

APPENDIX.

A. (p. 11.)

SINCE the text was in print, three or four small pieces of shale were found, which had been brought down by the Expedition and were forwarded to me from Brisbane for inspection; and on one of them is a portion of a frond which has the characters of *Glossopteris*. (19th August, 1873.)

B. (p. 26.)

IN alluding to surveys and mining investigations, I had in view all mineral inquiries, including that for coal, because I considered that if the surveyors and searchers for metals had come across any coal deposits or associated strata, in places not included in any special search, we should have heard of them.

No one who has read the Address can doubt that I scrupulously avoided all exaggerations, and kept in view the sensible remark I quoted from Mr. Warrington Smyth respecting "elements for subtraction."

It is, however, difficult to find out what precise sums Victoria has expended in her most useful and inimitable surveys and mining operations; nor do I know exactly how much ought to be set apart for coal search alone, seeing that private operations have left but few traces capable of being expressed in figures.

But the particulars which I will now mention will be sufficient to show that no charge of exaggeration can justly be brought against me.

In Mr. Selwyn's return as to total cost of his surveys from 1852 to 1861 (inclusive) [Report of 1861], I find (at page 27) an amount of £32,516 0s. 5d., or at an average of £3,612 *per annum*. This, in the approximate estimate of Mr. Braché (Selwyn's Report, 1863, p. 41) from 1852 to 1861 inclusive, comes up to £41,116 9s. 10d.; and in the introduction to the first volume of the Memoirs of the Geological Society of Italy, according to information derived from Victoria, it is stated that Mr. Selwyn's survey for thirteen years, including salaries, cost 2,500,000 Italian *lire*, which, at the value of 8½d. to the *lira*, is £84,635. The introduction is by the President of the Society, Igino Cocchi, and is entitled, "Brevi Cenni sui Principali Istituti e Comitati Geologici e sul R. Comitato Geologico d'Italia." (Firenze, 1871.)

In addition to these estimates is one made by Mr. Braché for Mining Surveys, from 1858 to 1862, which seems to be independent of the Geological Survey, as it occurs in the same report

quoted above (from Mr. Selwyn, 24th June, 1863), as to a cost of £24,300.

On searching the "Votes and Proceedings" of the Parliament of Victoria from 1863 to 1872, it is found that the united annual expenditures under the head of "Minister for Mines" for that period come to no less a sum than £197,983 14s. 5d.

Selecting out of these amounts only Mr. Braché's estimates, Mr. Selwyn's own return, and the figures given in the Votes and Proceedings, we have an acknowledged expenditure for Surveys and Mining establishments, from 1852 to 1872 inclusive, not merely £100,000, but of no less a sum than £263,400 4s. 3d. sterling.

Such an example of faith and perseverance is not deserving of censure, but of praise and imitation; and it would be well for us of this Colony if we could quote from among our many speculative operations a similar instance of devotion to the cause of development of natural resources.

As the above data are taken from official sources, they are probably correct, although there may be others which have not yet fallen in my way.

Of this great amount, some was, I presume, expended on "*search for coal*"; but there are items of expenditure for coal only which deserve consideration, and which were incurred either by the Government or by private individuals and Companies.

Thus, in the district of Bellerine and Paywit, including Queenscliff, the Government cost of sinking and boring through 4,688 feet of strata was, up to 1863, £3,557 11s. 3d., but without any practical result.

The Government expenditure on account of the Griffith's Point Company, up to 19th January, 1866, was £888 10s. 6d. They "reached a depth of 822 feet 2 inches, without any coal having been cut."—(Selwyn's Report, 1865, p. 21.)

I do not know the full cost of Government coal search about Cape Patterson, but the Coal Company of that name had, in 1860, expended £3,050.—(Selwyn, May, 1860.) The same author tells us that, "during the last ten or twelve years, probably more than double that amount has been expended in the district, while about 100 tons of coal is all that has been brought to market."—(Selwyn's Catalogue of Victorian Exhibition, 1861, p. 185.)

Mr. Brough Smyth (Official Record, 1872-3) admits that "during the period from 1854 to 1868 many thousands of pounds were expended in boring and sinking shafts in the Cape Patterson Coal Field" and (p. 101-3) up to 31st December, 1871, there had been raised in the Colony 2,033 tons of coal, and 1,992 tons of lignite, whilst at Lal Lal, in 1871, there were raised 995 tons of brown coal, about half of which was saleable.

