

packet 1

34290

(Reprinted from *Journal and Proceedings of the Royal Society of N. S. Wales*, Vol. XLI.)

age

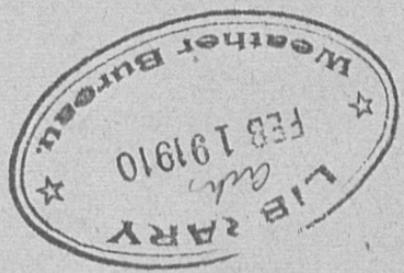
85-

THE EFFECT OF POLAR ICE ON THE WEATHER.

By E. DU FAUR, F.R.G.S.

[With Plates XIII. - XVI.]

[Read before the Royal Society of N. S. Wales, December 4, 1907.]



38290

LIBRARY

FEB 27 2008

National Oceanic &
Atmospheric Administration
U.S. Dept. of Commerce

QC
992
.D8
1907

National Oceanic and Atmospheric Administration

International Polar Year (IPY) 2007-2008

ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

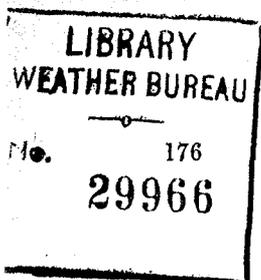
Discolored pages

Faded or light ink

Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the Climate Database Modernization Program, National Climate Data Center (NCDC). To view the original document contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or Library.Reference@noaa.gov.

HOV Services
12200 Kiln Court
Beltsville, MD 20704-1387
February 25, 2008



E. DU FAUR.

THE EFFECT OF POLAR ICE ON THE WEATHER.

By E. DU FAUR, F.R.G.S.

[With Plates XIII - XVI.]

[Read before the Royal Society of N. S. Wales, December 4, 1907.]

THE immediate incentive towards the preparation of my present paper was a sub-leader appearing in the *Evening News*, Sydney, of October last, headed 'Icebergs and Weather,' in which the writer stated:—

"There is one source of information which our meteorologists have not tapped, and that is, the weather conditions of the Antarctic Ocean. The prevalence of icebergs in the northern portion of that ocean is supposed to cause a showery summer in the south of New Zealand, followed by plentiful rains in winter, and their influence is acknowledged even in India. In the northern hemisphere, the people of Norway, who depend for their living on the tourist traffic, anticipate the value of the summer's business by the condition of the ice around Iceland. Perhaps Professor David, on his visit to the Antarctic seas, may be able to tell us something more of this important question, and whether the conditions prevailing in those regions — of which floating icebergs are symptomatic — influence our weather during the following year."

On reading this I at once furnished the editor with printed evidence that I had brought this matter before the public, first in a letter to the *Sydney Morning Herald*, of 7th February, 1881, and again more fully in a paper read by me before the Royal Geographical Society of Australasia, in September 1891, on "Antarctic Exploration." Both of these papers are so entirely out of date, that I think I am justified in repeating to a great extent my former words.

In my paper of September 1891, apart from the general subject of Antarctic exploration, and the possibility of a

revival of the whaling and fur-sealing industries in the Great Southern Ocean, by these colonies, I drew attention to "the possible effect of the varying position of floating ice and ice-fields, in that vast area, on the meteorology of the southern portion of our continent; and recorded that, on supplying the *Sydney Morning Herald*, February 7th, 1881, with a translation of a minute received from the Geographical Institute of Berne, respecting the then proposed Italian expedition, I prefaced it with a few remarks of my own, and ventured to express the opinion that:—

"It is from investigation into the sources and direction of Antarctic Oceanic currents, and into the varying disposition of Polar ice, in higher or lower latitudes, in different years, or during more lengthened periods, that we may ultimately hope to arrive at some knowledge of the laws under which our climate is directed. In the constant struggle for mastery, which we know to be carried on between the winds generated in those Polar regions, and by those causes, with equatorial and westerly winds, due to the rarification of the air from the heated surface of this vast continent, in this grand struggle between forces generated altogether beyond her limits, New South Wales must eventually look for the solution and governing laws of periodic successions of dry and moist seasons."

I went on to remark that "ten years ago, (1881) such a movement was, I supposed in advance of the times, as it received some very harmless ridicule from quite an unexpected quarter, and was dropped. But as it now (1891) appears to be more in favour, and a leading article in the *Sydney Morning Herald* of 24th April, 1891, remarked, 'that the meteorology of the Antarctic Circle may be otherwise of deeper interest to us, for there is not the least doubt that in our climatic changes we are closely linked with the meteorological and magnetic conditions of the great Polar region so close to our doors.'"

I should like to refer to some circumstances which many years previously to 1881 led me to the opinions above expressed. In the early fifties, I happened to take an

interest in the Great Circle Route, and in collating the logs of the ocean clippers, then competing for the fastest passage to Port Philip, many of which summaries were from time to time printed in the *Melbourne Age*. I have also a distinct recollection of ice-charts being occasionally published in those years, showing the varying latitudes in which ice had been encountered. (My collection of cuttings and extracts on the subject has, unfortunately, long since been lost or destroyed).

In those days the "Marco Polo," and her rivals, went into high latitudes, seldom I suppose now visited; and that was a comparatively dry period in southern Australia. Later on, in the later fifties, the obstructive ice was met with in so much lower latitudes, that Great Circle sailing was virtually abandoned, on account of the danger; and 1857 (the "Dunbar" year), and several following years formed a comparatively wet period in these colonies; and the conclusion appeared to me reasonable that, when the ice was confined to high latitudes, the northerly and westerly dry winds would have the predominance; when it encroached into lower latitudes (further north) the southerly polar winds would obtain the mastery.

If any such cyclical periods of varying position of the ice limit exist, we may for ever remain in ignorance of the great natural causes of such oscillation; but we can observe and record them for the benefit of posterity, if not for our own. Had the observations which led to the publication of the simple ice-charts of the early fifties been methodically maintained, we should now (1891) have nearly forty years record to show, and might hope to begin to know something on the subject. Unfortunately, the higher latitudes, in the parts of the Great Southern Ocean to the immediate southward of this continent, are seldom or never visited. Whalers, there, are probably unknown, and steam has

practically for ever closed the Great Circle route. Something might be done by collating the experience of homeward-bound ships rounding the Horn, but they only enter high latitudes when many degrees east of Australia; but should the present movement (1891) prove a success, and Antarctic exploration become the fashion, and commercial enterprise follow the right whale to his supposed habitat in the Antarctic ice, would it be too much to expect that a tender, or some fitting vessel of our colonial navy, (when we have one), should, say twice a year, when visiting Hobart (lat. $41\frac{1}{2}$ S.) take a dive further south for a few degrees, and record, in the same months, and on the same meridian, year by year, the limits where dangerous ice is first met. Having previously fully cited the circumstances under which Dumont d'Urville, in January 1840, left Hobart, and penetrated south for some 25 degrees, about 1750 miles, coasted for 210 miles, and returned to Hobart in seven weeks, meeting with no obstruction from land between that port and the Antarctic Circle; it might almost be said that, in these days, with steam as an auxiliary, the voyage would be reduced to less than a month's pleasure trip.

