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By His Honor's command,

J. C. RICHMOND, Provincial Secretary.

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Provincial Secretary's Office, Nelson,
June 8, 1863.

HIS Honor the Superintendent directs the publication of the following Report, for general information.

J. C. RICHMOND,
Provincial Secretary.

Nelson, June 5, 1863.

To his HONOR THE SUPERINTENDENT,
Nelson.

SIR,—

In compliance with instructions conveyed to me in a letter from the Provincial Secretary, dated March 11, 1863, I have the honor to inform you that to carry out those instructions, I was obliged to make two journeys to the Wangapeka, Baton, &c., as the limited time at my disposal on my first visit, was not sufficient to carry out the work.

In this report I shall in the first place, give an account of the route taken on these journeys, without reference to the formation of the country; and then compile all the information I have collected on this point; this will be better than giving a detailed account of the two separate journeys.

I started from Nelson on the 17th of March last, and proceeded by the Tadmor road to the Wangapeka; made a hasty examination of the country in the lower part of that river, more particularly the north side towards the Baton. I then went up to Rolling

River (a branch of the Wangapeka flowing from the south) and met with Mr. Rochfort's road party, but unfortunately he himself was in the interior, and from what I heard, I gave up all idea of meeting with him at that time. As it would have been quite impossible even to have gone over the ground necessary for making the most superficial examination of the coal field, during the short time I had to stay; I determined to delay the more distant part of my journey, until I could accompany Mr. Rochfort, and have the advantage of his previous knowledge of the different localities, where he had already found coal and indications of it. Acting on this idea, I merely devoted one day to the examination of the Upper Wangapeka, which I traced up eight or nine miles beyond the Rolling River. Next day I started for the Baton, by the road over the hills, near the junction of the Wangapeka and the Sherry, which enabled me to make some observations on the formation of the country, between these rivers and the Baton plain. On this occasion I had not time to examine the ridge spoken of by Mr. Rochfort, on the more elevated portions of the district; so I confined my observations to the banks of the river, and the lower part of the mountains; and returned to Nelson, by the road through Dove Dale, arriving on the 29th of March, 1863.

After finishing my plans and reports on the Buller and Mokihinui; I again started on the 16th of April, to continue the work I had commenced on my last journey. I joined Mr. Rochfort on the Wangapeka plain, and went with him to the source of that river, on the saddle between it and the Karamea; (about 26 or 27 miles above the plain) thence down the Karamea about one and a half miles, and up a small

branch from the south about two miles to the saddle between it, and what now turns out to be the Mokihinui, not the Lyell as at first supposed. This is called coal saddle by Mr. Rochfort, as here a seam of good coal is found.

As the line was not blazed further than this point and the part of the country I wished to see was on proposed road, I joined Mr. Rochfort's party, and assisted him to blaze a line on the south side of the saddle towards the West Coast; examining the country as we went on. This, although it caused a little delay in the first place; was, I am convinced the best arrangement; as it enabled me to take advantage of Mr. Rochfort's information, over the whole line of country, without interrupting his road work. From Coal saddle the track is taken down the side of the mountain by an easy gradient, for about six miles; it then crosses the river to the left bank, and continues through a very rugged gorge for about three miles, to the junction of a large stream from the north. Here, we ascended a mountain to get a better view of the lower part of the gorge, and to see over the surrounding country; and it was from this elevated position, the discovery was made that the river we were on was not a tributary of the Buller; but most probably, the upper part of the Mokihinui. The flat land, supposed to be at the junction of the Buller and the Inangahua, proved to be an extensive flat, of 5000 or 6000 acres, through which the Mokihinui flows. And the wide valley joining it from the south, in the same direction as the Inangahua, together with the very close resemblance between the mountains there and the Paparoha range to the south of the Buller, completed the deception, which was almost perfect. It was not till we were sufficiently far to the west, to get a view up this southern branch, that the mistake could be discovered. From this mountain Cape Foulwind was quite visible, and we could even see the sea breaking on the Buller bar; the mouth of the Buller bears south west, by pocket-compass, from this point.

