

C.S.

REPORTS

MIN/GEO/1#7

1921

No. 67/21

S. of S. No. 127

SUBJECT.

192 0

Quarterly reports to be furnished on
Geological Investigations.

29th October

Previous Paper.

C.S. 230/21

MINUTES.

G. H.
M.P. No.
415/20

H.C.S.

For Information

(Itld) J. M.
6/1/21

Despatch withdrawn.

H.E. the Governor,

I submit herewith three typed copies of Dr.
Baker's report for the period 26th December 1920 to the 31st
May 1921.

A. S. 18/6/21.

H.C.S.

*Address to which specimens (or annexes) are
despatched should be given for purposes of
Record.*

Subsequent Paper.

*2. What is the "scheme" referred to at para
2 of report.*

*3. Two copies of report to go to Sqs with
formal covering despatch in which reference should be made
to S of S D. 127/20*

Dispatch to Secretary of State No 47, dated
20th June 1921 ————— Encl. (2)

H.E.the Governor,

I understand from Dr.Baker that the address
to which specimens have been forwarded is:-

Mr.G.S.Sweeting.

Geological Department

Imperial College of Science & Technology

South Kensington

London. S.W.

This should be under

Dr Sweeting to be sent

*Done
ad. 13
Ch. Clerk
20th June 1921*

B. Thompson

A. C. S. 21/6/21.

21 June 1921

*Letter from Government Geologist
dated 17th June 1921*

Encl (3)

H.E.the Governor,

Submitted for information with draft letter
to Crown Agents.

B. Thompson

A. C. S. 22/6/21.

22 June 1921

Letter to Crown Agents; dated 23rd June 1921

Encl (4)

Colonial Engineer,

For your information & guidance, and will
you please pass papers to Government Geologist to note and
return to C.S.O,

B. Thompson

A. C. S. 23/6/21.

The Hon. Col. Secy.,

Thank you. Noted.

R. B. Basley

Colonial Engineer.

24/6/21.

Government Geologist,

To you accordingly.

R. B. Basley

Colonial Engineer.

24/6/21.

Hon. Col. Sec.

Noted and returned herewith

H.A. Baker
Government Geologist
25/6/21.

Minute from Govt. Geologist, 6th September,
1921.....Encl. (5)

Letter to Crown Agents. 7th Sept 1921
Encl (6)

H.E. the Governor

Submitted for approval.

H.A. Thompson
M. a.c.s. 7/9/21
8 SEP 1921.

Minute from Govt Geologist d/23/12/21 Encl (4)
Copy of Report _____ Encl (4a)

Y.S.
Submitted.

1. I regret to say that I understand nothing in the Report except the statement that the mineral resources of the Colony are nil. The Geologist appears to have done a lot of hard work.

2. Report to go to S.O.S.?

~~ttttt~~ 2/12/21

H.C.S.

Draft despatch herewith.

L.H.
4 January 1922

Desp to S.O.S N^o 10 of 10 Jan'y 1922 Enc

Y.P. Despatch submitted for favour of
signature

Willy 11/1/22

12/1/22

So of S despatch etc 119 of 15 Dec 1921 Encl (9)

His Excellency
Submitted

W.H. 17
for O.S.
25 Jan 1922

H.C.S.

copy of Q to go to S. Baker in West
Australia by first opportunity.

W.H.
26 January 1922

Letter to Dr Habaker. 27th Jan 1922
Encl (10)

Minute from Govt Geologist d 15 Feb 1922 Encl (11)

Copy of Report. Encl (11a)

Y.P. Submitted
12/1/22

H.C.S.

Repts to go on to S.G.S.

2. Mr. Hamilton had instructions to
bring rock specimens from Jason Island.
He was on the 21st March when he had

Oct. 38/22
There is a minute
report on the subject
of

It is to be so a specimen has been collected by Mr. Harrison & sent to Dr. Baker in this case specimen an only specimen from Sea Lion Rock & Blanche Island. It is Dr. Baker for the specimens which Mr. Harrison sent.

3. Will you please express thanks to Dr. Baker for the careful & comprehensive geological survey of the Colony which he has made & for his valuable report on the guano deposit on Kidney Island.

4. Will you also arrange for passage to England by S.S. Oceana. J.P.

23 March 1922

Despatch to S. of S. No. 49 of 24. 3. 22. Encl. (12)

Letter to Dr. Baker. 24. 3. 22. Encl. (13)

Y.S.

Submitted

2. Will Y.S. inform me of the date to which the Comm. Agent should be instructed in his Last Pay Certificate to pay Dr. Baker?

J.P. 24/3/22

H.C.S.

Thank you for drawing attention to
the paper. I have prepared a draft
despatch, which is in L.O. 339/20.
After seeing D. Baker today

HN

28 March 1922

Y.L. Despatch submitted

ttttt 30/3/22

HN

30 March 1922

ref. 67/21

This may be sent to Mr. Neave
for his information. He is anxious
to see geological reports on the
country, in connection with his
experiments in boring

ttttt 19 Oct. '23

Mr. Keane.

Passed to you

GR 13

Dir/Sec

20 Oct 1923

K.H.
2/7/58

48.
I much regret that I have been unable to trace the report by Dr. Baker on shell conglomerate at Cityroy which Your Excellency requires.

I find from Dr. Baker's itineraries paper that he visited Cityroy between 7th & 12th February 1921. In a memo from Your Excellency dated 13th April 1921 reference is made to shell conglomerate reported on by Dr. Baker. The report would therefore seem to have been made between 12th Feb & 13th April 1921 but though I have made a very thorough search of registers and different posts which might probably lead up to it, I have been unable to find it.

I attach Dr. Baker's quarterly reports (the first submitted

17 each # May 1920 (later than the date on which the report required must have been submitted). No mention is made in any of these reports regarding shell conglomerate

W. H. Dyer
10/1/20

I do not wish too much time to spend on searches for report on ~~the~~ shell deposit but I should very much like to have it if it can be found.

Is it attached to papers about Juana? or is it indexed under Indumis a cyrenulum?

W. H. Dyer
10/1/20

(2)

C.S. 67/21

FALKLAND ISLANDS.

No. 47.

GOVERNMENT HOUSE,

Stanley,

20th June, 1921.

Sir,

With reference to Viscount Milner's despatch No. 127 of the 29th of October, 1920, I have the honour to transmit herewith a report by Dr. H. Baker on his geological investigations for the period, 26th December, 1920 to the 31st May, 1921.

In duplicate.

I have the honour to be,

Sir,

Your most obedient,

humble servant,

J. Middleton.

THE RIGHT HONOURABLE

W. L. S. CHURCHILL, M.P.,

SECRETARY OF STATE FOR THE COLONIES.

GEOLOGICAL INVESTIGATIONS IN

THE FALKLAND ISLANDS

General Report for the period
25th December, 1920 to 31st,
May, 1921.

-:-:-:-:-

Stanley,

Falkland Islands.

31st May, 1931.

GEOLOGICAL INVESTIGATIONS IN THE FALKLAND ISLANDS 3

General Report for the period 25th December, 1930 to 31st May 1931.

Sir,

I have the honour to submit herewith a general report on the progress of my geological investigations in the Falkland Islands during the period 25th December, 1930, to 31st May, 1931.

Going to the lack of means of communication in the Islands I was unable to return to Port Stanley in time to prepare a progress report at the end of my first three months' work. I therefore spent the remainder of the summer in the field and deferred writing my report until now, when the uncertainty of the weather conditions militates against continuous field-work.

In the perusal of this report it will be found helpful to refer to a paper by Dr. Thore G. Halle "On the Geological Structure and History of the Falkland Islands," (Bull. Geol. Inst. Univ. Upsala. Vol XI. 1911.

I arrived in the Colony on 25th December, 1930.

At the outset I found my work much facilitated by a study of the geological specimens exhibited in the Public Museum in Port Stanley. The collection, though small, has been arranged with care and accuracy, and credit is due to those responsible

The Honourable

The Acting Colonial Secretary,

Stanley.

for

this work. This museum was, I understand, initiated by the late Mrs. Constance Alinari, and the useful work commenced by her has been fostered by subsequent Governors, I am arranging to augment the geological exhibits, where necessary, with specimens from my own collections.

Going to the lack of means of communication, travelling in the Colony must be done either overland on horseback, or by sea. There is a small steam schooner, owned by the Falkland Islands Transport Company, which visits the various settlements of the Islands for the purpose of conveying stores and mails and collecting the wool, hides, tallow, etc., All the settlements are on the coast; inland there are only a few very widely separated shepherd's cottages, and occasional ⁵ huts occupied during only a few weeks of each year. By taking passages in the schooner I have been able to see practically the whole of the coast of the Islands, and to visit many of the settlements. Whilst the vessel has been engaged in discharging and loading cargo I have been afforded opportunity to examine the ^a coastal sections on foot along the beaches and also have often had time to proceed some distance farther afield, either along the coast or inland, on horseback. In this way I have been able to secure a good general idea of the geological structure of the Islands, and to locate those areas which call for specially detailed investigation,

At an early stage it became apparent that, in order to elucidate the geological sequence of the older strata of the Islands it would be necessary to spend some time in detailed work on West Falkland, and this has now been done.

In East Falkland, in addition to the district round Port Stanley, I have, so far, been able to visit and make a preliminary examination of the rocks in, the following areas:-

Port Harriet, Fitzroy (South), Port Pleasant, Darwin Harbour, Carritos, Walker and Island Creeks, (South side of

Choiseul Sound) North Arm (Bay of Harbours), North San Carlos, South San Carlos, Port Salvador (all settlements viz:- Teal Inlet, Rincon del Moro, Salvador, Rincon Grande, Horseshoe Bay), Lively Island, Speedwell Island, and Brenton Loch.

In West Falkland I have examined the following areas:-

Port Purvis (from the Parrah River to Mount Rosalie), Manybranch Harbour, Port Howard (and a considerable area round it), Fox Bay (and neighbourhood), Port Stephens (and neighbourhood) Port Philomasi, Chartres River, Roy Cove, and Hill Cove.

I have thoroughly examined the whole coast from Manybranch Harbour to Fox Bay, and the area of Archaean rocks at Cape Meredith. I have also landed on and seen something of the geology of the following Islands:-

West Swan, Weddell, Beaver, New, West Point, Caracas, Saunders, Keppel and Peoble.