Such records supplemented by all information on the subject obtainable from mercantile and whaling vessels, would be as valuable to future generations in these colonies as a similar record for the past forty years, above referred to, would have been to ourselves.

Quoting again (still in 1891) from the leading article in the *Sydney Morning Herald*, above mentioned:—

“It may be at once admitted that such an enterprise is of the kind that does not appeal very forcibly to that class of mind which asks—what is to be the use of it? regarding any proposal which does not promise a direct return in pounds, shillings, and pence.” And speaking only as an amateur, not as an official meteorologist, my suggestion may elicit many cavils; but after

the patient investigation which our scientists have given to Lunar theories, Sun-spot theories, and other universal theories—if I may use the expression—which, if of any force, must apply equally to all parts of our globe, it does not seem too much to ask them, *as Australians*, to give a portion of their attention, and their best influence, towards carrying out a methodical and scientific investigation into the secrets and changes of the ‘gigantic refrigerator’¹ which we have ‘comparatively close to our doors,’ in constant conflict with the semitropical heated currents generated within our own continent, and into the laws and periods by which either predominating influence affects the climate of southern and eastern Australia.

The Geographical Society of Australasia might commence some useful work by endeavouring, through its kindred society in Victoria, to verify my personal recollections of earlier years; there must be records, in some of the old shipping offices in Melbourne, bearing on the subject, the early files of the *Age* would supply many a clipper’s log, and there must be enough of my contemporaries still in existence, who were interested in shipping matters in those days, to make it probable that some of the ice-charts, which I remember, might be brought to light, which would relieve us from beginning again, in these later days, with quite a clean sheet.

For many years subsequent to 1857, absence from the colonies and then the exigencies of heavy official and business life, precluded my watching and recording the trifling data bearing on the subject which the advancement of steaming versus sailing traffic left available. But the proposed Nordenskiöld Antarctic Expedition re-awakened

A refrigerator representing a circle of some 4,000 or 4,500 miles in diameter, equal to an area of some 15 or 16 millions of square miles, may fairly be called ‘gigantic.’ its northern limit extending to within 1,000 to 1,200 miles of Tasmania.

my interest in it. Also in 1888 when Mr. Egesson, working on carefully collated data as to sun-spots, promulgated his forecast that "the following three years would be years of excessive drought in Australia," I did my best to stem the scare which this caused in the pastoral industry, with which I was directly connected. Having noticed that ships, passing between the colonies and Cape Horn, had reported much ice, unusually far north, I very publicly expressed my opinion, based on my earlier observations, "that we might rather expect three years of excessive moisture," in fact, "backing ice-bergs against sun-spots." The three, even four, following years, as it happened, proved to be almost the wettest we had known. On the average, as then standing, of 49·23 inches, 1889 showed 57·26; 1890 81·42 (the maximum on record); 1891, 55·30; 1892, 69·26; in all 66·22 inches, or 16·50 inches per annum, above the previous mean at Sydney Observatory.

My views met then with no official support, the only remark I noticed was one of ridicule—"that the effect of the shifting ice, in the Southern Ocean could have no more to do with the climate of New South Wales than an ice chest in our back yard," However I could afford to wait.

I will make but one extract from recent writers to show how modern data, and the train of modern thought, leave me little to be ashamed of in my early views. The distinguished scientist Baron von Richthofen wrote, shortly before his death in 1905:—

"We can guess that the greater or less heaping up of ice round the poles may explain the changes in the climates of the world. We know, from careful observations, that the beautiful heights of our Alps already show that their ice covering is diminishing. The same thing is taking place in the Andes of Ecuador, and on Kilimanjaro—in the Arctic regions the recession of the ice has been noticed. . . . *All points to a general drying up.* It is

now an important question whether this is also the case in the Antarctic regions. Is this withdrawal observed there, or is it different from what has been observed in the North? . . . At a spot visited by Ross there were exact observations taken, they show that the ice-edge of Ross is now thirty miles further south than it was in his day, and that the glaciers of Victoria Land have gone far back. In Ross' time the glaciers reached the sea, but they no longer do so. The German Antarctic Expedition discovered traces of glacier recession on Gaussberg. It was necessary in order to determine the rapidity of this recession, to decide the present position of the ice by measurement, in order that future observers may be able to ascertain changes that have taken place in an interval of a few years. So far as we can judge, this retirement of the ice-cap is of the highest importance for future generations. Still, at any moment, changes of an opposite character may take place; and to recognise the changes certain lines are necessary, such as were fixed at Gaussberg. . . . Far seeing researches in recent years show that the changes in the distribution of ice, and the changes in the currents of the sea round Greenland have an important influence on the changes of climate in Germany. The time does not seem to be far distant when it will be possible to predict the character of the seasons months beforehand. This is only the beginning of the practical use of these researches."¹

So distinguished a scientist cannot, in his phrase—'a general drying up' have referred to any great cosmical change, such as we know to have occurred in vast geological periods. I am assured that astronomy points to nothing of the sort in the comparatively trifling era over which its accurate determinations extend. His subsequent remark that 'at any moment, changes of an opposite character may take place,' shows that he referred only to cyclical changes, of unknown period—the see-saw between accumulation and denudation of ice, the necessity for the observation of which he so strongly accentuates, in the

¹ The Geographical Journal, January 7, 1906.

interest of coming generations, as I had done a quarter of a century before.