The great difficulty in exploring a mountainous country, like this part of the Province of Nelson, almost entirely covered with dense bush, is to fix your position, when, after groping your way for days through the bush, you are fortunate enough to arrive at some place where a view of the country can be obtained. This may be from the bare top of a mountain, or the top of a tree; from such an observatory, in an uncertain position, topographical observations are necessarily vague and unsatisfactory; particularly as the rugged mountains of New Zealand present such different shapes, when seen from various points.

I may here state, that, although there is little hope by the route above mentioned of reaching the Inangahua valley, and thus forming a direct road from Nelson to the Grey country, still a very direct road can be made this way to the mouth of the Mokihinui, thus connecting that part of the coal field, and a considerable extent of flat land situated on this river, with Nelson. From the mouth of the Mokihinui, to the mouth of the Buller, horses and cattle can go along the beach without difficulty. The road for the whole distance would be easy, except about seven miles through the gorges above named, and this would require a good deal of rock work to make a bridle track; but certainly there are no difficulties which could not be surmounted, by a moderate amount of labor; though at present it may be said to be impassable even for foot passengers, for the bed of the river cannot be travelled, and the sides of the gorge are so steep and rocky, as to render walking, or rather scrambling along them, without a path, a matter of great difficulty, and some little danger.

On my return from the Upper Wangapeka and the country beyond it, I again visited the Baton, and this time ascended the spur between Clark's and Skeet's river, to the bare ranges south and west of Mount Arthur; and after examining that part, and making a more detailed survey of the base of the mountains, I started for Nelson on the 27th of May, and arrived on the evening of the 28th, after an absence of six weeks.

Having now given a sketch of the route, I will proceed to describe, as far as I can, the nature of the country, more particularly the coal-bearing part of it. And here let me observe that the examination of such a rugged, broken country, formed of confused masses of rocks of almost every kind, and the whole surface covered with dense bush, is a task of no ordinary difficulty; and to reduce it to any kind of order, is more than I will pretend to attempt. I shall therefore confine myself to a few facts, which I fear will do little more than illustrate that difficulty.

The Wangapeka, Sherry, and Baton plains, and the low hills between them, as also the base of the mountains, are composed of a tertiary formation, consisting of soft sandstone, marl, limestone, &c., with coal and shale in various places. At the junction of the Wangapeka and the Sherry, the limestone rocks of this formation, are found in cliffs from 100 to 150 feet high, dipping pretty regularly to south, south-west, about 35°. Under these rocks, there is a small cave, with a stream of water flowing through it, and in this stream, drift *brown coal* and shale is found, and doubtless seams might be met with. Towards the west, and skirting the base of the mountains between the Wangapeka and the Baton, the formation is much more broken and confused, about three miles up from the junction of the Sherry, in a small branch of the Wangapeka, a seam of brown coal about 2 feet thick is found; this dips to east about 70°. I went about a mile and a half further up this stream, and found nothing but tertiary rocks *in situ*, generally very much on edge, though in places they were nearly level for a short distance. In this stream there were large boulders and also angular masses of crystalline limestone.

The hills between the Wangapeka and the Baton at the base of the mountains, so far as I can judge, are entirely tertiary, with here and there a sort of soft decomposed granite. The same formation, is met with in the Baton river and its tributaries for some considerable distance up. Many seams of coal are found here, but so far as I have seen they are all tertiary, and generally very much confused and broken; for instance, one about six feet thick (coal and shale together) crosses the river near the store; this strikes north-east and south-west, with a dip to south-east of 60. About 50 yards further down the river, there is a seam of from two to three feet thick in the same position, and both up and down seams are found, but generally very much on edge, and with every indication of violent convulsion. So that had the coal at present known at the Baton been of good quality, there would have been very little chance of working it extensively; but all the samples I have seen are of very inferior quality, and much mixed with shale. The seam opened by Mr. Clark though at first sight it looks pretty well, on closer examination is found to contain a very large proportion of foreign matter, so intimately mixed with the coal as to render separation impossible; and though it burns freely the greater portion remains unconsumed, and the lump comes out of the fire almost in the same shape as it was put in.

