotch Harry were Delaney Mr. P's. shepherd found the gold, and were Mrs. Fitzgerald was murdered there is good indications of Copper ore—he has got several specimens of it=the letter from Scotch Harry from Mr. P."

This document is endorsed, "Mem°.—On the County of Bathurst, April 19th, 1850."

FRANCIS FORBES, ESQ.

1849.

This gentleman, a graduate of the University of Cambridge and eldest son of Sir Francis Forbes, one of the late Chief Justices of New South Wales, contributed his share to the advancement of knowledge by publishing a paper, in 1849, on the "Production of Gold," in which he quoted from Sir Roderick Murchison's letter to Sir C. Lemon (which I had referred to in 1847), and gave some useful statistical details. Having the honor of Mr. Forbes' friendship, I had corresponded with him respecting some enquiries he made of me as to the metalliferous riches of his own neighbourhood on Darling Downs. Whether Mr. Forbes ever himself found gold I do not know—his letters to me make no mention of it. But he was a man of great talent and scholarship, and taking a deep interest in the advancement of the discovery of gold in California, went thither and, unfortunately, died.

COLONEL BADDELEY, R.E.

1849-1850.

My friend Colonel, now Major-General, Baddeley, when residing at Dawes' Battery, in Sydney, during the years 1849 and 1850, amused himself with mineralogical investigations, and these he published in the columns of the *Sydney Morning Herald*, under the signature of A. A. Among other determinations, he proved the existence of gold in two localities in the Western, and in one, in the Southern districts. He had formerly found gold in Canada, as stated in Silliman's Journal; and was so impressed with the existence of a Gold Field here, that he actually started from Sydney to Bathurst, in 1850, to look for it;—but, having been seized with violent illness, he was compelled to return to Sydney unsuccessful.

THE LATE S. STUTCHBURY, ESQ., F.G.S.

1850-1.

Mr. Stutchbury's name is introduced here, because he was engaged in the first official geological survey of the country; but, it appears, he found no gold till after April, 1851.

E. H. HARGRAVES, ESQ., J.P.

1851.

It is my desire to say nothing of this gentleman but what can be substantiated by evidence.

He has given some particulars of his early history in the prefatory observations to a book, entitled "Australia and its Gold Fields," understood to have been in part the work of a gentleman now living in the colony, and who had delivered at public lectures the substance, if not the *ipsissima verba*, of the two first chapters. As the end of the book contains three letters, containing a "New Theory of Gold, by Simpson Davison, Esq.," the middle of the work is all that, I presume, strictly belongs to the author, and I wish it did not, as it contains at least one thing not true (viz., that I ever purchased gold of any one), and was written so as to serve the purpose of the author himself, at the expense of the reputation of me, with whom, in a Report to the Government, three years before, he had written he was "on the best of terms." If I deserved the impertinence with which I am mentioned in this book, since the transactions alluded to respecting my discovery of gold occurred before the Report in question was written, neither Mr. Hargraves nor his anonymous co-adjutor ought to have noticed me at all, because the charge made, is not that I am ignorant of Geology, but that I endeavoured to claim a discovery which, he says, is no discovery at all, and to have made "prognostications" of future discovery which only Sir Roderick Murchison really made. And, then, the critic enters upon what he calls "Mr. Clarke's pretensions," and makes merry about a "*pennyweight* of gold," which I had reported in my evidence before the gold Committee, as having found, reading me a lecture, and taunting me with writing, after "*I heard of the discovery of available gold fields in New Zealand,*" *that* "*I had long been impressed with the persuasion* that New Zealand must contain a portion of those more ancient formations which in this country are found to be auriferous." As this is pretty well refuted by a quotation given at p. 7 of this volume, Mr. Hargraves is welcome to say what he likes about New Zealand; but it is a pity, when he set himself up for an author and reviewed other peoples' "*pretensions,*" he did not recollect the old proverb, "*those who live in glass houses should not throw stones.*"

We will now endeavour to see what are *Mr. Hargraves'* "*pretensions.*"

But, I will first add, that if this book had been printed in this Colony, where *his* "*pretensions*" could be sifted, and not in London, where he became a detractor of those who being 13,000 miles away, could not answer him on the spot, neither would Sir Roderick Murchison have quoted this book as confirming his own views respecting the Ural, nor would the Editor of the Year Book have ventured to state, that anything said in Mr. Hargrave's book could refute my own assertions, which he does, in a note appended to a memoir of Sir Roderick Murchison, illustrated by the likeness of that distinguished geologist!

Mr. Hargraves, it appears, when a youth, lived for a time in the country somewhere between Bathurst and Wellington, and after various vicissitudes of fortune went to California in 1849, in company with Mr. Simpson Davison and Mr. L. Potts (mentioned at p. 52 of this work). Mr. E. W. Rudder, J.P., of the Macleay, was, I believe, already there. The latter gentleman had been known to me long before, and he had consulted me respecting the mineral wealth of the Colony. I have every reliance on his word, as well as on that of Mr. Davison; Mr. Potts I have not the pleasure of knowing, nor is he concerned in the matter under discussion.