I assume that most of you are fairly posted up in the literature of Antarctic Exploration during the last twenty years, which from time to time has been so ably summarised by Sir Clements Markham, and other Presidents of the Royal Geographical Society. Previous to this, we were restricted to the data supplied in the early part of the nineteenth century by Biscoe, Bellamy, Dumont d'Urville and Wilkes, ending with the voyages of Captain James Ross, 1841-3, which closed the early history of Antarctic exploration, and was to receive no addition for fifty years. Half a century passed, a nation had arisen in the Australian colonies, almost daily visited by vessels improved to the latest developments of naval architecture, and no longer dependent on the chance winds of heaven for clawing off a lee shore, or beating a hasty retreat from unexpected troubles, and yet it has seemed impossible to awaken any active interest in obtaining further data for our guidance. You will probably allow that I was justified twenty-seven years ago in thinking, that "if any cyclical periods of varying position of the ice-limit exist, we may for ever remain in ignorance of the great natural causes of such oscillation," but my life has been spared long enough to allow me to alter that opinion; the explorations of Lieutenant Peary, United States Navy, in Greenland have shown a gigantic ice cap of unknown depth, 1,000 to perhaps 5,000 feet, covering an area of 25,000 to 30,000 square miles; the present theory appears to be that this great mass, increased every year by successive layers of snow, where rain never falls, and snow never melts, with its superincumbent weight exercises an enormous dynamic pressure on the glaciers and ice-cliffs at its foot, forcing them out to sea in the shape of bergs, which extend some-

times to the banks of Newfoundland, when a period of comparatively equable stability intervenes until the superincumbent pressure has been renewed. Is not the same process, perhaps on a much larger scale, because on a less interrupted area, going on in our Southern Ocean? Ross' ice-barrier has been proved to be a 'floating mass,' at least five times as great below as above sea-level; its recession does not mean that it recedes, but that by pressure or possibly by volcanic action, vast masses are cut away and floated northwards by the prevailing south wind, and the edge that is left remains further back by thirty miles to what it was sixty years ago. Is this a permanent 'set back' or will the gigantic ice-cap behind, renewed by successive deposits of snow, reassert its pressure, and again drive its ice barrier to the position (or even further north) which it occupied in 1841-3?¹

But while we know that this vast withdrawal or 'recession' of the 'Ross Ice Barrier' has occurred since 1841-3, we are entirely ignorant, for lack of continuous accurate measurements, whether it may have taken place, equably, throughout the period of about sixty years, or have been the result of spasmodic efforts of pressure or volcanic agency, confined to within one or more minor portions of that period. Herein is where during almost two generations we have neglected our opportunities, and now find ourselves only on the threshold of a scientific research, in which we should have already accumulated so many valuable data.

¹ "At the South Pole lies a continent surrounded by a great ring of water; gigantic masses of tabular ice come from the continent and slowly melt. Here is a great problem with reference to the difference between the North and South Poles,"—Baron von Richthofen.

"The ice-barrier probably 1,600 feet in perpendicular height, of which 150 to 200 feet are above the sea."—Sir Clements Markham, *Geog. Journ.* November, 1899.

Capt. Scott is inclined to reduce this estimate to 1000 or 1200 feet; much would depend on the amount of earthy or saline particles in different bergs, affecting their specific gravity.

At the present stage of our enquiries it appears to me that one of the most important is, as to whether the Great Southern ice barrier consists of 'Palæocrystic ice,' *i.e.*, remains from some long distant Glacial Period, or of 'Recent Ice,' *i.e.* in constant formation varying in quantity as the deposition of snow varies from time to time, in cycles of yet unknown period.

The removal from the Ross Ice Barrier of such an almost inconceivable mass of ice as one 30 miles from north to south, and of unknown width, (but the barrier was originally estimated by Ross as 400 miles from east to west), and of probably 1,400 to 1,600 feet in thickness, and if of Palæocrystic formation, not to be renewed under the present conditions of our globe, is very startling, and tends towards Professor Richthofen's rather ominous hints of '*a* (temporary) *general drying up.*'

But this vast change in the 'Ross Ice Barrier,' almost due south of our shores or rather of New Zealand, does not perhaps, more immediately affect them; borne northwards to the Antarctic Circle, by the prevailing south winds, the drift meets the easterly current due to prevailing west winds of the Great Southern Ocean, and is carried towards the American continent, as plainly shown on our diagram. Referring to Sir Clements Markham's valuable paper in Geographical Journal of July, 1901, dividing the Antarctic regions into four quadrants:—

- No. 1 Victoria Quadrant from 90° E. to 180° W.
- „ 2 Ross Quadrant from 180° E. to 90° W.
- „ 3 Weddell Quadrant from 90° W. to 0° E.
- „ 4 Enderby Quadrant from 0° W. to 90° E.

the changes in the Ross Quadrant seem to expend their principal energies far away from our continent, and I am inclined to think that, from the selfish point of view, we should direct our main attention to the more accessible

coastal limits of the Victoria Quadrant, and part of the Enderby Quadrant; it is from these that the easterly drift bears the detached ice towards our shores.

Is there an equal, though at present less known, supply of material in those directions? About midway in the former, Bellamy, in 1839, discovered 'Sabrina Land,' a lofty mountain range covered with snow, Long. 122° E., and the Bellamy islands in Long. 165° E. Between these points Dumont d'Urville in 1840, January 20 (not three weeks out from Hobart) discovered Terra Adélie, Long. 140° E., "lofty land nearly hidden by icebergs."

January 21st, "Surrounded by icebergs, the Corvettes dwarfed by the surrounding masses, seemed to be in the narrow streets of a city of giants. . . sun shining in all its brightness."

January 27th to 30th further west he "discovered Côte Clarie, Long. 128° E., sailed along a vertical wall of ice, 100 to 150 feet high, for twelve hours, its aspects truly prodigious, could detect no land only an Ice Barrier, precipitous towards the sea. Reached the western extremity of this ice barrier trending S.W."

January 31st, "Ice barrier no longer in sight, but many ice islands. Shortly afterwards sighted barrier again to west and north-west, apparently a continuance of the former one and forming a great gulf around us, Lat. 65° 20' S., Long. 128° 21' E. Bore up for Hobart."

From the time of Dumont D'Urville (1840) we have gained little further information respecting these quadrants; they were visited by the 'Challenger' in 1874, and by the German Exploring Ship 'Valdivia' in 1898, neither of which much more than skirted the Antarctic Circle, but confirmed the existence of the Ice Barrier as far west as Long. 78° 22' E. From indications based on the isotherm of 32°, it has been supposed that d'Urville's Terre Adélie and Côte Clarie are only large islands, and that any continental land is far to the south; in fact that there is a space of 250 to 300 miles

between those indications of land near the Antarctic Circle and Victoria Land.—(Sir Clements Markham, July 1901.)