Mr. H. Levi says (Minutes of Evidence, 23rd April, 1872! Report of Board, p. 28) that "the Victorian Coal Company

expended between £12,000 and £14,000 in improving their boat harbour, in boats, shipping coal, and proving the seams, but the impossibility of transporting the coals at any reasonable cost put success out of the question."

At Barrabool Hills, near Geelong, Mr. Thomas spent £8,000 in sinking and boring. This spot was examined by myself in 1856; the depth reached was 600 feet, and all that had been discovered was a 6-inch layer of coal.

The Newton and Chilwell Prospecting Association (as I am informed by a proprietor) expended at least £2,000 in their operations, reaching a depth of 1,150 feet.

The Griffiths Point Company expended, in addition to the Government grant of £888 10s. 6d., the sum of £444 5s. 3d., making for that adventure £1,332 15s. 9d.

Collating these statements, we have the sum of nearly £31,000 sterling, as the cost, up to the times fixed, of the particular localities enumerated. What may have been the expenditure in other places does not appear.

As to some of the researches, I may mention, as a proof that I have not spoken of the Victorian coal simply from what I have read, that the directors of the Newton and Chilwell Association placed in my hands sections of the borings, together with the materials brought up, so that I was enabled to judge for myself.

The Company working on the Bass River also consulted me, and furnished me with plans and charts, &c.; and the same opportunity was afforded me by the Company at work in the Glenelg district, near Coleraine.

I may say here, briefly, in each case I was compelled to state that I recognized nothing approaching to the data that could be furnished by the coal seams of Newcastle or the Illawarra, and that I concluded no such strata would be reached except at very great depths, and then only if not cut out by intrusive or bed rocks of other formations.

In all these beds from Victoria I saw no trace of our distinguished plant *Glossopteris*, nor has it ever been recognized by any geologist or palæontologist in that Colony. But it exists in New South Wales in the Hunter River beds, both below and above the marine fossiliferous beds among the workable coal seams; and also in the sandstone at Muree, abounding in the marine fossils of Lower carboniferous age, in which a *Conularia* and a variety of fossils are seen with the remains of a *Glossopteris* that must have been washed into the sea when the marine beds were being deposited.

The marine fossils of that locality were figured by Professor M'Coy, from the collection sent by me to the late Professor Sedgwick of Cambridge. (*Annals of Natural History*, vol. xx., 1847, 1st Series. See also 2nd Series, September, 1848, and 3rd Series, August, 1862.)

C. (p. 28.)

THE VICTORIAN COAL-FIELDS.

THE following is the first Report of Mr. John Mackenzie, F.G.S., Government Examiner of Coal-fields, New South Wales, on the Coal-fields of the south-eastern district of Victoria :—

To the Honorable Angus Mackay, M.L.A., Minister for Mines.

Sir,

Melbourne, July 28, 1873.

In accordance with your request, and with the permission of the Honorable the Minister for Lands, I have visited and examined the coal and strata of The Bass, Griffith's Point, Blue Mountains, Sandy Waterholes, Kilcunda, Cape Paterson, Strzelecki near Anderson's Inlet, Stockyard Creek at Corner Inlet, Traralgon, and Crossover. I have now the honor to submit the following report thereon.

THE BASS.

A shaft has been sunk on the river bank (see A on plan), and some coal said to have been found in it, but owing to its being half full of water, I was unable to see the strata sunk through.

I examined both sides of the river near the shaft, and could observe no trace of coal. Several days' rain prevented my seeing the rock in the bed of the creek, where Mr. Krausé informed me there was a small vein or patch of coal, and I could not hear of any regular seam of coal having been discovered.

GRIFFITH'S POINT.

In this district I examined the cliff sections and position of the old shafts sunk for coal. The carboniferous strata, where the shaft lettered B on plan has been sunk and a small vein of coal found, are lying at an angle of 75° , and no workable seam of coal exists there. It is, in my opinion, only a waste of money to sink or bore further in this locality.

At C on plan the strata dip north-east, and have been bored through to a depth of 850 ft. below the sea level, and no coal seam found. From here to the Sandy Waterholes (see letter D on plan), a distance of about two and a half miles, a constantly ascending series of beds, consisting of conglomerates, sandstones, and shales, with drifted pieces of fossil wood, junks and streaks of coal and carbonaceous matter, are exposed in natural sections in the cliffs, but in which there are no regular seams of coal.