I have also ridden overland from Cape Meredith to Port Stephens and from thence via Caron Harbour, Double Creek, and Port Richards to Fox Bay, I have also ridden the whole length of the track from Fox Bay to Port Purvis several times.

So far as the results of my work carry me at present, the geological strata of the Falkland Islands comprise:-

1. Rocks of Archaean age
2. Rocks of Devonian-Carboniferous age
3. Rocks of Lower Gondwanan age (Lafonian Beds)
4. Igneous intrusions of later date.

1. ROCKS OF ARCHAEOAN AGE.

Igneous and metamorphic rocks, presumably of Archaean age, were discovered by Professor J. Gunnar Andersson in 1903 at Cape Meredith, the southernmost point of West Falkland, Dr. Andersson gave some account of his discovery in a paper published in 1907 ("Contributions to the Geology of the Falkland Islands", Dulau & Co., London), but unfortunately his specimens of the Cape Meredith rocks were lost with the

"Antarctic"

"Antarctic". Drs. Skottsberg and Halle, during their stay in the Colony, in 1907-08, had no opportunity of visiting Cape Meredith.

In response to an earlier request of mine, Mr. W. Markham Dean, the owner of the Port Stephens area (which includes Cape Meredith) very kindly procured personally and sent me some specimens of the igneous rocks. During my recent tour in West Falkland I found opportunity to visit Cape Meredith and examine the section fairly thoroughly. Fortunately, quite near to the Cape there is a shanty, I was able, through the kindness of Mr. J. Robertson, J.P. (manager, Port Stephens, and a former Government Stock Inspector) to occupy this shanty for several days and thereby to devote adequate time to the examination of the rocks.

Amersson described the cliff at the western end of the section as inaccessible, but after a somewhat hazardous climb, in a high wind, I found a way down, and was able to secure specimens and photographs. I examined the section from west to east, but had to ascend to the cliff-top before reaching the southernmost point of the cape. At the latter place the descent to the sea is quite easy, and I was able to renew my examination and to follow the rocks for some way round the bay between the two points of the cape. On the eastern side of this bay, however, the cliffs rise vertically for nearly 300 feet, with the older rocks inaccessible at the bottom.

Before visiting Cape Meredith I had thought it possible that these igneous rocks might be in the nature of a post-Devonian intrusion into the overlying sandstones, but the evidence of their pre-Devonian age is perfectly clear, and I have no hesitation in concurring with Amersson's opinion that they are of Archaean age. As can be seen from the photographs, the overlying Devonian sandstones, with a gentle northerly dip, rest with a strong

unconformity upon them, and, as pointed out by Anderson, the junction-line is irregularly undulating. Although the older rocks are abundantly intersected by dykes, none of the latter reach up into the overlying Devonian sandstones.

At the western end of the section, where the older rocks first emerge from the sea, there is a great mass of dark-coloured mica-schist, with a north-westerly dip. Its appearance strongly suggests a metamorphosed sandstone. Intruded into this, in the form of laccolitic masses, dykes, veins, strings and patches, is another mass of pale-pinkish very coarse-grained pegmatitic igneous rock. The crystalline schist has been much folded and contorted by the intrusions. Cutting both these masses occur dykes of very homogeneous chocolate-coloured rock. Tracing the exposure eastward, toward the southernmost point of Cape Meredith, the mica-schist is seen to disappear, and the igneous rock to occupy more and more of the cliff-section until, for some distance on either side of, and at, the most southerly point of the Cape, the entire cliff section is in the igneous rock. Here, in addition to the coarse-grained rock, a red rhyolite occurs, also a red dyke-rock, gneiss, and a yellowish granite, the latter badly weathered, for the most part. I at once recognised the yellowish granite and the red dyke-rock as identical with many of the worn boulders which I had found in the Lafonian tillite at Hill Cove, Port Purvis and elsewhere. Tracing the section still farther eastward, the Devonian sandstones again begin to make their appearance at the top of the cliffs and to occupy more and more of the section until, at a point a little westward of the inlet known as the Lagoon, the igneous rocks disappear from view beneath the sea.

The section at Cape Meredith appears to afford the only exposure of Archaean rocks in the Falkland Islands.

B. ROCKS OF DEVONO-CARBONIFEROUS AGE.

Above the Archaean and below the Lafonian tillite of the Gondwana Beds occurs a series of sediments of great, but unknown, thickness. These rocks are discussed by Hallé, in his paper, under the heading "Devonian Formation". In all probability, the lower part of the series is of Devonian age, but there is no palaeontological evidence available to establish the point, since these lower rocks appear to be entirely devoid of fossils. These unfossiliferous beds are overlain by a series of sandstones and shales containing a fauna of marine invertebrates which establishes a definite correlation with rocks elsewhere, namely, with the Bokkeveld Beds of Cape Colony. These latter beds are generally regarded as Devonian-Carboniferous in age. Succeeding these beds in the Falkland Islands is a series of sandstones, flagstones and shales with plant-remains. In Cape Colony the upper part of the Bokkeveld Beds have yielded plant-remains, as have also the succeeding Witteberg Beds of that area - a series of sandstones, quartzites, and shales. The plant-bearing beds of the Falkland Islands are similarly succeeded by quartzites and quartzitic sandstones, with intercalated shales - beds in which I have discovered a few lepidodendroid plant-fragments. It is justifiable, therefore, to assume that representatives of both the Bokkeveld Beds and Witteberg Beds occur in the Falklands. The age of the latter beds is commonly accepted as Carboniferous. In the Falklands they are succeeded by the lowest member of the Gondwana Beds - the Lafonian tillite - just as in the Southern Karroo the Witteberg Beds are succeeded by the Dwyka Series, with similar glacial boulder-beds. According to the latest classification (Du Toit, 1913) the age of the boulder-bearing beds is to be regarded as Upper Carboniferous.

In view of these considerations, I prefer to speak of the rocks between the Archaean and the Gondwana Beds in the Falklands, as the Devonian-Carboniferous Series.

The establishment of the geological sequence of the members of this series of rocks constitutes the most difficult problem in the geology of the Falkland Islands. In East Falkland these beds occupy the northern part of the island but have there been so affected by folding movements that, in view of the meagre character of the exposures, they offer a well-nigh insoluble problem to the stratigraphical geologist. Perceiving this, at an early stage I proceeded to West Falkland, where, save for the small space occupied by the outcrop of the Archaean and Gondwana Beds, the whole area is composed of the Devon-Carboniferous Series. After some weeks' work I was able to establish the general sequence of the series. The following is the succession of the beds, in descending order:-

DEVON-CARBONIFEROUS ROCKS OF THE FALKLAND ISLANDS.

5. Quartzites and quartzitic sandstones, with occasional intercalated shales (with *Lepidodendroid* plant-fragments).
 4. Sandstones, flagstones and shales, with plants.
 3. Sandstones, shales and slaty rocks, abundantly fossiliferous at certain horizons (*Spirifer* and associated brachiopods, and trilobites).
 2. Sandstones with *Rensseleria* and large *Orbiculid*aeas.
 1. Sandstones, quartz-conglomerates and quartzites (unfossiliferous)
- Resting with a strong unconformity on
Archaean rocks.

The beds numbered 2 in the above succession are probably the equivalent of the "Scaphoecelia sandstone" of Bolivia, the lowest fossil-bearing horizon of the Devonian of that area. The beds numbered 3, and perhaps part of 4, are equivalent to the Hekkeveld Beds of Cape Colony, and those numbered 5, with perhaps

part of 4, are probably equivalent to part of the Witteberg Beds of Cape Colony. The lower unfossiliferous beds numbered 1 are perhaps to be correlated with the Table Mountain Series of Cape Colony.

So far as my observations carry me at present the Devonian-Carboniferous rocks of East Falkland chiefly comprise beds 3, 4 and 5 of the succession. I have collected the marine invertebrates at North Star Bay and at several places around Port Salvador, and have recognised the characteristic flagstones of bed 4 in material which has come from Port Louis, but have not, so far, obtained any plant-remains in East Falkland.

In West Falkland the lower beds (1) which are of great but unknown thickness, occur throughout the whole of the Port Stephens area, and on Weddell, Beaver and New Islands. The common rock is an easily broken sandstone composed of very well rounded white quartz grains of uniform size, with occasional larger rounded quartz pebbles. There is often very little cementing material, so that the rock, when freshly fractured, can be crumbled to a coarse sand between the finger and thumb. The small amount of cementing material present is somewhat ferruginous, thus imparting to the rock a yellowish or brownish colour. The weathering of the rock results in the production of a good deal of coarse sand which, under the influence of the frequent high winds, is scattered about the neighbouring "camp" greatly to the detriment of the sheep-pasture. Clean, white, somewhat coarse sand is found on the beaches, but not in such quantity as might be expected. Under the action of weathering the rocks often assume extraordinary shapes. Very fine examples of wind-weathering are to be seen (e.g. the so-called "Indian Village" at Port Stephens - see photograph). In some places the rock is much coarser, being in reality a conglomerate composed of well-rounded quartz-pebbles. In such cases the rock is much harder, owing to the pebbles being set in a siliceous matrix. These

lower rocks in the south-western part of West Falkland are often practically horizontal, although sometimes showing a gentle northerly dip. Nevertheless many cases of conversion of the rock into quartzite are to be observed. It is a very common phenomenon to find the rocks possessing an intensely hard outer crust of quartzite (or even rock quartz) and yet changing within to a comparatively soft and sometimes almost unconsolidated sandstone. This feature is interesting as affording clear evidence of the formation of quartzite under the ordinary action of weathering, in consequence of solution and re-deposition of silica within the interstices of the rock.

I have no knowledge of the total thickness of this barren lower formation, although Mount Weddell, on Weddell Island, which rises to a height of 1,200 feet, is composed entirely of these beds, the strata being nearly horizontal.

In the north-eastern part of West Falkland, the prevailing dip of the Devonian-Carboniferous series is northerly, varying in amount between 15° and 30° . The strata around Manybranch Harbour comprise beds 3 and 4 of the succession. I there collected the usual marine invertebrates of beds 3, and saw exposed the sandstones, flagstones and shales of beds 4. It follows from this that lower beds must occur to the southward. It was to the northward of the settlement at Port Howard, on the track to Manybranch Harbour, that Hallé obtained his specimens of *Rensselaeria falklandica*, characteristic of beds 2 of the sequence. I examined all the rock-exposures between Port Howard and Manybranch Harbour but did not obtain *Rensselaeria*, although I secured specimens of large *Orbiculoides*, which, according to Clarke, are widespread in early Devonian rocks.