On ascending the spur between Clark's river and Skeet's river, nothing can be seen of the formation for some distance, but about 1,000 feet above the plain, several large gritty rocks are found, these cer-

tainly bear some resemblance to the grit so largely deposited on Mount Rochfort, and other parts of the Grey Coal-field, but whether they belong to the same series I cannot tell; certainly they appear different to the tertiary rocks found below. About 500 feet further up shale is found (as stated by Mr. Rochfort), but as the part exposed is very limited in extent, I cannot say much about it; possibly Mr. Rochfort is correct in supposing that it belongs to the true coal formation, but I cannot express a definite opinion on the subject. This shale dips to the north about 30 degrees. Further up the spur there is little more to indicate the presence of the coal formation, the rocks being principally slates and schists very much on edge.

On arriving at the top of the spur, which is quite open, being above the snow line, I found the rocks, as before mentioned, to consist of slates and schists, with a general strike about north-east, dipping to south-east about from 50 to 70 degrees. In these rocks there are peculiar fossil shells, some of which were sent to Nelson by Mr. Rochfort; although I sought for them as long as daylight would allow me, I only found a few imperfect specimens.

The whole of this neighbourhood is extremely broken, and so far as I have seen there is little indication of any regular and continuous strata; neither do I think the nature of the district at all encourages the hope that such will be found.

Having said this much of the Baton and Lower Wangapeka district, I will now give some account of the higher part of the latter river. For about 20 miles up the Wangapeka above the plain, I could find no indication of coal; a variety of rocks are seen, but they are generally very much broken, and more or less on edge; seldom or never at a less inclination than 45 degrees, and often almost perpendicular.

Beyond this point, however, there is a marked change; shale and other rocks belonging to the coal measures are found; indeed drift coal, and I think true coal, has been picked up in the bed of the river by Mr. Rochfort; though I was not fortunate enough to find any myself. Here there is a very large deposit of hard shale, literally full of impressions of leaves and ferns, in a beautiful state of perfection. Mr. Rochfort has sent a number of these to Nelson, and on our return down the river we both collected as many as we could carry in addition to our loads, and brought them to Rolling River, to be sent to Nelson by the return drays. There are several beds of very bituminous shale in the immediate neighborhood, but I could find no coal. To show how very irregular the strata here is, I may state that the dip of the beds containing these fossil leaves is to west about 63 degrees; and 100 yards further down the river, it is to north-east 45 degrees; and a mile and a half further down still, it was so near perpendicular that I could scarcely determine the direction of the dip. A little further up the river I found a good deal of tertiary rock, but for the next seven or eight miles to the saddle between the Wangapeka and the Karamea, no indication of coal, neither did I see any till near Coal Saddle, about four miles further. Here I have no hesitation in saying that there is a formation of true coal; the same or very similar to that found in such perfection near the mouths of the rivers Grey, Buller, and Mokihinui; there are similar grits, sandstones, and shales, and what is more, a seam of really good coal, the first I had seen since I left Nelson.

The following is a section of the strata so far as I could measure it, viz. :—

	Ft. in.
Grit (thickness unknown)	
Black Sandstone...	... 0 9
Coal 2 0 }	
Coal and Shale... 0 6 }	... 4 6
Coal 2 0 }	
Black Sandstone (thickness unknown)	

Dip to S.W. or S.S.W. 45 deg.

The coal burns and cokes freely, gives a very good heat, and is free from shale or other foreign matter. Several pieces have been sent to Nelson, and I have some which will be sent by the return drays. The outcrop of the seam is in a small stream, within 100 yards of the top of the saddle. I have no idea what may be the extent or thickness of the coal field, but about half a mile to the east it is cut off by the underlying formation of slaty rocks, and half a mile to the west there is a large deposit of tertiary rocks, probably overlying it. On both sides of the saddle coal is found in a great number of places, indeed, as the path just cut gets a little worn down, you are constantly finding loose coal upon it. In one gully, about 1,000 feet below the saddle, on the south-west side, shale, with the impression of leaves, &c., exactly similar to that found in the Upper Wangapeka, is met with; and in the same gully, and within a very short distance, both coal and granite are found. The coal can be traced some distance, a little below the surface, quite loose with nothing solid enough to enable me to judge of its position. In the very next gully there is not the slightest indication of coal, and in several places on the same hill side, there is a great quantity of tertiary marl, in places very rich in fossil shells, a number of which I collected, and they will be sent with the other specimens. Coal saddle is about thirty miles from the Wangapeka plain, and is 3,200 feet above the level of the sea.