It is, therefore, useless to look for, or to expect to find, any workable seams below those exposed in the cliffs at the Sandy Waterholes and Griffith's Point, as the cliff sections and borings show us that there are none.

SANDY WATERHOLES.

On Mr. Turnbull's land (see letter D on plan) there are seams of coal exposed in natural cliff sections as shown on section I.

These are regular seams of coal extending over a considerable area, and I believe them to be identical in geological position with those commonly called the Rock and Queen veins at Cape Patterson, and that it is here where they first make their appearance above the sea-level again on the coast west of I on plan, near Cape Patterson.

The coal is of very good quality, but it is very much disturbed by faults, and dips at an inclination of 21° towards the north-east.

The only workable portion of the No. 1 seam is 11 in. of good coal (see section No. I) and this is too thin to be of any commercial value.

No. 2 measures $13\frac{1}{2}$ in. of good coal (see section); and if it had been formed with a better roof, and had been lying at a less angle, it might possibly have been worked by holing in the 3 in. of coal lying about 2 ft. below.

KILCUNDA.

I was accompanied in my inspection of this mine by Messrs. Krausé, Watson, and Thomas. Six different measurements taken in the main heading gave 20 in. as the average thickness of the seam of coal at E on plan. At F on plan, about one quarter of a mile south-west of the main heading, it is 2 ft. in thickness.

The dip is about 8 deg. to the north-east, and two faults have been proved, one of 120 ft. and another of 20 ft.

The coal produced is bright, bituminous, and non-caking, and the Coal Board's estimate of 15 in. of good or round coal is, I consider, a very liberal one, and quite as much as it will yield.

The seam extends over a large area, and I believe it to be identical with the one found at the Blue Mountain and Strzelecki Ranges, and on the sea-coast west of the Rock and Queen veins (see letter H). It has a bad roof, is disturbed by faults, and near the latter, as is usually the case, the greater part of the coal is very soft, and has an irregular cleavage, and when exposed to the weather decrepitates. In my opinion it will be impossible to mine it at such a price as will enable the proprietors to compete with the New South Wales or other intercolonial coal in the Melbourne market. The following is a section of this mine :—

Yellow sandstone.	ft.	in.
Grey and blue shale	10	0
Coal (average of six measurements)	1	8
Floor—Indurated clay.		

I annex drawings showing how this coal is worked, and the Newcastle coal in New South Wales. (See sketch section, page 11.)

BLUE MOUNTAIN.

At a height of about 310 feet above the sea-level a 17-inch seam of coal (see G on plan) is to be seen outcropping in the side of a creek. It lies at an inclination of 28° , dips north 25° west, has brown sandstones and shales above it, similar to those at Kilcunda, and is, I believe, identical in geological position with the 20-inch coal at that place. I consequently infer that no other thicker seam of coal is likely to be found at a workable depth in this locality. (See general section, No. 2.)

It is too thin to be of any commercial value in such a position. The following is its section:—Alluvial, 2 feet; sandstone, 4 feet; brown shale, 1 foot; good coal, 1 foot 5 inches.

CAPE PATTERSON.

Here I find the coal measures intersected by numerous basaltic dykes and faults, and the dip changing in inclination and direction at very short distances.

The undulating or folding nature of the strata exposes the basset edges of two seams of coal, exceeding 1 foot in thickness, in three different places, at short distances apart. These might make it appear to a casual observer that they were the outcrops of three others, although they are really only the same again appearing at the surface of the ground.

Their measurements are shown in vertical section No. 3.

I believe the Rock and Queen veins are identical in geological position with those before mentioned, exposed in natural cliff sections on Mr. Turnbull's land at the Sandy Waterholes.

The quality of the coal is good, but the faulty nature of the ground, the irregular and constantly changing dip, the thinness of the beds of coal, and distance from a shipping port, prevent its being worked at a profit.

The average of three different measurements of the Rock vein only gives 2 feet 4 inches of coal, which is divided by two bands of clay, &c.; and the average of three measurements of the Queen vein gives 2 feet $2\frac{3}{4}$ inches of coal, intersected by no less than three bands of shale, &c., although the Rock vein has been called and reported to be a 4-foot coal, and the Queen vein a 3 feet 6 in. seam of coal.