Mr. Davison states in a published letter, that "Mr. E. W. Rudder, who went to California, as the representative of some Australian Company, accompanied Mr. Hargraves and himself in a *trading trip* up the Sacramento River in 1850, and whilst Mr. Hargraves, who *never liked prospecting, remained in charge of merchandise* at Marysville, near the head of navigation, at the confluents of the Yuba and Feather Rivers, he went with Mr. Rudder, on a short expedition to initiate him into the art of practical gold mining."*

During his stay in California, Mr. Hargraves says,† he became convinced of the similarity of California and Australia, and expressed his persuasion to his friend Davison, that "we should soon hear of a discovery of gold in the latter country, and his determination, if not discovered before his return to New South Wales, to prosecute a systematic search for it." This certainly was well enough for a man who "did not like prospecting;" and is quite contradicted by Mr. Davison's statement in the *Empire* newspaper, as well as by letters which I have seen from Mr. Rudder, in which the information is said to have been conveyed *to,* and not received from Mr. Hargraves. Be it as it may, the latter came back to this Colony in 1851, to look after his family affairs and "domestic ties," as Mr. Davison says, but according to himself *for the purpose* of making the discovery of gold, of which Mr. Davison writes thus: "A select Committee of the Honorable the Legislative Council of New South Wales, *discovered* that Mr. Hargraves returned from California to

* Sydney *Empire*, 8th February, 1855. † Australia and its Gold Fields, p. 86.

Australia, expressly to find gold—the *greatest discovery*, it must be admitted, of modern times, and competent judges have decided, that their report was founded on evidence."*

Mr. Hargraves told the Committee † that he placed himself in communication with Mr Norton, and Mr. Davison adds, that Mr. Norton informed him, that *another discovery* of gold in the quartz matrix had been made by Mr. Icely, and in consequence of this *additional information* he proceeded to the Western Districts with the intention of prospecting for alluvial gold, in the first instance, in the *neighbourhood of the auriferous quartz discovered by Mr. Icely.*" ‡ Well, what did he actually do? By his own letters, which I have seen, it is clear, he went to the western country on a "*mission*," that he was supplied with funds to carry out that mission, but that instead of going to Carcoar he "went to Guyong and asked Mrs. Lister for some persons to act as guides," that "she requested him to take her son with him, and he consented to do so on condition that he observed the *strictest secrecy* as to his proceedings."|| On the 12th February, he adds, "I went to *Lewis Ponds* and *there* made the *discovery*."

The reader will be good enough to refer to Mr. Smith's Guide Paper (p. 288-9) where he will see "secrecy" enjoined, and *Lewis Ponds* and Yorkey's Corner mentioned as places where the "*yellow stuff* was," where the "g .d" was, &c.

Mr. Cowper asks: "will you state here, what took place between yourself, Mr. Lister and Mr. Tom, the first time you went to Guyong?" The reply is emphatic:—"There was nothing took place, except that I told Mrs. Lister I wanted a guide to conduct me to that part of the country, that is, *Emu Creek, Lewis Ponds, and Summer Hill Creek*."

Now, I think no reasonable man can doubt, that the "*information*" to which Mr. Davison says, Mr. Norton's was "*additional*, must have been derived, either directly or indirectly, from the "Guide Paper," or from those who had it, for the purpose of a mission to the localities named. If this was not the case, then I willingly admit, that this intuitive enquiry for those *three localities* is the most wonderful proof that ever was offered of the genius of discovery, and that all Mr. Hargraves has said about his comparison of the external features of the country, &c. &c. &c., and the use of his "magician's wand," § is in excellent keeping with the assertion that though he came to the Colony on purpose to "*prosecute a systematic search for it*," yet no sooner did he get within the magician's circle in Lewis Ponds Creek, than he said, *without making any search at all*; "where you walk over now is gold, and *I will show it to you, directly after getting something to eat*." ¶

Well, what did he show? What did he, according to his own testimony,—procure from this spot in which he says he felt as if he "*was surrounded by gold*." ** Did he get a *pennyweight*? Oh! no—he got "*five little particles*," that "*did not amount to a grain in weight*," †† and which the Colonial Secretary said, were so "*very minute*" that "*they were scarcely visible*." ‡‡

* Sydney *Empire*, 17th September, 1855.
† Evidence before Gold Committee, 29th June, 1853.
‡ *Sydney Empire*, April 3rd, 1856.
|| Evidence before Gold Committee, 29th June, 1853.
§ Australia and its Gold Fields, p. 115.
¶ Evidence, 29th, 1853.
** Australia and its Gold Fields, p 115.
†† Mr Tom's Evidence, 30th June, 1853.
‡‡ The Hon. E. Deas Thompson's Evidence, 27th July, 1853.