The day must come when our Commonwealth Nation must recognize its duty in assisting scientific research, at least so far as it may intimately concern its own interests. I do not refer to extensive expeditions in search of the South Pole, or the solution of general scientific problems, but of comparatively trifling expeditions from time to time of a few weeks duration, to enable scientists and others to make such records as I have referred to, for the promotion of future knowledge as to the primary causes affecting our Australian climate.

I have far exceeded the limits I had proposed to my pen on this subject, but I hope that the points which have been brought before you, selected from a large amount of accumulated data, will have been of some interest to you. We must all take the heartiest interest in the expedition about to leave New Zealand under Lieut. Shackelton, R.N., with our friend Professor David, but as it is bound for the Ross Quadrant, we cannot expect it, for reasons above given, to fulfil the hopes of the editor of the *Evening News*, to be informed "as to whether the conditions prevailing there will influence our weather during the following year." Deductions from observations to be therein made, as relating to phenomena which have occurred far away to the leeward of our meridian, can only, as I have endeavoured to explain, inferentially apply to what we may assume to be cognate phenomena taking place in 'our Antarctic Ocean' under similar influences. But we feel sure that the learned Professor, winds and weather permitting, will do valuable service to general science, in his geological researches and other scientific investigations, amongst them I hope, on the structure of palæocrystic and recent ice; in the other matter, one man on a short visit can but

be an atom where the collated evidence of observations for a century, ^{or} centuries may be required.

ADDENDUM, 1st JANUARY, 1908.

FURTHER ANTARCTIC EXPLORATION.

Mr. Du Faur has suggested, through the Tourist Bureau, and Messrs. Burns, Philp and Co., the possibility of organising a *Midsummer's Picnic Excursion* to the Antarctic Circle, at the latter end of December next, drawing attention to papers read by him before the Royal Geographical Society in 1891 and 1892, and before the Royal Society of New South Wales on 4th December last, showing the apparently little personal risk therein involved.

As the most favourable time for starting on such a cruise from Hobart would be about Christmas, returning within the first fortnight of January, 1909, he has pointed out—

1. That this would be the season when many young men could most conveniently afford an absence of three weeks from their business, and scientists from their studies.

2. That there would be time to ventilate the subject in Europe, which might induce some of our visitors to take part therein.

3. That possibly the Admiralty, and the Commonwealth Government, might be willing to arrange for one of the smaller vessels on the station to accompany, as a consort, such first expedition.

4. That the attractions to be put forward, apart from the questions of meteorological and general scientific interest, as fully discussed in the papers above referred to, would be little more than an appeal to the spirit of adventure, not yet extinct—the novelty (to those who have not visited North Cape and the Arctic Circle), of the first experience of daylight throughout the twenty four hours,

and of a glimpse of the "midnight sun," and of the glorious effects of the "Aurora Australis," possibly some sport in sealing, &c., photography of Antarctic land and ice, and the being the first to renavigate seas not visited for nearly seventy years.

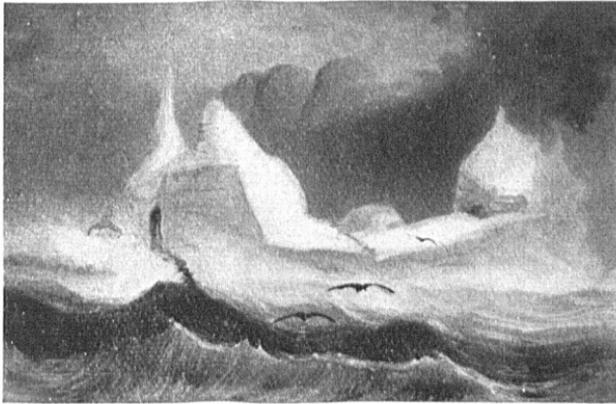
Details of the extent to which the Antarctic Circle may be followed need not, as yet, be considered. Dumont d'Urville passed along about 250 miles of it, calms much impeding his progress (in sailing vessels); from his furthest to where it was touched by H.M.S. "Challenger" in 1874, is 50° of longitude, equal to about 1400 miles, practically unexplored; the early navigators, before Dumont d'Urville, being debarred from approaching, under sail, lands which they sighted from a distance.

Should this proposal evoke any interest in the necessary quarters, a future opportunity will be taken of publicly illustrating, from the log of the "Astrolabe" (Dumont d'Urville), the daily experiences and traverses of that navigator, in the Antarctic Ocean (between 16th and 31st January, 1840), after passing through the belt of westerly winds in the lower latitudes of the Great Southern Ocean, which appear to justify the assertion that, under steam and equally favorable conditions, it may be considered as a "*Picnic Excursion.*"

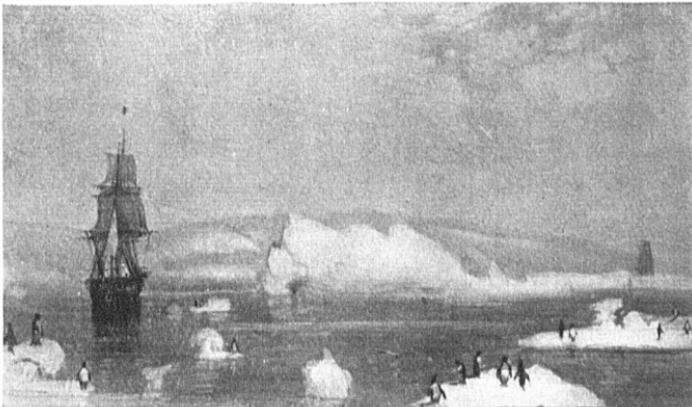
VOYAGE DE 'L'ASTROLABE,' DUMONT D'URVILLE—1840.

Reproduction of sketches taken near Antarctic Circle.

L. LE BRETON, Artist.



No. 1.—View of Ice Island, Lat. 64° S. 18th January 1840.



No. 2.—'Terre Adélie,' discovered 19th January, 1840.

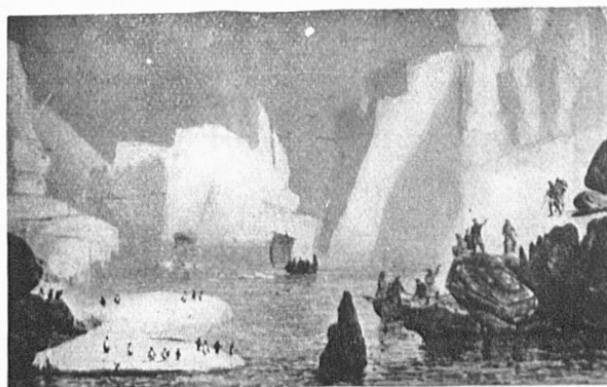
VOYAGE DE 'L'ASTROLABE,' DUMONT D'URVILLE—1840.