The numerous boreholes put down in this locality have proved beyond doubt that there are no other payable seams of coal likely to be found at a workable depth here.

STRZELECKI (M'CALL AND CO'S LEASE.)

In a creek on these ranges, and at a height of about 660 feet above the level of the sea, a seam of good coal is to be seen exposed. The sandstones and shales lying over it are similar to those at Kilcunda and the Blue Mountain, and I believe it to be the same coal as is found there.

The following is a section of it at L on plan:—Alluvial, 2 feet; shale, 2 feet; coal, 8 inches; indurated clay, 8 inches; coal, 1 foot 3 inches; band, 1 inch; coal, 5 inches; total of coal, 2 feet 4 inches.

The coal and strata are lying nearly horizontal, having only a very slight inclination or dip towards the north-west. This coal has a friable shale roof, which would make it expensive and difficult to work, and as the owners of the lease have never attempted to work it, but are boring below, in hopes of finding a more workable seam, I presume that they, like myself, do not consider that it could be worked to a profit.

On the 28th ultimo, the lessees had bored a distance of 256 feet below the above-mentioned coal, and the borer told me that the strata gone through consisted of sandstones with grey and blue shales, and no coal.

My opinion is that they will have to bore at least 1,200 feet before any other regular seams of coal will be met with, and that they would then intersect those identical with the Rock and Queen veins at Cape Patterson. (See general section, No. 2.)

The rocks now being bored through at this place will probably have junks and pieces of coal in them similar to those seen on the coast between Sandy Waterholes and Kilcunda, and if any should be found, a seam of coal will appear to have been struck, and will no doubt be recorded as such.

STOCKYARD CREEK (HILL'S PROSPECTING LEASE.)

A very thin and inferior coal is outcropping in one place on a creek on this lease, and a thin stratum of bituminous shale in another.

The latter was described to me by those interested in it as a valuable seam of coal. The deposits lie at an angle of 18 deg. to 24 deg., and rest on Silurian rocks, which are to be seen about a quarter of a mile lower down the creek. The following is their measurement. (A sketch is here given of the first deposit, showing a layer of sandstone, followed by inferior coal 9 in. to 1 ft., after which is a stratum of very hard shale. In the case of the second deposit, the strata came in the following order:—Very hard shale 6 ft. in thickness, indurated clay and black bituminous shale 3 in., black bituminous shale 2 in., stone 2 in., black shale.)

How any one having the slightest pretensions to a knowledge of coal-mining could ever look upon these as workable seams of coal I am at a loss to understand; for of all the reported discoveries of coal I have ever seen, here or elsewhere, during the last twenty-five years, I never saw one of less promise.

TRARALGON (N ON PLAN.)

I was accompanied in my examination of the coal discoveries here by Mr. Krausé, Dr. Simmons (one of the Coal Committee),

and Mr. Duncan Campbell. At the time of my inspection, and previous to it, there was heavy rain, which made my examination rather difficult.

I looked at the place where the coal had been found, and on proceeding a short distance higher up the creek I saw the same strata and coal exposed in a natural section above the bed of the creek.

There was one layer of coal 2 in. in thickness, and another 10 in. of shale and coal.

This appears to be the north-easterly edge of the western Port and Cape Patterson coal basin, and the shales here contain similar fossil flora.

Thick beds of conglomerates, sandstones, and shales, with no workable coal seams in them, are to be seen rising from under this coal as you ascend the creek, and they rest on Silurian rocks. Therefore, no workable coal seams will be found by boring or sinking below the bed of the creek where the shaft was sunk.

Whether the 300 ft. or 400 ft. of sandstones and shales, &c., in the ranges over where the shaft was sunk contain any workable coal, it is impossible to say for certain without provings being made.

But I think that, if they did contain any thick or workable seams of coal, we should have seen some pieces or trace of it in walking round the ranges. We discovered none.

CROSSOVER (O ON PLAN).

Having given my knee-joint a very severe wrench through a buggy accident, whilst proceeding on my journey here, I was unable to examine all the different outcrops of lignite and brown coal in this locality, as it was impossible to go to two of them without walking several miles through a scrubby country, which I was then unable to do.

I therefore left instructions for specimens and sections to be procured me from the two places I was unable to visit, and engaged two men to further test the nature of the brown coal in the drive I inspected.