In addition to the area round Manybranch Harbour, I have met with beds 3 of the sequence, and have collected the usual fossils, at the following places:- Port Howard, Fox Bay, Chartres River,

River, Summers Island, and Pebble Island. There is no need for me to append a list of fossils here, a list will be found in Halle's paper. My specimens are being forwarded to the Imperial College of Science and Technology for detailed consideration later.

I have found beds 4 of the sequence at Fox Bay, Manybranch Harbour, and at Shallow Harbour and Half-way Cove, two localities at Port Philomel. At Fox Bay ^a small quarry has been opened for the purpose of obtaining the flagstones, which make very useful paving-stones. The quarry also exposes shales and slaty rocks, and from these latter beds a good specimen of a fossil plant has been obtained. The specimen is at present exhibited in the Public Museum in Port Stanley. I have not yet identified this plant with certainty, but it appears to be *Sphenopteris*, or an allied genus. Within the last few days the rock-fragment containing the specimen has been trimmed down and further specimens of the plant have been discovered. These new specimens have passed into my possession and I am forwarding them, together with plaster casts of the original fossil (kindly made for me by Mr. A. G. Bennett, Customs Officer) to Dr. A. Smith Woodward, of the British Museum. Neither at Fox Bay nor Manybranch Harbour have I, so far, found any plant-remains in the flagstones themselves, but I secured poor specimens in the sandstones at Shallow Harbour (Port Philomel) and in the flagstones at Half-way Cove (Port Philomel).

At one locality only, have I, so far, ^d discovered plant-remains in the beds 5 of the sequence. This was in sandstones exposed on the northern side of the rinceon (peninsula) which runs in a north-easterly direction from near the mouth of the Warrah River, on the northern side of Port Purvis. These sandstones emerge from beneath the quartzites and quartzitic sandstones of the uppermost part of the Devonian-Carboniferous sequence, and in them I discovered some few specimens of plants of *Lepidodendroid* affinities.

I have

I have no knowledge of the thickness of beds 2 of the sequence, and, so far, I have no evidence to show the thickness of beds 3 and 4, although, by means of field-observations which I took at Fox Bay I calculate that in this locality a thickness of about 450 feet of strata occurs between a fossiliferous horizon of beds 3 and the glauk-bearing beds of 4 above.

All the high ground of the Devonian-Carboniferous area of East Falkland, and of the northern half of West Falkland, is composed of beds 5 of the sequence. These upper beds are of great thickness, although I have little evidence to show what the thickness is. Mount Maria has a height of 2,135 feet and is composed of beds 5, with a dip of about 25° N. 20° E. which dip persists to the summit. At the foot of the mountain, around Port Howard, the fossiliferous beds 3 are exposed, and a rough calculation indicates a thickness of at least 1,000 feet for beds 4 and 5.

2. ROCKS OF LOWER GONDWANA AGE (Lafonian Beds)

These rocks are known by many names. They have been called Gondwana Beds, Permian-Carboniferous Beds, Beds with Glossopteris flora, Karroo Beds, etc., with regard to their representatives in the Falkland Islands, Hallé, in his paper, dealt with them under the heading "Permian-Carboniferous Formation" and gave them further the local designation of "Lafonian Beds", on account of their distribution, an excellent name, to which I propose to adhere.

According to De Toit's classification, the boulder-bearing beds at the base of this series are now to be regarded as of Upper Carboniferous age, whilst the overlying Ecca series of the Southern Karroo, containing the Glossopteris flora and separated from the boulder-beds below by a stratigraphical break, are to be considered as of Permian age. Since, in the Falkland Islands, the lower glacial beds are succeeded by strata bearing the Glossopteris flora, and these latter do not appear (so far as my observations carry as at present) to possess any excessive

thickness

thickness, the retention of the term "Permian-Carboniferous Beds" appears still to be permissible in this area. So far as the Falkland Islands are concerned, we are therefore at liberty, for the present, to refer to these beds indifferently as either Lower Carbonian, Permian-Carboniferous, or Lufonian Beds.

Both in East and West Falkland I have verified the occurrence of Hallé's Lufonian Beds. On the East I have examined the lower portion of the series at Corritos, and have verified Hallé's observations and conclusions in that locality. I have, further, located the junction of the Lufonian with the Upper Quartzites of the Devonian-Carboniferous at Port Fitzroy (an area not visited by Hallé) and have noted that the generalised boundary between the two formations, as inserted in his map, will require some modification. I have had no opportunity, so far, to visit the Port Susan area, nor to make my contemplated traverse across East Falkland for the purpose of establishing, with greater precision, the position of the junction-line between the two formations. Both in East and West Falkland I have established the order of succession of the beds in the lower portion of the series, and on the West have been able to determine the thickness of the lowest beds. In East Falkland I have seen something of the succeeding beds, and have obtained the *Glossopteris flora* at Darwin Harbour, Walker Creek (South side of Choleski Sound) and North Arm (Bay of Harbours) although I am acquainted with the succession of these higher beds in a general way only.

In West Falkland I have verified the existence of the Lufonian Beds at Hill Cove, as discovered by Hallé, and have noted that this occurrence is not a small outlier, as he supposed, but the western extremity of a larger outcrop, the boundary of which extends eastward, and which I propose to map when opportunity occurs. I have, furthermore, discovered the Lufonian Beds on the southern side of Port Purvis - an area in which their existence was apparently unsuspected by Hallé and Shottsberg, as they visited

this neighbourhood - and has traced them from the eastern end of Port Purvis to, but not beyond, the Warrick River. I have thoroughly explored the whole coast of West Falkland, from Fox Bay to Manybranch Harbour, have determined the precise nature of the junction between the Devono-Carboniferous and the Lafonian. In this area, have discovered that a long ^acoastal strip of Lafonian Beds occurs here on the mainland of West Falkland, and have established the important fact that the junction between the two formations is a perfectly normal one, and that the Lafonian Beds are certainly ^{not} faulted down into the older rocks. (N.B. Hall regarded the whole of Lafonia (the southern part of East Falkland) as having been let down, in respect to West Falkland, by a fault of more than 1,000 metres throw, in view of the fact that the horizontal Lafonian plant-bearing beds of Speedwell Island are level with the nearly horizontal Devono-Carboniferous basement-beds at Cape Meredith. But Cape Meredith and Speedwell Island are nearly 40 miles apart, and an easterly component in the dip, of less than 1° , would suffice to produce this result.)

Similarly, the junction between the Devono-Carboniferous and the Lafonian appears to be perfectly normal, both at Hill Cove and Port Purvis. At neither place did I see the slightest evidence of a faulted junction. At Hill Cove, the Upper Quartzites of the Devono-Carboniferous, with their N.N.E. dip towards Byron Sound, are succeeded quite normally by the boulder-bearing glacial beds of the Lafonian, and these again by the Lafonian Sandstone which follows, still with the same seaward dip. When it is remembered that the upper Devono-Carboniferous Beds contain plant-remains and the lowermost Lafonian Beds ^{are} terrestrial glacial deposits the perfectly normal nature of the junction is emphasised. Both at Hill Cove and Port Purvis the Lafonian tillite (Glacial Boulder-beds) and the succeeding Lafonian Sandstone are the only Lafonian strata represented (so far as I am at present aware) and at Port Purvis again the uppermost quartzites of the Devono-Carboniferous on the northern side of

the Six Hills, with a northerly dip, are followed by a characteristic exposure of the Lafonian tillite, with its usual inclined igneous and other erratics, occupying all the low land intervening between the Six Hills and the southern shore of Port Purvis, and well seen at many places along the shore. Here also the tillite is succeeded by the Lafonian Sandstone, dipping northwards into the water, and seen all along the beach.

With regard to the western boundary of the main mass of the Lafonian Beds, in the neighbourhood of the eastern coastline of West Falkland, Halls was, as I have said, of opinion that this coastline was determined by a great fault, with an easterly downthrow, and that this fault constituted the boundary between the Devonian-Carboniferous of the coastal ridge and the Lafonian to the eastward. In commencing my examination of the nature of the boundary in this area I began by riding down from Port Howard to the coast opposite West Swan Island and rowing across to this island, which is the most easily accessible one from this part of the mainland of West Falkland, and which is not geologically coloured in Halls's map. I crossed the coastal ridge a little south of Snag Cove, finding, on the way, abundant evidence that the ridge is one of folding, the rocks consisting of nearly vertical Devonian ^{o-Carboniferous} quartzite stretching away to the N.N.E. and S.S.W. as far as the eye could see. Descending the seaward face of the ridge I was at once struck by the presence of a continuous coastal strip of low-lying land between the foot of the ridge and the beach. At the point where I crossed this strip of low land to the boat-shed on the beach opposite West Swan Island, there were no exposures until the beach itself was reached, and here I saw thin-bedded Lafonian claystones dipping 75° to the E.S.E. and striking N.N.E. - S.S.W. parallel to the coastal ridge. Proceeding to the island I found it to be composed of similar Lafonian rocks and including some slates and thin sandstones. The strike of the rocks was the same, but the E.S.E. dip decreased gradually from about 70° on the western side of the island to about 30° on the eastern side.

Suspecting

Suspecting the existence of a long coastal strip of Lafonian Beds I made a systematic examination of the coast from Fox Bay to Manybranch Harbour. The most southerly occurrence in West Falkland of the Lafonian Beds is at the nameless point on the coast west of the little West Island. Here there is a very good exposure of the Lafonian tillite showing a strong vertical cleavage with a N.N.E. - S.S.W. strike, but the coastal strip is not of sufficient width to bring in any higher Lafonian beds. The white Upper Devonian-Carboniferous quartzite, standing vertical, was seen a few yards westward, but the actual junction of the two formations is concealed by a sand-drift.