Reproduction of sketches taken near Antarctic Circle.

L. LE BRETON, Artist.



No. 3.—Ice Barrier off 'Terre Adélie,' 20th January, 1840.



No. 4.—Disembarcation on 'Terre Adélie,' 21st January, 1840.

VOYAGE DE 'L'ASTROLABE,' 1840.



No. 5.—Taking possession of 'Terre Adélie,' 21st January, 1840.



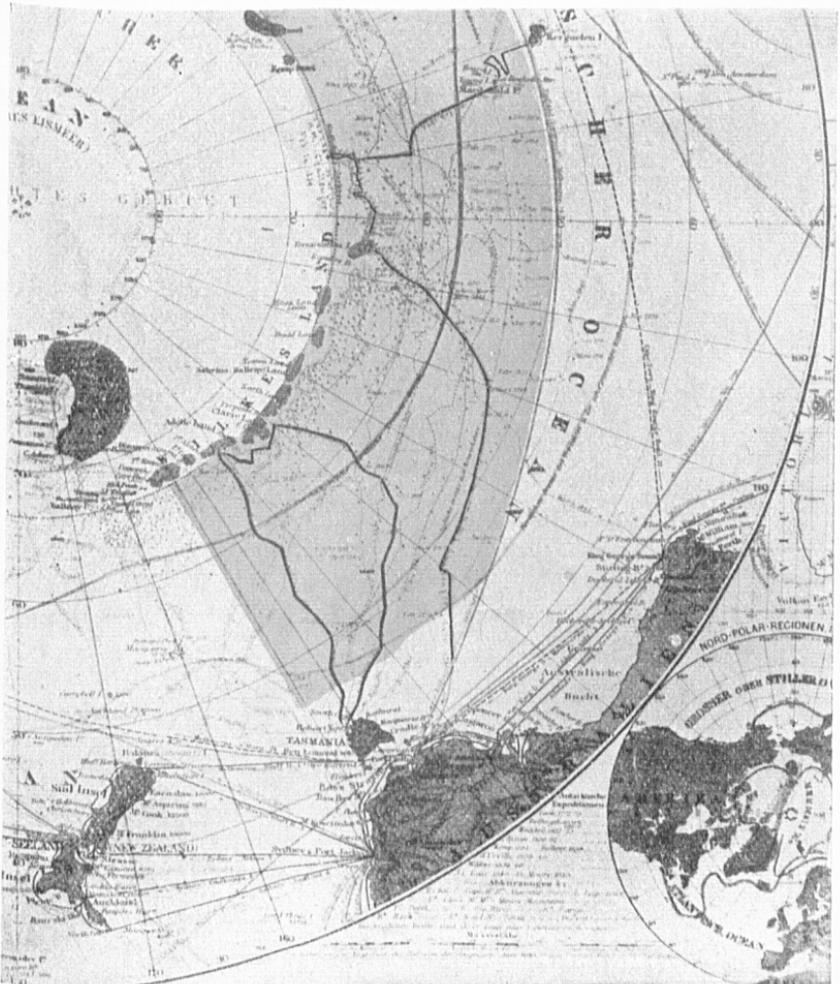
No. 6. - A heavy squall amongst ice, 23rd January, 1840.



No. 7.—Discovery of 'Côte Clarie,' 26th January, 1840.

VOYAGE DE 'L'ASTROLABE,' DUMONT D'URVILLE, 1840.

Map showing the Victoria Quadrant of the Antarctic Circle, reduced from the 'Sud Polar Karte,' by Von A. Petermann.



Portion tinted blue shows an area of about 5½ million of square miles of the Great Southern Ocean, which has virtually never been traversed since Dumont d'Urville's voyage in 1840. (Partially visited by H.M.S. 'Challenger' in 1874.)

The tracks of the 'Astrolabe' and the 'Challenger,' and also of such vessels as pass south of Kerguelen's Land, are shown by firm dark lines.

Part of 29966.

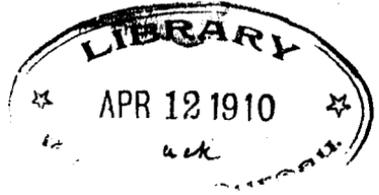
"THE EFFECT OF POLAR ICE ON THE WEATHER,"

By E. DU FAUR, F.R.G.S.

[Read before the Royal Society of N. S. Wales, December 4, 1907.]

Further Addenda to the above 1910.





FURTHER ADDENDA

TO PAPER ON

“THE EFFECT OF POLAR ICE ON THE WEATHER,”

By E. DU FAUR, F.R.G.S.

At the time of originally writing the above paper, I was not aware that the “Nimrod” Expedition would touch at Sydney outward-bound; it had been set down for reading on 4th December, when it was suddenly decided that the “Nimrod” would come here in a few days. I endeavoured to have it temporarily withdrawn from the agenda, which proved to be impracticable. I amended a few of the later paragraphs to meet the circumstances; but being followed in a few days, by the enthusiastic reception given to Lieut. Shackleton and Professor David, and public interest being centered on the floating of the British flag at the South Pole, the paper of course remained unnoticed.

My enclosed papers show that, during a long life in Australia, 54 years, I have taken a close interest in its meteorology, and that, in the question of Antarctic Exploration, I ventured as early as in 1881,¹ to express my opinions in the public press thereon; again in 1891,² in a paper read before the Royal Geographical Society of Australia, after recapitulating the main points of earlier expeditions, and my previous remarks, I endeavoured to excite the public interest in prosecuting such researches further, by occasional visits to the ice lands nearest to our coasts, a work involving comparatively little danger and expense, thus providing a progressive record of the varying conditions,

¹ *S. M. Herald* 7/2/81. ² Proceedings Vol. v, No. 1, 21, 27, with map.

and state of the ice in those parts of the Antarctic Ocean, presumedly most affecting our climate. About the same time, I reported to the same Society¹ that I had appealed to a leading steamship company, as to the possibility of carrying out the same project through them, with the assistance of a few scientific friends, but it came to nothing. Finally on 4th December, 1907, I recapitulated my former papers before the Royal Society of New South Wales, as first above related, but particularly insisted that the enormous extrusion (not recession) of ice from Ross' Sea, amounting to billions² (English) of tons since 1842, could not practically affect our climate, as, borne northwards to the Antarctic Circle by prevailing south winds, the drift reaches the easterly current due to prevailing westerly winds in the Great Southern Ocean to the eastward even of New Zealand—2,000 miles to leeward of Australia—and against 2,000 miles of "The brave west winds in the roaring forties," no effect from even a continent of ice could be reflected back to our shores.