After receiving the specimens and measurements, I hope to be able to form an opinion as to the value of these deposits.

To summarize the remarks made in the foregoing Report, I may briefly state that, having given the whole subject my very best consideration, I have arrived at the following conclusions:—

1. That it is useless to expend any further sums of money in searching for payable seams of coal in The Bass, Griffith's Point, Western Port, Cape Patterson, Strzelecki, or Stockyard Creek districts.

2. That the Kilcunda, Blue Mountain, or Strzelecki seam of coal might be sought for and opened out in the ranges east and north of Messrs. M'Call and Co.'s lease at Strzelecki, proving it at intervals of a few miles apart to determine the thickness.

3. That the country might be examined between the above-mentioned ranges and the river Latrobe, or north-easterly and north-westerly edge of the coal basin, to see whether the Rock or Queen veins, or their equivalents, rise to the surface again in this direction, and are of any value. Such an exploration can only be properly and efficiently carried out by your Mining Department, and under a responsible person. The very excellent and valuable geological maps prepared by the late Director-General of the Geological Survey, and the more recent maps published by your present Secretary for Mines—Mr. R. Brough Smyth, F.G.S.—are proofs beyond dispute that you will, by this means, have the work done in the best and most efficient manner possible.

I cannot conclude this Report without expressing my thanks to Mr. Krausé for his valuable assistance in conducting me to many of the places herein referred to, which were very difficult of access; and also for his kind attention to me personally when I met with the accident at Moe; also to Mr. Murray, for his kind attention and assistance at Cape Patterson and the neighbourhood.

[The above Report was laid before the Victorian Parliament Tuesday, 12 August, 1873, and is reprinted here in justice to my own opinion previously expressed.]

The following is a second Report of subsequent date, also laid before the Parliament of Victoria:—

To the Hon. Angus Mackay, M.P., Minister for Mines.

Melbourne, August 19, 1873.

Sir,

I have the honor to submit my Report upon the coal and lignite you desired me to examine in the Crossover, Barrabool Hills, Winchelsea, and Loutit Bay districts.

CROSSOVER—LIGNITE DEPOSIT.

In my previous Report I mentioned that, owing to an accident, I was unable to examine two other alleged discoveries in this locality, and before expressing any opinion I thought it advisable to have measurements and samples sent me from all the different places, the alleged discoveries being represented as of a much superior quality to that being worked in the drive I inspected.

After putting on men for a fortnight to procure specimens, I have only received some from the original drive.

No reference being made to the new ground, I am inclined to think that its productions are either inferior in quality or that no lignite exists therein.

The following is an account of the strata proved in the cutting and drive opened out:—

	ft.	in.
Surface soil	1	0
White clay and grit	2	6
Black clay, with imperfectly carbonized pieces of wood	1	6
Lignite or brown coal.....	3	4
Brown coal (conchoidal fracture).....	1	7
Brown bituminous shale.....	0	2½
Brown shale.....	2	10
Yellow clay, with fossil resin.....	1	10
Brown coal or lignite	4	4
Brown clay	1	0
Yellowish-white plastic clay	0	6
Greenish sandstone.		

The lignite in the drive is of a very fair quality, but is at the present time of no commercial value in such a position, as it could not compete with firewood for house-fire purposes in any of your large cities, and is not suitable for locomotive engines.

BARRABOOL HILLS, GEELONG, AND BELLERINE.

The lithological character of the Barrabool Hills sandstone is the same as that which lies over the 17-inches to 2-feet coal in the Western Port district.

I inspected the 1,200 feet shaft and borehole made by Mrs. Thomas and others at Barrabool Hills, in which 6 inches of coal were said to be found. I also carefully looked over the accounts of the strata sunk and bored through in numerous places in the Bellerine district, where a vertical thickness of over 4,000 feet of strata has been tested, and no workable seam discovered.

I am of opinion that the above-mentioned shafts and boreholes have proved that there are no payable coal seams at a workable depth in either of these districts, or in the intervening country at Drysdale, Geelong, &c.

WORMBETE, NEAR WINCHELSEA.

I was accompanied, in my examination of the coal worked here, by Messrs. Stirling, Krausé, and Moran.

At a height of about 750 feet above the level of the sea, near the head of Wormbete Creek, a 3½-inch to 4-inch layer of coal is to be seen in several places.