Proceeding northward along the coast from this point, I traced the Lafonian continuously to where the junction-line between the two formations leaves West Falkland. This occurs on the coast about four miles south of the entrance to Manybranch Harbour. Throughout the whole length of this coastal strip, from opposite the little West Island to Manybranch Harbour, the quartzite, dipping very steeply to the E.S.E. was seen to be succeeded by the Lafonian tillite, with its very characteristic and unmistakable appearance, and usual suite of included boulders. I saw no evidence whatever of the existence of a great strike-fault at or near the junction of the two formations, and although both the quartzite and Lafonian rocks are sharply upturned in the neighbourhood of the junction, in consequence of post-Lafonian folding movements, the junction is quite a normal one. Where the width of the coastal strip permitted, the tillite was seen to be overlain by the fine-grained Lafonian Sandstone, with the same strike as the Devonian of the coastal fringe, and the same high dip to the E.S.E. On the small narrow peninsulas of the ragged coastal fringe, the Lafonian Sandstone, which does not appear to be of any great thickness, was seen to be succeeded by thin-bedded claystones and slaty rocks, with included thin sandstones, all with the same N.N.E.-S.S.W. strike and E.S.E. dip.

ip. The dip, though always high, showed a steady decrease towards the east.

The coastal ridge is breached by the sea at Hill Gap, Snag Cove and Port Howard entrance, and at each of these gaps I found good opportunities of studying the structure of the ridge itself and the nature of the junction between the quartzite and Lufonian tillite. On the north side of Hill Gap I saw clear evidence that the folding which produced the coastal quartzite ridges affected the tillite also, for here the latter was seen forming a subsidiary coastal ridge for a considerable distance. Also, all along its outcrop, the tillite everywhere shows abundant signs of disturbance, being always much contorted and fractured, and showing no signs of regularity of disposition, although frequently exhibiting a vertical or very highly inclined cleavage with a strike parallel to that of the coastal ridge.

The best piece of evidence of the post-Lufonian date of the folding, lay, however, in the discovery of an outlier of the tillite at the head of Bell Cove (the creek running N.W.E. between Bell Point and the entrance to Port Howard). The coast from Bell Point to Manybranch Harbour, is formed by a fold-ridge of the Upper Quartzite, and the tillite is found flanking this ridge, both on its eastern side, around Bell Point, and on its western side, around the head of Bell Cove.

I was able, from observations along the coast, to form some idea of the thickness of the Lufonian tillite in this area. It appears to have a thickness of from 2,500 to 3,500 feet. The succeeding Lufonian Sandstone probably does not exceed about 500 feet in thickness here.

In the Dwyka Series of the Southern Karroo (the stratigraphical equivalent of the Lower Lufonian of the Falkland Islands) a series of Lower Shales intervenes between the glacial boulder-beds and the Witteberg Beds below. I have definitely established

that

that in the Falklands this series of Lower Shales is wanting, the glacial boulder-beds always resting, both in East and West Falkland, directly upon the Upper Quartzites of the Devonian-Carboniferous. In the Falklands, too, the boulder-beds, (Lafonian tillite) appear to be considerably thicker than their South African representatives, the figure for the Falklands being not less than 2,500 feet, as compared with about 1,000 to 1,500 feet for South Africa.

LOWEST CORDWANA BEDS OF SOUTH AFRICA AND FALKLAND ISLANDS COMPARED.

	<u>South Africa.</u>	<u>Falkland Islands.</u>
	feet.	feet.
Ecca Series (Permian)	{ Sandstones, Shales and Sandstones } 2,000-3,000	Claystones, Sandstones, Shaly and Slaty coals unknown
Dwyka Series (Upper Carboniferous)	Upper Shales 600-750	Lafonian Sandstone about 500
	Boulder-beds (Dwyka tillite) 1,000-1,400	Boulder-beds (Lafonian tillite) 2,500-2,800
	Lower Shales 700-1,000	Wanting

It is possible that some portion of the claystones, sandstones, slaty and shaly rocks of the Falkland Lafonian may be the equivalent of the Ecca Beds which follow the Dwyka Series in the Southern Karoo. I have no information at present concerning the thickness of the beds which follow the Lafonian Sandstone, but it does not appear likely that they can possess any great thickness in Lafonia. Had the Lafonian Beds actually been let down into the older rocks by great faults, as Halle supposed, there would have been more hope of the existence of a considerable thickness of these beds in East Falkland. I have already stated, however, that I have seen no signs of any such faulting. If strike faulting occurred, there would be discordance between

between the dip of the Devonian-Carboniferous and that of the Lafonian, and there is perfect agreement. Moreover, higher beds of the Lafonian would be found in juxtaposition with the Devonian-Carboniferous, and such is not the case. The Upper Quartzite is invariably succeeded by the Lafonian tillite. A critic might make the suggestion that possibly some representative of the Lower Dwyka Shales occurs in the Falkland Lafonian, but is always concealed from view by being put out by strike-faulting. Apart from the unlikelihood of such complete concealment of a set of beds, any such criticism is overthrown by the consideration that such a throwing-down of the beds would involve the tillite also, leaving only a portion of the thickness of that deposit exposed. This would mean that the Lafonian tillite would have to possess a thickness much greater than the figure I have given for it (2,500-2,800 feet). This is most unlikely, since the exposed thickness of the tillite in the Falklands is already much greater than that of its representative in South Africa.

I have pointed out that the steep dip of the Lafonian Beds, in the neighbourhood of the junction with the Devonian-Carboniferous rapidly flattens out. In Lafonia the strata are nearly horizontal over wide areas, or possess only a very gentle inclination, save where local minor faulting has disturbed them. The whole of Lafonia is low-lying land and does not appear to rise anywhere more than about 130 feet above sea-level. Consequently, there appear no strong grounds for the hope of finding any considerable thickness of Lafonian Beds above the Lafonian Sandstone. This consideration has a very important bearing upon the question of the possible occurrence of coal-bearing rocks - a question I propose to deal with in a subsequent report.

Nevertheless the evidence afforded by the fossil plants shows that the Falkland Lafonian includes a certain thickness of strata containing the Glossopteris Flora. I secured the best specimens of this flora obtained so far, from North Arm (Bay of Harbours).

Presumably

Presumably, the Lafonian Beds exposed here are on an horizon as high (or almost as high) as any in the Falkland Islands (with the exception perhaps, of Bleaker and Sea Lion Islands, neither of which localities I have visited, as yet). In the Lafonian Beds of North Arm I obtained *Cangasopteris*, *Glossopteris* and a plant which appears to be either *Phyllothea* or *Senizoneura*.

/N.B:-With reference to the specimens of the *Glossopteris* flora, alluded to above, collected by me in Lafonian claystones at North Arm, Bay of Harbours, East Falkland, an interesting point arises, which it may not be out of place to mention here. Among the specimens, I secured several which were quite new to me and unlike any specimens referred to in the British Museum Catalogue on the *Glossopteris* Flora. I secured several excellent specimens of unmistakable bulb-like, or onion-like bodies, apparently underground stems, some of them with stem-attachments very like *Phyllothea* or *Senizoneura*. The specimens impress me as being of special palaeobotanical interest. I am of opinion that they should be handed over for examination to a recognised expert on the *Glossopteris* Flora, like Professor Seward, of Cambridge, or one of the British Museum Authorities. /

I propose to deal with the question of the folding-movements which have affected the Falkland Islands in a subsequent report, when considering the possibility of the occurrence of liquid petroleum.

IGNEOUS INTRUSIONS OF LATER DATE.

The occurrence of eruptive dykes in the Falkland Islands has long been known. Sullivan noted them in West Falkland during the expedition of the "Beagle", and specimens of igneous rock were secured by the "Challenger" expedition. Amersson discovered two small dykes at Fox Bay. Harris noted the presence of a dyke

at Half-way Cove, Port Philomel, saw the two discovered by Amersson at Fox Bay, and observed another on the track to Port Howard. He also located others at Spring Point (Port Philomel) ~~and~~ at Branton Loch and ~~at~~ Port Sussex in East Falkland.

I have, as yet, seen no dykes in East Falkland, but on the West I have seen, and secured specimens of, each of those mentioned above, with the exception of that at Spring Point. In addition, I have mapped and secured specimens of numerous other dykes in West Falkland. Some of the West Falkland dykes are of large size - much larger, apparently, than any which have hitherto been noticed. In particular there is a fine example which extends from northward of Mount Maria to the outskirts of Fox Bay. This dyke forms a ridge over 100 yards wide, rising to more than 50 feet above the general level of the "camp". The crest of the ridge is everywhere covered by an accumulation of large, loose boulders of the diabase-rock, many of them deeply weathered. I traced the course of this dyke for several miles in the Port Howard "camp", located it again south-west of Hill Gap and followed it for several miles in the Fox Bay "camp". In the north, another dyke running into the south-east side of Port Purvis appears to reveal its northerly continuation, as it lies on the same line. This dyke follows, generally, the strike of the rocks, as is a very common feature amongst the others. Many of the other dykes which I have seen are comparable in size with the one mentioned, and there are also many similar ridges in the ^West Falkland suggestive of the presence of dykes but which do not show an outcrop of igneous rock. I have also been told of the existence in West Falkland of several other dykes which I have not, as yet, seen.

Hand specimens of these dyke-rocks show great similarity in general appearance. The fresh rock is always extremely hard, heavy, rather fine-grained and bluish-black in colour. All the intrusions appear to be of the same age, and that age, post-Lafonian. The dykes cut through both Devonian and Lafonian strata.

strata. The rock is quite distinct in character from the igneous rocks of the Cape Moresby Archipelago. The intrusions were probably of about the same date as that of the earth-movements which folded the Palikians.

With regard to the preparation of the geological map of the Palikian Islands, I am inserting the geological data upon the Admiralty chart.

A small sketch-map of the Cape Moresby area and photographs will be found at the end of this report.

I have the honour to be,

Sir,

Your obedient servant,

Herbert A. Baker
D.Sc., M.Sc., D.I.C., F.G.S.
Government Geologist.

Addressed to: (Mr G. S. Lewis)
Geological Department
Imperial College of Science
& Technology
South Kensington
London S.W.7

Delivered to the Colonial Secretary

NOTE ON GEOLOGICAL SPECIMENS DESPATCHED TO ENGLAND UP TO DATE

1st Consignment:- Per s.s. "Duenias", March, 1921.

One box, containing specimens of fossils from the Devonian-Carboniferous rocks of the Falkland Islands.