No wonder Mr. Hargraves felt disheartened, and finding the oracle had deceived him, contemplated his return to California, abandoning the country which he had been led to by the intuition of genius and the "exercise of his skill."

So ends the famous "*first discovery*" of gold in Lewis Ponds Creek after it had been discovered there, over and over again, and after a Guide Paper had been drawn up expressly to point out where it had been found.

On such a slender basis as this, it was impossible for Mr. Hargraves to found his fortune.

But the fates were prosperous. Having taught his guides to use the cradle, *they* rocked him into celebrity.

The four ounces which *they* found, enabled him to make his claim upon the Government; and, in the expressive language of the Colonial Secretary, to father the "Golden baby," produced by Messrs. Tom and Lister. Now, admitting, in spite of this, that Mr. Hargraves really did fancy that he formed a right conjecture as to the locality from the "outward appearance," how happens it, that when he went in great state to Bendigo, warning the people on his way, against such useless places as Adelong and the Ovens, and utterly refusing to examine the places pointed out in his Instructions (see p. 7 (5,)) except at Nackie Nackie,* where, he says, he found gold, which had already been found in 1849 (see p. 5); how happens it, that when he reached Bendigo, where really he was "surrounded by gold," he could not recognise its claim to be what it is, for he says :† "had I seen this country before it had been worked, I should not have thought it a field of such extraordinary richness as it has proved to be..... I have not seen any quartz veins here." ! !

Honours and offerings, public dinners, and complimentary tea services, now flocked in upon the "first discoverer" of the "less than a grain" of gold dust, who rose from poverty to affluence upon the result of Messrs Tom and Lister's prospecting, which they had been trying for a year and more in the same place, on a less profitable plan; and not the least of the honours bestowed on the fortunate adventurer was the celebrated "*pure gold cup,*" *of the value of £500 sterling*, bearing the following inscription: "*Palmam qui meruit ferat.*" "The presentation of this *magnificent* testimonial," he tells us in his preface, "took place at a public dinner, at which were present the Governor-General, the Colonial Secretary, and all the high officers of the Government." But he does not tell us how much of the £500 sterling *was contributed by himself*, in order to make the motto more appropriate, and the testimonial more magnificent than the town of Sydney intended it to be; and it has been left for the chronicler of what is now the past to complete the history of this testimonial of the town of Sydney, by narrating how the presentee, intent upon "*a second discovery*," took the cup of "*pure gold*" to the Mint, and had it melted down, thereby effacing for ever, perhaps from a conscientious sense of returning modesty, the "*Palmam qui meruit ferat*," and discovering, too late, that as "*all is not gold that glitters*," so like the gold in the quartz at Lewis Ponds (which we read of in the "Guide Paper"), lay deeply bedded *no less than eighteen ounces of lead and copper*, for which the price of gold, at the *then* market value was demanded, under fear of a summons or warrant from E. H. Hargraves, Esq., J.P. for N.S.W. and Victoria.

All this is, probably, as much unknown to thousands as was the

* Australia and its Gold-fields p. 130. † Report 17th December, 1852.

locality of the gold in the western country, till the guidance of Messrs. Lister and Tom led to the testing of the genius of that "*first discovery*," of which we have heard so much, and which Mr. Stutchbury found them making at Yorkey's Corner. (Report, 18th July, 1851.)

But, after all, has Mr. Hargraves no merit? Certainly. Very great merit is due to him for teaching his guides to wash the earth after the Californian fashion, so that the development of the gold fields, so long delayed, might even then be commenced. Though I deny, therefore, resolutely, the claim to a "*first discovery*" of gold in 1851 to any one, and especially at Lewis Ponds, I should be very unjust if I did not give Mr. Hargraves his due credit, and had he rested his claims on what he *did*, and not on what he *did not*, he would have saved me the trouble of proving that any discovery *for the first time* of gold in 1851, must have been either a fraud or a fiction.

I have now brought this Synopsis to a close. I have endeavoured to give a true and faithful account of the discovery of gold in New South Wales, and I have only to add a word or two on what took place after the announcement of Messrs. Tom and Lister's success. Mr. Hargraves' work ended, his rewards began. My work, however, has not ceased at this moment.

Let him not think it invidious, then, if I ask him, as an honest man, whether, after what he knew I had been doing, for the sake of others and not for myself, after he knew, that I had proved, to a great extent, that what I had asserted of individual localities was *true*;* that though he has never since made any further disclosure or discovery of gold; though I had pointed out to him places, which this volume shows were known to me, and which he might have ascertained to his own credit, he acted as a person worthy of respect, in taking advantage of his presence in Europe to represent me as an impostor and pretender, and to turn into ridicule one who had done all he could to render him the most effectual service?