Now there can be no doubt that there exists a barrier of equal importance to that of Ross, and probably of far greater length, comparatively close to, and to the westward of Australia, along the Antarctic Circle, from which, inferentially, as great an extrusion of ice has taken place, but, somewhat to our disgrace, the investigation of which has been neglected for the last half century.

In our maps and ice-berg charts, every iceberg shown represents a ship's observation. Between Cape Horn and

¹ *Loc. cit.*, No. 6, Sept. 1891, 139, 143,

² Say 300 miles long, in lieu of Ross' 450 miles

30 miles broad, amount of extrusion of ice (Scott)

$5/9000$ square miles \div 1150 feet depth— $\frac{1}{2}$ th of a mile (estimated by Sir C. Markham at 1600 feet; by Capt. Scott at 1000 to 1200 feet) 1800 cubic miles extruded since 1842 (Scott). One cubic mile=147,197,952,000 cubic feet \times by 1800 \div by 38 (cubic feet in one ton of ice) gives nearly 7 billions (English) of tons extruded.

the Bluff, New Zealand, ships are compelled to navigate a course between 56° and $47\frac{1}{2}^{\circ}$ S. Lat., and between Cape Horn towards Cape Leuwin, between 56° and 46° S. Lat. as far as the 60th meridian; therefore those parts of the Great Southern Ocean are shown as studded with icebergs, observed by innumerable ships. But, from Kerguelen's Land to the eastermost meridian of Australia, from Lat. 50° to the Antarctic Circle, that enormous waste of waters, containing some six millions of square miles south of about Lat. 50° , has virtually never been traversed, since the days of Wilkes, Dumont d'Urville and Ross, except by H.M.S. "Challenger" in 1874, on whose course icebergs are shown from the Antarctic Circle to about 50° S. Lat.; that is, in the 70 years which have elapsed from the date of those early explorers, no other ships have passed, and no icebergs have been recorded, and the casual inspector of such maps infers that no ice exists in those waters. But we have records of exceptional seasons, when very heavy ice has advanced within a few hundred miles of Cape Leuwin, while generally it appears not to extend northward beyond Lat. 45° . In what appears to have been an exceptional season, January 1840, d'Urville seems to have encountered no dangerous ice until nearing the Antarctic Circle in Lat. 64° S., (see Sketch No. 1 in Pamphlet) while in 1874 H.M.S. "Challenger" carried it as far north as Lat. 45° , as stated above.

Recently, in May 1904, we had reported a sensational account of enormous masses of ice freed further west, encountered by ship "Maletta" fourteen days after leaving La Plata. She sailed for 343 miles through ice surrounded by bergs some estimated at 600 feet high? This in a comparatively low latitude showing that, probably by some cataclysm, unusually enormous masses had been freed, to join further eastward, in the easterly current, the general

aggregation of ice eastward of Kerguelen's Land, passing through unknown seas to the southward of our continent.

The area tinted blue on accompanying map¹ shows the "waste of waters," virtually unexplored since 1842, extending westward to "Enderby Land," in all for 90° of Longitude; the ice in which, drifting north into the easterly current to the *windward* of Australia is melted, except in exceptional seasons, between 50° and 45° S. Lat., and is therefore never observed. This is the "gigantic refrigerator comparatively close to our shores," referred to in my paper of 1891 above quoted, by which I have contended for so many years, that our climate is affected more or less, as it extends further north towards our shores or is restricted to more southern limits, and it is to this quadrant (parts of the "Victoria" and "Enderby" quadrants), that I have so repeatedly endeavoured to draw attention, not only as affecting the direct practical question of Australian weather and its forecasts, but as containing problems of great geographical and scientific interest, the solution of which still lies before us.

The glamour of floating the first flag at the axial pole has influenced the collection of noble contributions from time to time for the purpose of following mainly in the steps of Ross, in that direction some half dozen expensive expeditions have so followed them in recent years, and that of Sir Ernest H. Shackleton has solved all the difficulties of reaching that point, and apparently settled the question of the position of the Pole on a land plateau. The failure in the achievement of his full expectations was due solely to an under-estimate of the number of food depôts required. Another forty or fifty thousand pounds are to be spent in following in his tracks and bridging the few miles of which he was obliged to forego the traverse; and barring the

¹ "Effect of Polar Ice on the Weather," Plate xvi.

Possibility of an exceptionally bad season, this would appear apart from a very large amount of important scientific work proposed to be carried out at Ross' Barrier and elsewhere, to be almost "a walk over," if, profiting by his experience, a few more depôts are established on the road. Few will place Sir Ernest and his gallant party second to those who finally hoist the flag on his objective. His and their pluck and endurance solved all the problems of real importance in traversing for 400 miles unknown dangers and untrodden wastes, and thus securing the success of those who follow in their footsteps with a larger supply of food.

The Magnetic Pole.—The axial pole may be considered virtually, though not absolutely, as a fixed point. Once accurately determined, its position will serve, at any rate, for a few hundreds of years. But with the magnetic pole it is not so. In the northern hemisphere it has been determined that its declination librates between $11^{\circ} 20'$ E. and $24^{\circ} 30'$ W. = $35^{\circ} 50'$, while the corresponding secular change in the dip = about 4° ; that is, it librates in an ellipse of which the major or longitudinal axis is $35^{\circ} 50'$, and the minor or latitudinal axis is about 4° , while the whole libration each way occupies about 240 years, with an annual variation of $7'$ in the one case, and about $1.5'$ in the other; (See the well-known diagram prepared by Dr. L. A. Bauer) and it is supposed that the magnetic axis of the earth is rotating round the geographical axis in a direction opposite to that of the earth's rotation. For the present it may be assumed that the south magnetic pole is subject to a similar libration, and *an equal one if the earth may be considered as a true magnet*, but in reverse directions. This assumption is borne out so far as our limited data for computation allow.

The early navigators, such as Wilkes, d'Urville, Ross and Moore, appear to have generally determined their crossings

of the meridian of no variation about or between Terre Adélie and Côte Chairée, in about 145° E. Long., but varied in their estimates as to distance south at which the pole should be located; Ross' determination of it was 76° S. Lat. and $145^{\circ} 20'$ E. Long. (Imperial Dictionary). Of the more recent observers

Gauss, by theory, locates it about $72^{\circ} 15'$ S. Lat. 152° E. Long.