2nd Consignment:- Per R.M.S. "Oruba", June, 1921, seven boxes, numbered 1 to 7. Contents as follows:-

Box 1, Fossil plants (Glossopteris Flora) from the lower Carboniferous (Lafonian) Beas of East Falkland.

Box 2, Specimens of igneous and metamorphic rocks of the Archaean of Cape Meredith, West Falkland. Also specimens of rock from lower portion of the overlying Devonian.

Box 3, Calcareous nodules containing fossils. From the Devonian-Carboniferous shales of Pebble Island, West Falkland.

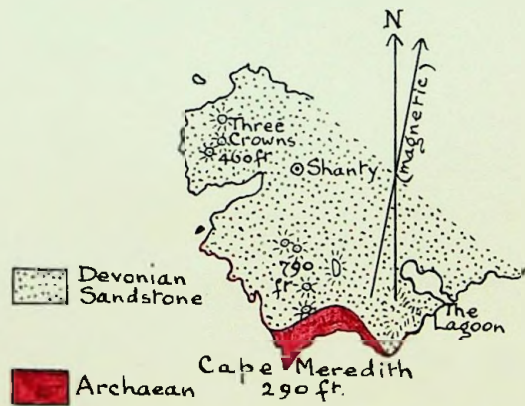
Box 4, Further specimens of calcareous fossiliferous nodules from Pebble Island. Also fossils from Pebble Island and quartzitic pebbles.

Box 5, Devonian-Carboniferous fossils from Fox Bay, West Falkland.

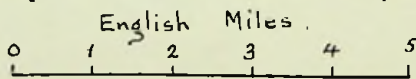
Box 6, Further Devonian-Carboniferous fossils and specimens of igneous dyke-rocks from West Falkland.

Box 7, Specimens of Lafonian tillite and erratic boulders therefrom. Also specimens of white quartzose sands from the Falklands. Specimens of bitumen and bog iron ore.

Addressed to: (Mr. G. I. Sweeting.
The Crown Agents for
the Colonies for
delivery to } Geological Department,
Imperial College of Science
& Technology,
South Kensington
London S.W.



Geological sketch-map of Cape Meredith.



H.A.B.

MIN/660/127-01



Cape Meredith, West Falkland, View from near western end of section, looking towards southernmost point of Cape. Showing junction of Devonian Sandstone above with Archaean below,

MIN/660/127-02



Cape Meredith, West Falkland, View near western end of section, showing junction of Devonian Sandstone above with Archaean below.

MIN(GEO)1#7-03



View of so-called "Indian Village", Port Stephens, West Falkland. Showing weathering of Devonian Sandstone by wind-blown sand.

MIN(GEO)1#7-04



Nearer view of part of "Indian Village", Port Stephens, West Falkland, showing detail of weathering of Devonian Sandstone by wind.

MIN/GEO/1#7-05



View of coastal ridge, east coast of West Falkland, looking south. The low-lying land between the ridge and the sea is occupied by the outcrop of the highly-inclined Lower Laffenian Beds.

MIN/GEO/1#7-06



View of western side of entrance to Bluff Cove, East Falkland. Showing folding of upper Devonian-Carboniferous quartzitic sandstone. This view is typical of the folding to which the Devonian-Carboniferous of East Falkland has been subjected.

Stanley,

17th June, 1921.

The Hon. Colonial Secretary,

Sir,

I beg to report that I have seven boxes of geological specimens ready to be sent to England and I should be glad if they could be forwarded by the "Oruba".

My instructions from the Colonial Office are that my geological specimens are to be sent to the Geological Department, Imperial College of Science and Technology, South Kensington, S.W. 7, to await my return.

Mr. G. S. Sweeting, of the Geological Department, Imperial College, has very kindly undertaken to receive and take charge of any specimens thus forwarded.

I shall be glad if His Excellency will approve of the boxes being sent to the Crown Agents, with a covering letter, requesting them to be good enough to arrange for the forwarding of the specimens to Mr. Sweeting, at the Imperial College.

Cases marked 1 - 7:-

O. H. M. S.	
H.A.B. c/o	R.M.S. "Oruba"
Liverpool	

Crown Agents for the Colonies

London, S. W.

Measurement 21" x 13" x 8"
Total 9 cubic feet.

I have the honour to be,

Sir,

Your obedient servant,

Herbert A. Baker

Govt, Geologist.

(4)

CS. 67/21

67/21.

23rd June,

21.

Gentlemen,

I am directed by the Governor of the Falkland Islands to enclose herewith a copy of a letter from Dr. H. A. Baker, Government Geologist, relating to seven boxes of geological specimens which are being despatched to you by the s.s. "Oruba", and to request that you will be so good as to cause the specimens to be forwarded to Mr. G. S. Sweeting at the Imperial College of Science and Technology, South Kensington.

I am,

Gentlemen,

Your obedient servant,

W. A. THOMPSON,

Acting Colonial Secretary.

The Crown Agents for the Colonies,

4, Millbank,

Westminster,

London, S. W.



MINUTE PAPER.

Departmental Number. XV. B.

From Government Geologist.

Date 6/9/1921.

To Ag. Hon. Col. Sec.

SUBJECT.

Requests sending of letter to Crown Agents, advising them of despatch of three cases of specimens.

Reference
Numbers. }

Sir,

I beg to draw your attention to the fact that I am sending to England by the mail steamer, three cases of specimens, the cases being marked thus:-

C. H. M. S.

H. A. B. Liverpool.

No. 8 - 10.

c/o Crown Agents for the Colonies,

London, S.W.1.

The cases are numbered 8, 9, and 10 respectively. Case No. 8 contains specimens of Falkland Islands' guano for the Government Chemist, (Government Laboratory, 13 Clement's Inn Passage, W.C.2.).

Case No. 9 contains geological specimens, to be forwarded c/o Mr. G. S. Sweeting, Geological Department, Imperial College of Science and Technology, South Kensington, London, S.W. 7.

Case No. 10 contains specimens of Falkland Islands' guano for the Director of the Imperial Institute, South Kensington, London, S.W. 7.

I shall be glad if His Excellency will arrange for a letter to be sent to the Crown Agents, advising them of the despatch of these cases, and requesting them to be so good as to give directions for the forwarding of the cases as indicated above.

I have etc.

Herbert A. Baker.

Government Geologist.

(6)

C.S. 67/21

67/21.

7th September, 21.

Gentlemen,

I am directed by the Governor of the Falkland Islands to enclose herewith a copy of a letter from Dr. H. A. Baker, D.Sc., Government Geologist, relating to three cases of specimens which are being despatched to you by the s.s. "Orona", and to request that you will be so good as to cause the specimens to be forwarded to the different addresses stated in Dr. Baker's letter.

I am,

Gentlemen,

Your obedient servant,

H. A. THOMPSON,

Acting Colonial Secretary.

The Crown Agents for the Colonies,

4, Millbank,

Westminster,

London, S. W. 1.

(7)

MINUTE PAPER.

Departmental Number. XV.B.

From Government Geologist

Date 23/12/1921.

To Hon. Col. Sec.

SUBJECT.

Forwards three copies of report on Geological Investigations in the Falkland Islands.

Reference Numbers. }

Sir,

I have the honour to forward herewith three type-written copies of a report on the progress of my geological investigations in the Falkland Islands during the period 31/5/1921 - 17/12/1921.

I have etc.,

Herbert A. Baker, D.Sc.

Government Geologist.

GEOLOGICAL

H. A. BAKER, D. Sc., D. I. C., F. G. S., F. R. S. S.

General report for the period 31/5/1921 - 17/12/1921.

The Falkland Islands

The Principal Islands

Summary

1921.

GEOLOGICAL INVESTIGATIONS IN

THE FALKLAND ISLANDS.

General report for the period

31/5/1921 - 17/12/1921.

The purpose of this report is to give a summary of the geological investigations carried out in the Falkland Islands during the period 31/5/1921 - 17/12/1921. The principal islands visited were West Falkland, East Falkland, and the smaller islands of the group. The purpose of the investigations was to determine the geological structure of the islands and to collect specimens for the British Museum. The results of the investigations are given in the following sections: 1. General Geology, 2. Stratigraphy, 3. Petrology, 4. Mineralogy, 5. Geomorphology, 6. Paleontology, 7. Botany, 8. Zoology, 9. Conclusions.

The geological structure of the Falkland Islands is generally simple, consisting of a central mass of igneous rocks, surrounded by a thin layer of sedimentary rocks. The igneous rocks are of the same type as those found in the West Indies, and are believed to be of the same age. The sedimentary rocks are of the same type as those found in the West Indies, and are believed to be of the same age. The results of the investigations are given in the following sections: 1. General Geology, 2. Stratigraphy, 3. Petrology, 4. Mineralogy, 5. Geomorphology, 6. Paleontology, 7. Botany, 8. Zoology, 9. Conclusions.

Stanley,

Falkland Islands,

Dec., 1921.

GEOLOGICAL INVESTIGATIONS IN THE FALKLAND ISLANDS.

General report for the period 31st May 1921 to 17th Dec., 1921.

The Honourable

The Colonial Secretary

Stanley.

Sir,

I have the honour to submit herewith a report on the progress of my geological investigations in the Falkland Islands during the period 31st May to 17th December 1921.

It has not, so far, proved possible for me to submit progress reports of my work every three months.

The present report is to be regarded as a summary of the more important points in connection with the progress of my work.

I hope to prepare a detailed account at a later stage. I propose to spend as much time as possible in the field during the summer.

The winter was more severe than usual, causing me to lose several weeks' field-work.

I succeeded in examining the penguin guano deposits of Kidney Island during the winter, but the experience was a very unpleasant one. My report on this subject has already been forwarded.