It is pleasant, however, to know, that I have survived the various attacks of anonymous and other detractors, and that having submitted the *whole of the published documents* on the question of discovery of gold, successfully carried out to a useful end, to the judgment of Foreign Geologists, who have no bias or prejudice or jealousy to warp

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* I might put all this on one venture. The statement I made in 1851, to the Colonial Secretary, respecting the great Gold Fields of Victoria, was made in Mr. Hargraves presence (see p. 7 (3),); he had also read the same statement in my pamphlet of 1851.

Now, if I had made no other discovery, I certainly made one then; and Mr. Hargraves, had he pleased, might have realized it. The Legislative Council of Victoria have been pleased to acknowledge the value of that indication, for this is an extract from the Report of their Committee.

"*Mr. Thomas Hiscock, a resident at Buninyong*, INDUCED BY THE WRITINGS OF THE REV. W. B. CLARKE, *and by the discovery of Brentani's nugget in the Pyrenees district, five years before, had kept a constant look out for gold in his neighbourhood*. . . . It is obvious, that Mr. Hiscock's discovery, at Buninyong, by attracting great numbers of diggers to the neighbourhood was the cause of the discovery of Balaarat, which is, in fact, upon the same range, and at no great distance, about six or seven miles. . . . In the language of a disinterested witness, Mr. Alfred Clarke, of Geelong, 'the discovery of Balaarat was but a natural consequence of the discovery of Buninyong.'"

them, I am enabled to select from their verdicts, one which will bear to be looked at in the presence of the authors of even that admirable production, "Australia and its Gold Fields."

The celebrated author of the "*Histoire des Progrès de la Géologie,*" has done me the honor to write a letter, from which the following is an extract.

Paris, 21*st May*, 1855.

"I have received with much interest, the undeniable proof of your right to the priority of discovery of gold in Australia, a discovery which could scarcely be honestly contested with you, but *you have not stopped there*, you follow up your very useful undertaking with a perseverance and success which cannot but do you much honour. Be assured, that I will neglect nothing in what may concern you in this respect, in making use of the documents which you have been good enough to send me, to render justice to whom it is due."

I am the more gratified with this letter, because it does not rest what the writer is pleased to consider my services, on what the apologist in the Quarterly Review rests them, viz., "*the recognizing a piece of auriferous rock;*" but on the inductions from that recognition, which constant discoveries of new localities indicated by me from my own researches, have been demonstrating with success, and in localities neither examined nor suspected by others, extending altogether, at this time, over a period, from 1841 to 1860, of *nineteen years*.

I may close this account with a remarkable passage, from the "*Memoirs of Horrox,*" which may be dwelt upon by all concerned in this eventful history.

"Few men are permitted to originate, to confirm and to promulgate a great discovery. This is usually the work of successive generations. Each master spirit pushes the enterprise a step further: and hence it is often difficult to decide who is fairly entitled to the credit. The final elucidation may be the result of an accumulated experience."

For myself, I only ask for that acknowledgment, which my own share in the advancement of the Colonies may receive from impartial judges; and if that acknowledgment declares, that under difficulties, without scientific aid, without sympathy, and in spite of a thousand inconveniences, I did my part up to 1851 as a loyal citizen of the land in which I dwell, I shall be satisfied. What has been done since and what this volume in part details, is beyond the limits of this abstract of a history that may, perhaps, hereafter be told with much that is now omitted.

Reading and Wellbank, Printers, Bridge-street, Sydney.

CORRIGENDA.

Page 70.	Line 28.	for "Saponaceous,"	*read*	Steatitic.	
86.	17.	,, "into,"	,,	in.	
93.	33.	,, "Ophite,"	,,	Serpentine.	
,,	35.	supply		16 Diorite,	
115.	25. &c.	for "86,"	,,	115.	
,,	,,	,, "295,"	,,	336.	
,,	,,	,, "260,"	,,	301.	
147.	15.	,, "Brogolong,"	,,	Brogalong.	
158.	22.	,, "XI."	,,	XII.	
165.	22.	,, "define,"	,,	defines	
167.	4.	,, "Brockalong,"	,,	Brogalong.	
226.	15.	,, "9000,"	,,	8,170.	
238.	36.	,, "traces,"	,,	trace.	
240.	16.	erase "bottom of the"			
256.	40.	for "California,"	,,	New Grenada.	
285.	6.	,, "Anarthrocana,"	,,	Anarthrocanna.	
,,	29.	after "Arachnophyllum,"	supply	Chætetes crinita.	Carboniferous.
,,	,,	,, ,,	,,	,, gracilis.	
286.	8.	,, "Cyathocrinus,"	,,	Pentadia corona.	

[These make the number of Fossils 272.]