Chetwynd ("Discovery") ... $72^{\circ} 51'$,, 156° ,,

David ("Nimrod") $72^{\circ} 25'$,, $155^{\circ} 16'$,,

If these premises are confirmed by closer investigation into the data than I am able to make, (having been prevented by illness for some months past from consulting any library but my own), it will be abundantly proved that the secular declination librates in an ellipse, as in the northern hemisphere—though Chetwynd's estimate of an annual progress of $26'$ in lieu of $7'$ is startling—it will also appear that some time previously to the observations on the "Discovery," or at about that time, the libration had reached its extreme eastern limit, and Professor David's observation showed that it was returning on its westward track.

Now should a permanent meteorological observatory (not for permanent occupation but for visitations from time to time by scientists), be ever erected, it is manifest that there would be no object in locating it at the vagrant magnetic pole, which in four years, would have shifted $\frac{1}{2}^{\circ}$ from it, or according to Chetwynd $1\frac{1}{4}^{\circ}$; any suitable spot, preferably within the ellipse referred to, which in future years that pole would approach, pass over, pass by, and return to, would meet the requirements of the case, and as our data increase its position at any time could be ascertained by computation, but it must be as far as possible to the westward, i.e. to windward of Australia, if observations on its climate are to be of real service to that continent.

As the scientists of the United States of America appear to be turning their attention towards this neglected quadrant, their first work would necessarily be to prove whether the lands already known to exist more or less along the Antarctic Circle, from Enderby's Land to Terre Adélie are insular or continental, and if shown to be the former, as to amount of sea between them and the mainland. In the course of such investigations, the possibilities of finding some such suitable locations seem to be great, and if successful, my thirty years of interest and work in the matter will not have been thrown away.

E. DU FAUR.

Turrumurra, New South Wales,
January 1910.

THE EFFECT OF POLAR ICE ON THE WEATHER.

THE EFFECT OF POLAR ICE ON THE WEATHER.

By E. DU FAUR, F.R.G.S.

[With Plates XIII. - XVI.]

[Read before the Royal Society of N. S. Wales, December 4, 1907.]

THE immediate incentive towards the preparation of my present paper was a sub-leader appearing in the *Evening News*, Sydney, of October last, headed 'Icebergs and Weather,' in which the writer stated:—

"There is one source of information which our meteorologists have not tapped, and that is, the weather conditions of the Antarctic Ocean. The prevalence of icebergs in the northern portion of that ocean is supposed to cause a showery summer in the south of New Zealand, followed by plentiful rains in winter, and their influence is acknowledged even in India. In the northern hemisphere, the people of Norway, who depend for their living on the tourist traffic, anticipate the value of the summer's business by the condition of the ice around Iceland. Perhaps Professor David, on his visit to the Antarctic seas, may be able to tell us something more of this important question, and whether the conditions prevailing in those regions—of which floating icebergs are symptomatic—influence our weather during the following year."

On reading this I at once furnished the editor with printed evidence that I had brought this matter before the public, first in a letter to the *Sydney Morning Herald*, of 7th February, 1881, and again more fully in a paper read by me before the Royal Geographical Society of Australasia, in September 1891, on "Antarctic Exploration." Both of these papers are so entirely out of date, that I think I am justified in repeating to a great extent my former words.

In my paper of September 1891, apart from the general subject of Antarctic exploration, and the possibility of a

revival of the whaling and fur-sealing industries in the Great Southern Ocean, by these colonies, I drew attention to "the possible effect of the varying position of floating ice and ice-fields, in that vast area, on the meteorology of the southern portion of our continent; and recorded that, on supplying the *Sydney Morning Herald*, February 7th, 1881, with a translation of a minute received from the Geographical Institute of Berne, respecting the then proposed Italian expedition, I prefaced it with a few remarks of my own, and ventured to express the opinion that:—

"It is from investigation into the sources and direction of Antarctic Ocean currents, and into the varying disposition of Polar ice, in higher or lower latitudes, in different years, or during more lengthened periods, that we may ultimately hope to arrive at some knowledge of the laws under which our climate is directed. In the constant struggle for mastery, which we know to be carried on between the winds generated in those Polar regions, and by those causes, with equatorial and westerly winds, due to the rarification of the air from the heated surface of this vast continent, in this grand struggle between forces generated altogether beyond her limits, New South Wales must eventually look for the solution and governing laws of periodic succession of dry and moist seasons."

I went on to remark that "ten years ago, (1881) such a movement was, I supposed in advance of the times, as it received some very harmless ridicule from quite an unexpected quarter, and was dropped. But as it now (1891) appears to be more in favour, and a leading article in the *Sydney Morning Herald* of 24th April, 1891, remarked, 'that the meteorology of the Antarctic Circle may be otherwise of deeper interest to us, for there is not the least doubt that in our climatic changes we are closely linked with the meteorological and magnetic conditions of the great Polar region so close to our doors.'"

I should like to refer to some circumstances which many years previously to 1881 led me to the opinions above expressed. In the early fifties, I happened to take an

interest in the Great Circle Route, and in collating the logs of the ocean clippers, then competing for the fastest passage to Port Philip, many of which summaries were from time to time printed in the *Melbourne Age*. I have also a distinct recollection of ice-charts being occasionally published in those years, showing the varying latitudes in which ice had been encountered. (My collection of cuttings and extracts on the subject has, unfortunately, long since been lost or destroyed).

In those days the "Marco Polo," and her rivals, went into high latitudes, seldom I suppose now visited; and that was a comparatively dry period in southern Australia. Later on, in the later fifties, the obstructive ice was met with in so much lower latitudes, that Great Circle sailing was virtually abandoned, on account of the danger; and 1857 (the "Dunbar" year), and several following years formed a comparatively wet period in these colonies; and the conclusion appeared to me reasonable that, when the ice was confined to high latitudes, the northerly and westerly dry winds would have the predominance; when it encroached into lower latitudes (further north) the southerly polar winds would obtain the mastery.