The extraordinary way in which the different formations seem huddled together, and the great disturbance which has evidently taken place here, as elsewhere; together with the circumstances that the whole country is so much broken up into gullies, and the sides of these gullies, covered with debris from the mountains, and this again with dense vegetation, has I confess defied all my efforts to reduce it to any sort of order.

This apparent confusion of the strata, may to a certain extent be accounted for by the circumstance that everything is so much on edge, so that a very thick formation, may all crop out in a short distance on the surface, though had it been moderately level, it might have been extended over hundreds of square miles. Of course this rapid rising to the surface in a coal formation, will expose a great number of seams in a short distance. This is certainly the case on or near the saddle, though doubtless many of these seams are covered up by debris, composed of coal and other rocks connected with it. This, on being cut through by small streams, exposes loose coal in large quantities, though in no regular seams; indeed the quantity of broken coal found on and under the surface is very confusing to the explorer.

All that I can feel sure of is, that on this saddle and in the immediate neighborhood, there are seams of good coal, but very much broken and confused, though there is more appearance of regularity here than in most parts of the district; still I am not at all sanguine that regular and continuous seams, even with the heavy dip of 45 degrees will be found here.

Looking from the saddle towards the south, you are struck with the very peculiar shape of the Lyell mountains, rising regularly from the south-south-west at a very uniform angle of about 30° , to the height of upwards of 4,000 feet, and then breaking suddenly off towards the north-north-east in perpendicular cliffs of many hundred feet in height, forming deep ravines, then rising again and falling away in the same manner; giving the whole a remarkably sharp, serrated appearance. The whole upper part of these mountains, several hundred feet in thickness, is composed of regular stratified rocks, dipping the same way as the surface, and apparently without break or confusion; the whole having the appearance of being forced up in a solid mass, till it broke off suddenly at the highest point. Those rocks are destitute of vegetation, except snow grass, &c., and though I have not been on the top of the mountains, the close resemblance of the strata, to the overlying rocks of the coal formation on the west side of the saddle, leaves little reason to doubt that there, also, coal will be found below, and at a rather more convenient angle for working than in the east part of the field. Of course in that locality the coal is only accessible from the West Coast, and as there is such an abundant supply there in much more convenient positions, it is not likely that this part of the field will be required for many years.

I neglected to state that in the river bed at the base of the Lyell Mountains, the formation is granite.

Should it be thought desirable to explore this coal field further at present, I would recommend driving a level at the outcrop of the seam on Coal Saddle, in such a way as to cut the several beds at right angles to the strike of the strata. For as the dip is at an angle of 45° , a horizontal drive would only require to be the same length as a perpendicular shaft, to cut through the same number of stratified beds; and as it is less expensive to drive than to sink, the drive is to be preferred. Boring in such a broken and irregular strata would be very unsatisfactory.

A section of the strata thus obtained would be very valuable, even supposing that in this position it was of no commercial importance; for it is very useful to have correct sections of a coal field wherever they can be obtained, and this, I think, is a favorable position for the purpose. There is also reason to hope that near this saddle the strata may be found a little more level and regular. For on both sides there is certainly a tendency to flatten.

After the above remarks, your Honor will not be surprised when I state that I do not anticipate that coal can be extensively and cheaply worked in the part of the Province treated of in this report. And this not on account of the absence of good coal, for, as I have before stated, it exists in large quantities in some parts, and I believe will be found extensively scattered over the mountain ranges between Nelson and the West Coast. But I think from the very broken nature of the surface of the country, and the still more broken and irregular geological formation, there is not much ground to hope that an extensive and continuous field of coal, in a workable position, will be found here; however, many seams may be discovered in different localities. And I do expect that coal will be found in many parts of these mountain ranges, where, till my last journey, I had no idea that there was a chance of its existence.