The following is a section of it, and the overlying and underlying strata:—

	ft.	in.
Brown sandstones, a great thickness.		
Blue shale, about	12	0
Coal, $3\frac{1}{2}$ inches to	0	4
Blue sandy shale.		
Sandstone.		

The strata and coal dip about $7\frac{1}{2}^{\circ}$ to the east, 20° south.

No other seam of coal has been seen, either higher up or lower down the creek, although there are excellent natural sections exposed to view in several places here, as well as in other parts of the district; it is therefore useless to expect to find a payable seam of coal in this locality.

The place is one of those described by people inexperienced in such matters as giving "good indications," and money has been uselessly expended in driving in a $3\frac{1}{2}$ -inch coal, with the hope of its becoming thicker when further developed. It was also supposed to be a "good indication" of finding a thick and payable coal below, although they could see no coal underneath it in the natural exposed sections of strata lower down the creek, and consequently will find none by sinking or boring.

LOUTIT BAY TO STONY CREEK, ALONG THE COAST.

Excellent natural exposed cliff sections are to be seen here, and they show us that there are considerably more than 1,000 feet of sandstones, with shale very similar to those at Barrabool Hills, and on the Blue Mountain and Strzelecki Ranges, in Western Port, in which there is no coal of any value, the thickest being about 5 inches.

A shaft has been sunk and a borehole put down by the Colac Company to the depth of about 120 feet, on "good indications," and money expended in piercing strata similar to that exposed to view in natural cliff sections adjacent to where the borehole was made.

Thin irregular patches of coal, called "good indications," are to be seen in the cliff sections, and also, at low water, in the rocks outcropping on the beach, the shaft and borehole only going through the same strata as are seen in the cliffs.

STONY CREEK, NEAR AIREY'S INLET.

I went down a shaft 45 feet deep, at the bottom of which a place has been driven about five yards in an inferior bed of lignite 18 inches in thickness. Other shafts have been sunk through the upper portion of the lignite deposit, and in one of them 4 feet of inferior lignite and sandy shale have been cut through.

I was unable to measure a section of the different strata between the upper 4-feet bed of lignite and sandy shale, and the

lower 18-inch seam, on account of the main shaft being timbered; but the two beds examined were considered to be the best.

The extent of these lignite deposits is very limited, and they have now been sufficiently tested to show us that their quality is not likely to improve by any further sinking or driving; and they may therefore be regarded as of no commercial value, so long as there is any quantity of cheap firewood to be obtained.

In conclusion, it may be as well for me to state my reasons for recommending, in a previous Report, that any future provings should be carried out under the direction of your department.

They are as follows:—

Because I found that large sums of money had been expended by the Government in supplementing sinkings and borings in different districts, at the recommendation of private individuals, who had their own more or less crude ideas as to “good indications,” and where coal was likely to be found.

Thus, some one in the Western Port District, not qualified to give an opinion, but who happens to have lived in a mining township in Wales or Lancashire, imagines that the surface of the ground here reminds him of a spot he knew there where coal was found, and reports it as “good indications,” where money should be expended by the Government.

Another—in Cape Otway or Wincheslea—who by chance may have been born in a coal-mining district in Scotland, sees a place which reminds him of his native country, and forthwith proclaims its “good indications,” and a consequent appeal is made for Government funds.

A third imagines that if there are a few inches of coal in any rock in his district, a “good indication” exists to justify sinking through it in the expectation of finding a thicker seam below.

I have already pointed out the fallacy of such reasoning.

In another case, a borer or sinker passes through some black shale which reminds him of a similar deposit over a 6- or 10-foot coal in England, and therefore concludes that a like seam will be found under the black shale here.

I have, &c.,

JOHN MACKENZIE, F.G.S.,
Government Examiner of Coal Fields, N.S.W.

D. (p. 38.)

The extension of coal in this direction is rendered probable by the fact that a seam of coal crosses the Macintyre, about nine miles below Inverell, and is doubtless connected with the Warialda and Gragin country.



Clarke, William Branwhite. 1873. "Appendix to the Anniversary address."
Transactions of the Royal Society of New South Wales 7, 40–51.
<https://doi.org/10.5962/p.346148>.

View This Item Online: <https://www.biodiversitylibrary.org/item/125471>

DOI: <https://doi.org/10.5962/p.346148>

Permalink: <https://www.biodiversitylibrary.org/partpdf/346148>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.