In the course of recent field-work I have visited several other penguin rookeries in various parts of East Falkland, but in every case the guano deposits were insignificant and of no account whatever economically. The sites were small (not exceeding $\frac{1}{2}$ to $\frac{1}{4}$ acre) and the deposits were surface accumulations of an inch or so, the guano being much mixed with either sandy or peaty material. I was able to recommence geological field-work on 24th September, when I left Stanley for a tour across East Falkland, with the object of examining the lower beds of the Lafonian or Gondwana series, and, if possible, to establish with greater definiteness

The nature and position of the junction between the Devonian-Carboniferous rocks and the Gondwana Beds. This task occupied me until 17th October. The stratigraphy of the Lower Gondwana Beds is somewhat complicated. There has been much isoclinal folding, and from Port Harriet to Mount Pleasant the Lafonian Tillite or Glacial Boulder Beds (the lowest bed of the Gondwana Series here) is folded up in the valley-bottoms between parallel ridges of the Devonian-Carboniferous quartzite. Successive exposures of the tillite are separated by dis-faults, of which there is a series, arranged in echelon. From Mount Pleasant to Port Sussex, however, the tillite outcrop occupies a single belt of country. The junction-line between the Devonian-Carboniferous and Gondwana formations is therefore much more complicated than is indicated by the line inserted in Halle's map. I have been successful in mapping both the lower and upper boundaries of the Lafonian Tillite completely across East Falkland, from its commencement at Port Harriet to its termination at Port Sussex, and have inserted the result upon the Admiralty Chart of the Falkland Islands. I determined the position of both the lower and upper boundaries with precision throughout their entire course, and, had it not been for the lack of topographical detail on the chart, could have inserted the two lines with minuteness. Owing, however, to the fact that a very great amount of detail is omitted from the chart, (whole ranges of mountains and hills, as well as isolated peaks and many large lakes, ponds and streams, being omitted) and the further fact that there is no contouring on the chart, I was obliged to show the boundaries as possessing a generalised smoothness which, in actuality, is modified by much minor crenulation.

Owing to the very indifferent nature of its exposure, and the isoclinal folding to which it has been subjected, it appears to be impossible to determine the thickness of the Lafonian Tillite in East Falkland, and I am therefore unable to check or modify the thickness-figure (2500 - 2800 feet) which I arrived at after examining the tillite of West Falkland. I have not, so far, observed

Any definite evidence of isoclinal folding in the tillite of West Falkland, but it is possible that it occurs, in which case the thickness-figure quoted is too great.

Owing to its repetition by folding, the tillite occupies a belt of country about 6 miles in width in its widest part.

The corresponding Dwyka Tillite of Cape Colony is both underlain and overlain by definite shale-beds. In the Falklands the actual junction of the tillite with the underlying quartzite appears to be everywhere concealed, but on the southern side of Bluff Cove (Fitzroy Basin), where the tillite adjoins the quartzite, I saw, very close to the base of the deposit, a few feet of ~~black~~ rusty-brown definitely laminated sandy and shaly beds. Also at one place at Port Fitzroy, I saw, near the base of the tillite, a few feet of black shales and sandstones. I regard these occurrences as local and lenticular, and am of opinion that in the Falklands there is no definite set of Lower Shales between the older quartzite and the glacial boulder-beds. On the other hand, there is, at the extreme top of the Lafonian Tillite, a quite thin, but definite and constant bed of blue-black, somewhat cherty slate, containing traces of fossils, which can be followed for many miles as a low ridge in East Falkland. The bed, however, is only a few feet thick and is not of sufficient importance to warrant a separate grouping. I regard it as the equivalent of the uppermost chert seam of the "White band" at the top of the Upper Dwyka Shales of the Southern Karroo. Cherty seams occur within the thickness of the Lafonian Tillite. I found one near Carritos and another at Fitzroy.

On 27th October I left Stanley for a general tour in Lafonia, and returned on 17th December. During this trip I succeeded in examining practically the whole coast of Lafonia, and also saw much of the interior. I was able, further, to visit Speedwell, George, Barron and Bleaker Islands. Lively Island I had visited previously. As the result of this tour I have been able to establish the sequence of the Lafonian or Gondwana Beds above the basal tillite, and make an examination of the rocks of the entire series.

The Lafonian Sandstone, which succeeds the tillite, is a fairly fine-grained, uniform, soft, rather thin-bedded brown sandstone. It is much concealed beneath the "camp" vegetation, exposures being singularly rare and unsatisfactory. It is, however, a characteristic rock which is identified immediately in the field. It has, like the tillite, been very much crushed and broken by lateral pressure from north and south, which has caused isoclinal folding. This fact, together with the unsatisfactory nature of its exposure, makes it very difficult to form any accurate idea of its thickness in East Falkland.

In its lower part the Lafonian Sandstone occasionally contains included fragments and small boulders of igneous and other erratics, such as are found in abundance in the underlying tillite. At Port Sussex, and at the head of Swan Inlet the base of the Lafonian Sandstone shows finer-grained, silty rocks, with a somewhat pale bluish or greenish tinge. These beds are obviously passages from the upper cherty slate of the tillite.

In its upper part the Lafonian sandstone shows a very interesting passage from typical sandstone into a striped rock of a lithological type for which there seems to be no suitable name in present usage. It is neither a sandstone nor a shale; in contradistinction to a mudstone with its correct aspect, this rock is thin-bedded and slaty in general appearance, yet it is coarser in constitution than a typical slate. Siltstone would be a good name for it if such a term were in general usage. The interesting feature of this rock is its striped or banded appearance on fracture-edges, produced by the alternation of darker and lighter coloured zones. This rock was mentioned by Halle, who compared it with the seasonally laminated clays from the areas of Diluvial glaciation and favoured the idea of its having been formed as a limno-glacial deposit in a large fresh-water basin. Along the northern shores of Brenton Loch and Choiseul Sound opportunities occur of tracing the gradual passage of the typical Lafonian Sandstone into this interesting striped rock. The sandstone becomes progressively finer in grain, the thin-

ness of the bedding is accentuated, and darker-coloured markings, which make their first appearance as sporadic, more or less irregular, blackish streaks in the rock, group themselves as definite bands of darker-coloured sediment. The transformation from sandstone to striped siltstone, though gradual, is rapid, being completed within the thickness of a few feet of strata. In the mapping of geological lines the horizon at which the Lafonian Sandstone first assumes a streaky appearance affords a useful boundary, which I have taken as representing the upper limit of the true Lafonian Sandstone. It should be remarked, however, that true Lafonian Sandstone occurs, in narrow strips, parallel to each other and to the northern shores of Brenton Loch and Choiseul Sound, a little to the southward of the boundary-line which I have inserted on the chart. Much isoclinal overfolding of the beds occurs here, and the thickness of strata involved in the folding exceeds that required to effect the passage from true Lafonian sandstone, through streaky sandstone, to striped siltstone. As a consequence, all three of these rock-types are found occurring as repeated, narrow separate strips, along the belt of country which skirts the northern shores of Brenton Loch and Choiseul Sound. The detailed mapping of the true Lafonian Sandstone boundary would have required the expenditure of much more time than I could afford in this connection.

The occurrence of the striped or banded siltstone is responsible, in a very remarkable degree, for the existence of Choiseul Sound and Brenton Loch. This rock weathers very badly, and in the capricious climate of the Falkland Islands, disintegrates with great rapidity. It splits readily along the numerous and closely-packed bedding-planes and also, after a little exposure, along the parallel planes separating the darker and lighter coloured layers. The thin laminae readily break up under weathering and soon crumble to a dirty greyish silt or coarse clay. The great inlets of Choiseul Sound and Brenton Loch occur at the outcrop of this feebly-resisting stratum, and the sea has made such inroads upon it that now only a fringe of it remains, bordering the northern

and southern shores of these arms of the sea. Were it not for thrust-faulting in the neighbourhood of Darwin Settlement, which has displaced the siltstone and substituted therefor more resistant rocks, Lafonia would be an island today.

The lithological change from sandstone to striped siltstone is readily detected in the field, and proved to be the means by which I was able to obtain definite field-evidence of what I had suspected, that the lower Lafonian Beds have been much affected by isoclinal overfolding. Along the shores of Brenton Loch and Choiseul Sound, as is also the case farther northward, the undulating land is disposed into parallel ridges and valleys, conforming to the trend of the two great inlets, the valleys frequently being the upper parts of creeks. I noticed repeatedly that the ridges were composed of much-fractured Lafonian Sandstone, the valleys were eroded in the Banded Siltstones, and that, to judge from the apparent dips, the sandstone of the ridges appeared to occur sometimes above and sometimes below the siltstone of the valleys. Investigation revealed that these features are the result of isoclinal overfolding. In the area farther north the outcrop of the lower part of the Lafonian Sandstone and the Tillite occupies a belt of similarly undulating country and the rocks, although very poorly exposed, show fracture and cleavage lines parallel to the trend of the ridges. I have no doubt that similar folding occurs here.

The islands in Choiseul Sound are composed of much-fractured sandstone, often with a beach fringe of siltstone. They are clearly remnants of sandstone ridges separated by submerged ^{trenches} of the softer siltstone. They show a fairly gentle apparent dip of the strata to the S.W. On the southern side of Brenton Loch and Choiseul Sound the land maintains its undulating aspect of ridges and troughs for some distance southward, leading one to suspect the continuance of isoclinal folding, but I have not obtained sufficient field-evidence to determine the southerly limit of the fold-belt with precision. The lower part of Bodie Inlet and the northern half of Lively Island lie within the fold-belt, and it is probable that

no overfolding occurs south of a line passing through or near the head of Bodie Inlet, midway between Choiseul Sound and Low Bay, and across the middle of Lively Island.

In consequence of repetition of the Striped Siltstones by overfolding I have not been able to determine their thickness, but it cannot be very great.

The rocks of Lafonia south of the southern shores of Brenton Loch and Choiseul Sound constitute a single series consisting of a monotonous alternation of arenaceous and argillaceous sediments which continues to a very considerable thickness of strata and comprises the whole of the remainder of the Lafonian or Gondwana succession in the Falkland Islands. In spite of the thickness of these rocks there is no lithological differentiation at any horizon sufficiently marked to serve for the purpose of subdividing them or as a boundary for geological mapping.

Satisfactory sections of these rocks are of rare occurrence, an exposed thickness of from 20 to 30 feet in any one section being very seldom exceeded, except in the case of the westerly dipping beds seen at the creeks along the western shore of Lafonia, between Dos Lomas and Danson Harbour.

The alternating beds of sandstone and claystone are of small individual thickness, both, in general, being seen in the usual insignificant section of a few feet. The sandstone beds in the series show little variation from bottom to top, the common rock being a brown to grey, fairly soft sandstone of medium grain, physically indistinguishable from the Lafonian Sandstone of the main mass. A very fine-grained and intensely hard greenish sandstone also occurs however, containing the *Glossopteris* flora. The argillaceous beds show rather more variation, ranging in colour from brown, yellow or grey, to green, and in constitution from almost a fine-grained sandstone to compact mudstones, laminated shaly rocks and sometimes typical slates. The finer-grained laminated varieties contain the best specimens of the *Glossopteris* flora.