Persons not familiar with the practical part of coal mining, may think that the position of a seam of coal is not of much consequence, provided the quality is good and the locality convenient. I think it is therefore only reasonable to explain why the position

of the seam in the ground, is one of the most important considerations in working coal. The most convenient position for a seam of coal, is for it to be as near horizontal as will allow water to run freely from it (say an angle of 3° or 4°) for then the wagons for bringing out the coal from the face of the workings, can go in any direction. It will readily be understood that to work, say 100 acres of coal in this position, is a comparatively simple operation; but if that 100 acres was set on edge instead of lying flat, the work would be much more difficult and expensive. And as a seam deviates from the horizontal, so will the difficulty increase. It is true that edge seams have been, and probably are still, worked in some places, but it is done under great disadvantages, and only to a limited extent; and generally where there are a number of seams near each other, so that several can be worked from the same level. It is also important that the rocks connected with the coal, should be strong and solid.

It is also true that most mineral veins, such as copper, lead, &c., are found in positions more nearly vertical than horizontal, and yet are worked successfully; but it must be remembered that the difference in the value of a ton of copper, or lead, and a ton of coal is so great, that a little extra expense in working the one would scarcely be felt, whereas in the other it might amount to more than the value of the article.

Speaking on this subject I may mention, that the Kowai coal in the Province of Canterbury, which I examined and reported on, about a year and a half ago, is, so far as I could then see, all on edge, or rather dipping at an angle at from 65° to 80° . At that time I wrote to a friend in the north of England, (Mr. Law, colliery viewer to Sir Matthew White Ridley, Bart.) a gentleman of large experience in coal mining; asking for any information he might have on working edge seams, and I beg to quote the following paragraph from his letter on the subject.

"I wish I could have given you some useful information regarding the working of such seams of coal as you describe. The dip 80° seems to me so unnatural a position for a seam of coal, that I should hope you will find as you follow it, a gentler dip which will render it easier to work. I am not aware of any book describing the working of such a seam, and the only coal approaching it, which I have seen was in the Bristol Coal Field, and there they seemed to work it by dropping the coal from one gallery to another. The shaft being sunk in the first place to cut the coal and the first gallery set away from its bottom, and then by working to the rise of this gallery a sufficient distance to set away another, from which the coals were dropt to the first or lowest to be taken to the shaft; and so on, one gallery or drift above the other. And after a certain portion of coal is worked in this way, another portion is obtained by sinking the shaft lower, and drifting out to cut the coal again; which of course can be repeated as often as found practicable. Should I find anything written on the subject you shall have it, but at present I do not recollect to have seen the working of such a seam referred to, I fear you will find a difficulty in working so as to obtain any quantity, but where coal is scarce it is valuable, and a price to cover some extra expenses will no doubt be paid for it."

The very circumstance which renders coal-mining so difficult in this part of the Province, makes it very hopeful, that other minerals will be found; if so, the coal may prove most valuable, as smelting, &c., might be carried on at the mines. For though I fear that extensive coal workings cannot be calculated on in this district, there is nothing to prevent it being done on a small scale; when the value of the

article will pay for the extra expense of working, and a large quantity is not required in any one place. It is quite possible also, that in some localities a good deal might be quarried, where the dip of the strata happens to coincide pretty nearly with the slope of the hill sides.

I am sorry that after spending so much time, my knowledge of the coal-field should still be so vague and limited; but, without actual mining, it is impossible to get more than a very superficial acquaintance, even with the most regular districts.

To sum up the result of my observations in a few words, I may state that, though good coal is found in various parts of the district, so far as I have seen, there is no place where I could say with confidence, if such and such work was done, a supply of so many thousand tons of coal could be obtained, or a regular field of so many acres could be relied on as contain-

ing workable coal. I do not say such places do not exist; but that I have not found any, and the nature of the country does not encourage me to expect that they will be found; but I may be mistaken, if it is merely my opinion, reasoning from the facts I have endeavoured to lay before you.

Before closing this report, I must acknowledge my obligation to Mr. Rochfort, who was my companion during the greater part of last journey; his assistance and information was of the greatest service, as he had previously explored the district, and knew so many places where coal, and indications of coal had been previously found, to all of which he kindly accompanied me. As the discoverer and first explorer of this coal-field, the Province is much indebted to him.

I have, &c.,
JAMES BURNETT.