The disposition of this alternating series of rocks over the greater part of Lafonia is such as clearly to show that the apparent order of succession is the real one, and not the effect of isoclinal overfolding. Over a wide area the rocks are either quite horizontal or gently dipping for many miles.

Much of the interior of Lafonia consists of gently undulating, frequently boggy land, covered with rough, coarse grass, over which one rides mile after mile without seeing even the most insignificant exposure to afford a clue to the nature of the rocks beneath. Occasionally a little ravine, either dry or occupied by a small "royo", will show a small section in the Upper Lafonian Beds, but the only adequate sections are those exposed in the sides of the creeks on the western side of Lafonia, from Dos Lunas to Danson Harbour. Here the beds are seen dipping in an unexpected direction, namely to the W. N. W., at an angle which varies slightly but is about 12 degrees on the average. The Lafonian portion of Falkland Sound therefore constitutes a synclinerium, since the Lower Lafonian Beds of the coastal strip on the opposite side of the Sound dip very steeply to the E. S. E.

Inland from the west coast of Lafonia the rocks are concealed to the eastward beneath the grass and peat-covered "camp", but here and there I observed a rare and insignificant section, and was surprised to note the continuance of the same steady dip of about 12 degrees for several miles inland. Somewhere between the west coast and the Bay of Harbours this dip must flatten out, however, for around the latter place the dip shows a faint trend to the S. S. E. The country in a line between Danson Harbour and Darwin Harbour consists of nothing but soft peat-flats and ponds. There are no rocks to be seen over this tract, but this must be about where the dip flattens out before becoming reversed in direction. If the same W. N. W. dip, seen on the west coast, prevails as far inland as this, it signifies that the Upper Lafonian Beds must possess a thickness of something like 9000 feet, although it is impossible to estimate their thickness within two or three thousand feet. On Speedwell, George, and Barron Islands the strata are horizontal,

ive for slight local disturbances. Around Adventure Sound the rocks are practically horizontal, and on Bleaker Island absolutely so. Around Bull Cove and Fanny Cove there is a very faint dip to the N. In these circumstances it is difficult to say precisely where the very highest Lafonian Beds occur. Probably the extreme west coast of Lafonia shows as high strata as any place, but I could detect no noteworthy lithological difference between the rocks here and elsewhere in Lafonia.

I had thought it possible that Speedwell Island or George Island might show Lower Lafonian rocks, perhaps the Tillite, but the strata here are well up in the Lafonian succession. This shows that the south-westerly limit of the Gondwana Beds lies well to the west of these islands.

In the light of later knowledge I have to correct one statement made in an earlier report. I expressed the opinion that no great thickness of Gondwana Beds would be found to occur in Lafonia above the Lafonian Sandstone.

I am inclined to correlate the Lafonian Sandstone with the lower part of the Ecca Series of Cape Colony, and to regard the whole of the remainder of the Lafonian succession as being equivalent to beds of Ecca and Beaufort age. I have, however, seen no trace of the reptilian fauna which the Beaufort Series of rocks has yielded. I am satisfied, from the evidence afforded by the fossil plants, that no strata corresponding with the Sternberg Series of Cape Colony occur in the Falkland Islands. The Falkland Lafonian, from the lowest to the highest fossiliferous horizon, yields *Glossopteris*, *Gangamopteris*, and the fossil which has been identified as *Phyllothea* but which may be *Schizoneura*. Silicified wood also occurs at several horizons. I have been successful in securing good specimens of the fossils belonging to the *Glossopteris* flora, particularly from Speedwell and George Islands.

Diabase or dolerite dykes occur in places in Lafonia, but they are not nearly so abundant as in West Falkland. One such dyke pierces the lower part of the Lafonian Sandstone at Port Sussex and has caused the rocks in its vicinity to become slightly

granitic. This is the material known as the Port Sussex "graphite" which has been twice examined by experts and condemned as worthless.

In view of the fact that so much of the rock-sequence of Lafonia is concealed from view I cannot speak with complete assurance concerning the mineral possibilities of these beds. I have, however, studied them in section around practically the whole coast of Lafonia.

I have seen no sign whatever of the existence of coal-seams. Neither is there a single surface-indication of the existence of petroleum in, or below, these beds.

Of other minerals of economic value, absolutely none exist. An exceedingly insignificant amount of chalybite occurs, very sporadically, and a quite worthless and equally insignificant amount of a black bog-iron-ore.

Silurian or "torbanite" does not occur in either the Gondwana or the Devonian-Carboniferous rocks of the Falkland Islands.

I found a further two specimens of this material during my last tour. They were again found with other litter on the beach (at Findlay Harbour) and had obviously been washed up.

I therefore regretfully conclude that, apart from glass-sand (of which there is abundance) the mineral resources of the Falkland Islands are nil.

During my investigations in the Falkland Islands I have conducted my work on survey lines, making the preparation of the geological map an important part of my programme. This has made good progress and I am very anxious to complete it as far as possible before the time of my stay in the Falklands expires. It will be quite impossible, in the time at my disposal, to attempt the mapping of separate divisions of the Devonian-Carboniferous rocks, but I hope to complete the mapping of the boundary between the two great formations in the Islands. I propose to proceed immediately to West Falkland, chiefly for this purpose. The Gondwana Beds appear

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to occur there in the form of outliers, and the work will probably be difficult, as I have very few clues to go upon.

It may be, too, that similar separate outliers of Gondwana Beds occur in the north-western part of East Falkland, so I hope, on my return from the West, to spend some time in this area.

Further, there are many of the smaller islands, as well as the more outlying islands, which I have had, as yet, no opportunity of visiting. The Jason Islands and the Sea Lion Islands I shall probably manage to visit, and it would be very interesting if I could succeed in visiting Beauchêne Island before I leave the Colony.

I have the honour to be,

Sir,

Your obedient servant,

Herbert A. Baker

D. Sc., M. Sc., D. I. C., F. G. S., F. R. C. S.

Government Geologist.

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FAKLAND ISLANDS.

No. 10.

GOVERNMENT HOUSE,

STANLEY,

10th January, 1922.

Sir,

With reference to my despatch, No. 47 of the 20th of June, 1921, I have the honour to transmit a report from Dr. H. A. Baker, D.Sc., on the progress of his geological investigations during the period from June to December, 1921. I regret that difficulties of communication and a very severe winter have prevented the submission to you of progress reports at regular intervals of three months.

In duplicate.

To Secretary of State
Nos. 54, 55, 56 of 12th
July, 1921.

2. At the time when the special reports, on the possibility of the occurrence of petroleum, coal and other minerals were furnished, Dr. Baker had not an opportunity of examining in detail the Lafonian rocks. He has now completed a most careful examination of Lafonia including practically the whole of the coast line of this area. Later investigations confirm Dr. Baker's previous statement that, considering the extent of the area under survey, he has never examined a series of rocks so barren from the point of view of their exploitation for included minerals, and he is reluctantly forced to the conclusion that, with the exception of glass sand, there are no minerals of economic value in the Colony. A definite opinion

To Secretary of State
No. 55 of 12th July,
1921 - page 4 of re-
port.

THE RIGHT HONOURABLE

W. L. S. CHURCHILL, M.P.,

SECRETARY OF STATE FOR THE COLONIES.

on/

To Secretary of State
No. 54 of 12th July,
1921 - page 1 of the
report.

on the suitability of the sand for the manufacture of glass awaits the chemical and mechanical analyses which Dr. Baker is to make.

3. With the object of obtaining information, which is required for completing the geological map of the Colony, Dr. Baker will spend the remainder of the summer in the northern parts of East and West Falkland. It seems unnecessary that he should visit the small outlying islands mentioned in the concluding paragraph of the accompanying report as the rock specimens, which he requires, can be obtained by Mr. J.E. Hamilton, Government Naturalist, who will have occasion to visit each of these islands in the course of the next few weeks.

4. This arrangement will enable Dr. Baker to complete the field work in connection with his investigations before the departure of the mail steamer which is expected to leave here early in April and is proceeding direct to England via Monte Video. On arrival in England Dr. Baker will undertake, subject to such instructions as may be given by you, the examination of the specimens which he has collected.

I have the honour to be,

Sir,

Your most obedient,
humble servant,

J. Middleton.

67/21

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FALKLAND ISLANDS.

No. 119.

Downing Street,

15th December, 1921.

Sir,

With reference to your despatches Nos. 46 and 47 of the 20th June and 54 and 56 of the 12th July, I have the honour to transmit to you, for your information, the accompanying copy of a letter from Dr. J. W. Evans furnishing his observations on the reports by Dr. Baker which were enclosed in your despatches.

2nd December.

2. I desire to invite your attention in particular to Dr. Evans' suggestion as to the preparation of a geological map.

I have the honour to be,

Sir,

Your most obedient,
humble servant,

WINSTON S. CHURCHILL.

GOVERNOR

J. MIDDLETON, ESQ., C. M. G.,

&c. &c. &c.

JWE/IW

IMPERIAL MINERAL RESOURCES BUREAU

2, Queen Anne's Gate Buildings,

Westminster,

London, S. W. 1.

2nd December, 1921.

Sir,

I have read and carefully considered Dr. Baker's four reports containing the results of his investigations during the period from the 26th of December 1920 to the 31st of May, 1921, and have come to the conclusion that he has made good use of his time in spite of the circumstances under which his survey was carried out - the scattered character of the area to be examined, and the difficulties of communications.

He has been able to work out as had never been done before, the structure of the rocks and the distribution of the formations that are present, as well as their correlation with those of South Africa which they so closely resemble. So far, unfortunately, his investigations appear to suggest that it is just those Upper Karroo beds that have yielded coal in South Africa which are missing in the Falklands, having been removed by the destructive action of natural forces from the areas that are now exposed above the level of the sea. There still however remains a considerable amount of work to be done before definite conclusions can be arrived at. This is especially the case in Lafonia, the southern portion of East Falkland, where the Karroo beds or "Lafonian" mainly occur. It is also important that we should know how far these rocks extend in West Falkland to the eastward of Hill Cove. I therefore look forward with interest to seeing the results of his work in the present summer.

The Under Secretary of State,
Colonial Office.

It.

It is to be hoped that before Dr. Baker leaves he may be in a position to construct a reliable geological map of the Colony which will be of permanent value for reference. The sketch map prepared by Halle appears to be in many respects misleading.

Dr. Baker can speak with some authority on that suitability of sands for glass making and it is just possible that at some future time there may be a market for the Falkland Island sand in the Argentine if the industry is developed there, but I do not think that it could pay to send it to Europe or the United States. I am afraid that even less can be said for any possibility of utilising the kaolin, the iron ores, or the graphitic deposits of the Islands.

As I have already indicated, I am quite in agreement with Dr. Baker that the possibility of the occurrence of coal depends on the existence of the Upper Lafonian (Karroo) beds in the south of East Falkland. The specimens of Cannel Coal discovered on the coast are probably broken off a deposit that occurs in some outlying shoal which is sufficiently near the surface to be affected by the force exerted by heavy seas and, being lighter than sea water, has floated on to the shore of the Colony under the influence of the south east winds. Ordinary coal might also occur under similar conditions but would not float. Such deposits are of course for all practical purposes inaccessible.

Nor are the prospects of the discovery of oil more promising. I should not go so far as Dr. Baker

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in restricting the occurrence of oil to rocks of marine origin, and I note that he qualifies his expression of opinion by the words "very frequently" Many important occurrences of oil have been attributed to the decomposition of accumulation of land plants. But in any case the absence of oil apart from some bituminous material in fissures in the similar beds in South Africa is not encouraging.

I am, &c.

(sgd) John W. Evans.

67/21

27th January,

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From Dr. J.W.Evans to
Colonial Office, 2nd Dec:
1921.

Sir,

I am directed by the Governor to enclose
a copy of a letter from Dr. J. W. Evans of
the Imperial Mineral Resources Bureau, contain-
ing his observations on your reports.

I am,

Sir,

Your obedient servant,

G. R. L. Brown,

for Colonial Secretary.

Dr. H. A. Baker, D.Sc.,
Government Geologist,
West Falkland.

MINUTE PAPER.

Departmental Number. XII.

From Government Geologist.

Date 15/3/1922.

To Hon. Col. Sec.

SUBJECT.

Forwards three copies of geological report.

Reference Numbers. }

Sir,

I have the honour to forward herewith three typewritten copies of my geological report covering the period 17/12/1921 - 31/3/1922.

I have etc.,

Herbert A. Baker

D. Sc., M. Sc., D. I. C., F. G. S., F. R. G. S.

Government Geologist.

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REPORT,

PRESENTED TO THE

COMMISSIONERS,

H. A. BAKER, D. Sc., D. I. C., F. G. S., F. R. G. S.

GEOLOGICAL INVESTIGATIONS IN THE FALKLAND ISLANDS.

GENERAL REPORT FOR THE PERIOD 17/12/1921 - 31/3/1922.

The Commission

The Honorable Members

GEOLOGICAL INVESTIGATIONS IN

1922.

THE FALKLAND ISLANDS.

General report for the period

17/12/1921 - 31/3/1922.

I have the pleasure to inform you that a report on the progress of the geological investigations in the Falkland Islands during the period 17/12/1921 - 31/3/1922 has been prepared and is submitted to you for your consideration. The report is divided into two parts, the first dealing with the general geology of the islands and the second with the detailed geological investigations in the Falkland Islands during the period 17/12/1921 - 31/3/1922. The report is divided into two parts, the first dealing with the general geology of the islands and the second with the detailed geological investigations in the Falkland Islands during the period 17/12/1921 - 31/3/1922. The report is divided into two parts, the first dealing with the general geology of the islands and the second with the detailed geological investigations in the Falkland Islands during the period 17/12/1921 - 31/3/1922.

Stanley,

Falkland Islands,

March 1922.

GEOLOGICAL INVESTIGATIONS IN THE FALKLAND ISLANDS.

General report for the period 17th Dec., 1921 to 31st Mar., 1922.

The Honourable

The Colonial Secretary

Stanley.

Sir,

I have the honour to submit herewith a report on the progress of my geological investigations in the Falkland Islands during the period 17th December 1921 to 31st March 1922.

In pursuance of the programme indicated in my last report I proceeded to West Falkland at the beginning of January, chiefly for the purpose of examining the Gondwana (Karoo or Lafonian) Beds to the eastward of Hill Cove, and if possible to map the boundary between the Devonian-Carboniferous and Permian-Carboniferous in West Falkland, in order to make my geological map as complete as possible in the time at my disposal.

I succeeded in completing the mapping of this boundary, so that, unless there be small, isolated outliers of Gondwana Beds in West Falkland and in the north-western part of East Falkland which have escaped my observation (I am now of opinion that there are no Gondwana Beds in the latter area) the geological division between the two main formations occurring in the Falklands has now been completely mapped on both islands.

The Lafonian Beds of the northern part of West Falkland occur as separate, isolated outliers, as I had suspected.

On the coast, about $4\frac{1}{2}$ miles west of Hill Cove I saw what I have long sought - the actual junction between the two main formations. The uppermost quartzitic sandstones of the older (Devonian-Carboniferous) formation are directly overlain by the Lafonian Tillite. There are no lower shaly beds. The junction was seen at the westerly termination of the Hill Cove exposure of Lafonian Beds.

I found that the Hill Cove Lafonian Beds terminate at Bull River. The beds comprise only the Lafonian Tillite and an impermanent seam of the Lafonian Sandstone which has been folded into the Tillite and thereby preserved. The coast from Bull River to Blackburn River is composed of the quartzitic sandstones of the older formation.

Along the northern side of Byron Sound a strip of Lafonian Beds (Tillite only) extends from near the mouth of Blackburn River to Sound Point. There are no Lafonian Beds on Burnt Island or Saunders Island, as I ascertained on visiting these places.

To the eastward of the head of Byron Sound there occurs an isolated, entirely inland outlier of Lafonian Beds (Tillite only). I was unable to map this outlier accurately, as it occurs in a deep valley between two ranges of high hills (one on the north and the other on the south, neither being marked on the chart) and from the valley none of the charted peaks could be seen, so that I was unable to get compass bearings. I therefore mapped the boundary of this outlier approximately, after a careful scrutiny of the ground.

The Lafonian Beds around Port Purvis are found only on the southern side. They occur as two separate outliers composed of Tillite succeeded by Lafonian Sandstone, between the Warrah River and the eastern end of Port Purvis.

The Tillite and Lafonian Sandstone of West Falkland exhibit the same features as the corresponding deposits of the eastern island. Although of scientific interest these beds are quite devoid of minerals of economic value.

I have been unable, in the time at my disposal, to make any attempt to map separate subdivisions of the Devonian-Carboniferous rocks. I should like to remark, however, that this is a profoundly difficult, if not well-nigh impossible task. An exceptionally brilliant field-geologist, devoting years to the work, might succeed, in a measure. The Devonian-Carboniferous rocks have been intensely disturbed. Isoclinal overfolding, overthrusting, repetition of beds, cutting out of beds, and complicated faulting are the features

universally shown by these rocks, save in the south of West Falkland, where, over a good stretch of country, Lower Devonian-Carboniferous rocks are seen comparatively undisturbed. These are the problems which face the luckless geological surveyor in a country where the coastal sections are for the most part inaccessible or extremely indifferent, and the inland sections conspicuous by their absence. In those parts of the Falkland Islands composed of the Devonian-Carboniferous rocks, the scenery is always the same - wild, rolling, treeless moorland, entirely covered with either coarse grass, peat, or "middle-see" (a variety of snowberry) with the ridges and peaks which are inevitably in the landscape showing gaunt grey quartzite tops and sternerun-plastered sides. The visible rocks tell the unfortunate geologist nothing fresh, and his common lot is to ride and ride, in driving rain, or shrieking wind, or both, hoping to light upon a rock-exposure in the banks of some uncharted "arroyo".

During my last tour I experienced great difficulty in securing horses and guides. It is now the busiest part of the sheep-farmers' season, and every available man and horse is fully occupied. By the time shearing and crossing are finished the winter will be here, and, to judge from my experience last year, I should then have few opportunities for field-work. As the data for my geological map are now complete, and I have accomplished all the work I had in mind when I left England, there seems no good reason why my departure from the Colony should be delayed. A good opportunity for a quick passage to England will be afforded by the "Oreoma" which is expected here early in April, and His Excellency the Governor has kindly arranged for me to take passage by that boat.

Had I been remaining longer in the Colony there would have been opportunities, at a later stage, for me to take trips in the Government Drifter, for the purpose of visiting some of the outlying islands. At the present time this vessel is fully occupied with work in connection with the protection of seals, whilst I have

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been engaged in completing my survey work inland. Frequent visits will be made to the Jason, Sea Lion and Beauchene Islands, but it is necessary to wait for suitable opportunities to land on these islands. I can learn much from an inspection of rock-samples from these places, and His Excellency has kindly arranged for Mr. J. E. Hamilton, the Government Naturalist, to secure specimens.

I have the honour to be,

Sir,

Your obedient servant,

Herbert, A. Baker,

D. Sc., M. Sc., D. I. C., F. G. S., F. R. S.

Government Geologist.

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FALKLAND ISLANDS.

No. 49.

GOVERNMENT HOUSE,

STANLEY,

24th March, 1922.

Sir,

With reference to my despatch No. 10 of the 10th of January, I have the honour to transmit a report by Dr. H. A. Baker, D.Sc., on his geological investigations for the period from December, 1921 to March, 1922.

In duplicate.

I have the honour to be,

Sir,

Your most obedient,

humble servant,

J. Middleton.

THE RIGHT HONOURABLE

W. L. S. CHURCHILL, M.P.,

SECRETARY OF STATE FOR THE COLONIES.

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67/21.

24th March,

22.

Sir,

I am directed by the Governor to express to you His Excellency's thanks for the careful and comprehensive geological survey of the Colony which you have made and for your valuable report on the guano deposits on Kidney Island.

I am,

Sir,

Your obedient servant,

H. Henniker-Heaton,

Colonial Secretary.

Dr. H. A. Baker, D.Sc.,
Government Geologist,
Stanley.