If any such cyclical periods of varying position of the ice limit exist, we may for ever remain in ignorance of the great natural causes of such oscillation; but we can observe and record them for the benefit of posterity, if not for our own. Had the observations which led to the publication of the simple ice-charts of the early fifties been methodically maintained, we should now (1891) have nearly forty years record to show, and might hope to begin to know something on the subject. Unfortunately, the higher latitudes, in the parts of the Great Southern Ocean to the immediate southward of this continent, are seldom or never visited. Whalers, there, are probably unknown, and steam has

practically for ever closed the Great Circle route. Something might be done by collating the experience of homeward-bound ships rounding the Horn, but they only enter high latitudes when many degrees east of Australia; but should the present movement (1891) prove a success, and Antarctic exploration become the fashion, and commercial enterprise follow the right whale to his supposed habitat in the Antarctic ice, would it be too much to expect that a tender, or some fitting vessel of our colonial navy, (when we have one), should, say twice a year, when visiting Hobart (lat. $41\frac{1}{2}$ S.) take a dive further south for a few degrees, and record, in the same months, and on the same meridian, year by year, the limits where dangerous ice is first met. Having previously fully cited the circumstances under which Dumont d'Urville, in January 1840, left Hobart, and penetrated south for some 25 degrees, about 1750 miles, coasted for 210 miles, and returned to Hobart in seven weeks, meeting with no obstruction from land between that port and the Antarctic Circle; it might almost be said that, in these days, with steam as an auxiliary, the voyage would be reduced to less than a month's pleasure trip.

Such records supplemented by all information on the subject obtainable from mercantile and whaling vessels, would be as valuable to future generations in these colonies as a similar record for the past forty years, above referred to, would have been to ourselves.

Quoting again (still in 1891) from the leading article in the *Sydney Morning Herald*, above mentioned:—

“It may be at once admitted that such an enterprise is of the kind that does not appeal very forcibly to that class of mind which asks—what is to be the use of it? regarding any proposal which does not promise a direct return in pounds, shillings, and pence.”

And speaking only as an amateur, not as an official meteorologist, my suggestion may elicit many cavils; but after

the patient investigation which our scientists have given to Lunar theories, Sun-spot theories, and other universal theories—if I may use the expression—which, if of any force, must apply equally to all parts of our globe, it does not seem too much to ask them, *as Australians*, to give a portion of their attention, and their best influence, towards carrying out a methodical and scientific investigation into the secrets and changes of the ‘gigantic refrigerator’¹ which we have ‘comparatively close to our doors,’ in constant conflict with the semitropical heated currents generated within our own continent, and into the laws and periods by which either predominating influence affects the climate of southern and eastern Australia.

The Geographical Society of Australasia might commence some useful work by endeavouring, through its kindred society in Victoria, to verify my personal recollections of earlier years; there must be records, in some of the old shipping offices in Melbourne, bearing on the subject, the early files of the *Age* would supply many a clipper’s log, and there must be enough of my contemporaries still in existence, who were interested in shipping matters in those days, to make it probable that some of the ice-charts, which I remember, might be brought to light, which would relieve us from beginning again, in these later days, with quite a clean sheet.

For many years subsequent to 1857, absence from the colonies and then the exigencies of heavy official and business life, precluded my watching and recording the trifling data bearing on the subject which the advancement of steaming versus sailing traffic left available. But the proposed Nordenskiöld Antarctic Expedition re-awakened

¹ A refrigerator representing a circle of some 4,000 or 4,500 miles in diameter, equal to an area of some 15 or 16 millions of square miles, may fairly be called ‘gigantic,’ its northern limit extending to within 1,000 to 1,200 miles of Tasmania.

my interest in it. Also in 1888 when Mr. Egeson, working on carefully collated data as to sun-spots, promulgated his forecast that "the following three years would be years of excessive drought in Australia," I did my best to stem the scare which this caused in the pastoral industry, with which I was directly connected. Having noticed that ships, passing between the colonies and Cape Horn, had reported much ice, unusually far north, I very publicly expressed my opinion, based on my earlier observations, "that we might rather expect three years of excessive moisture," in fact, "backing ice-bergs against sun-spots." The three, even four, following years, as it happened, proved to be almost the wettest we had known. On the average, as then standing, of 49·23 inches, 1889 showed 57·26; 1890 81·42 (the maximum on record); 1891, 55·30; 1892, 69·26; in all 66·22 inches, or 16·50 inches per annum, above the previous mean at Sydney Observatory.

My views met then with no official support, the only remark I noticed was one of ridicule—"that the effect of the shifting ice, in the Southern Ocean could have no more to do with the climate of New South Wales than an ice chest in our back yard." However I could afford to wait.

I will make but one extract from recent writers to show how modern data, and the train of modern thought, leave me little to be ashamed of in my early views. The distinguished scientist Baron von Richthofen wrote, shortly before his death in 1905:—

"We can guess that the greater or less heaping up of ice round the poles may explain the changes in the climates of the world. We know, from careful observations, that the beautiful heights of our Alps already show that their ice covering is diminishing. The same thing is taking place in the Andes of Ecuador, and on Kilimanjaro—in the Arctic regions the recession of the ice has been noticed. . . . *All points to a general drying up.* It is

now an important question whether this is also the case in the Antarctic regions. Is this withdrawal observed there, or is it different from what has been observed in the North? . . . At a spot visited by Ross there were exact observations taken, they show that the ice-edge of Ross is now thirty miles further south than it was in his day, and that the glaciers of Victoria Land have gone far back. In Ross' time the glaciers reached the sea, but they no longer do so. The German Antarctic Expedition discovered traces of glacier recession on Gaussberg. It was necessary in order to determine the rapidity of this recession, to decide the present position of the ice by measurement, in order that future observers may be able to ascertain changes that have taken place in an interval of a few years. So far as we can judge, this retirement of the ice-cap is of the highest importance for future generations. Still, at any moment, changes of an opposite character may take place; and to recognise the changes certain lines are necessary, such as were fixed at Gaussberg. . . . Far seeing researches in recent years show that the changes in the distribution of ice, and the changes in the currents of the sea round Greenland have an important influence on the changes of climate in Germany. The time does not seem to be far distant when it will be possible to predict the character of the seasons months beforehand. This is only the beginning of the practical use of these researches."¹

So distinguished a scientist cannot, in his phrase—'a general drying up' have referred to any great cosmical change, such as we know to have occurred in vast geological periods. I am assured that astronomy points to nothing of the sort in the comparatively trifling era over which its accurate determinations extend. His subsequent remark that 'at any moment, changes of an opposite character may take place,' shows that he referred only to cyclical changes, of unknown period—the see-saw between accumulation and denudation of ice, the necessity for the observation of which he so strongly accentuates, in the

¹ The Geographical Journal, January 7, 1906.

interest of coming generations, as I had done a quarter of a century before.

I assume that most of you are fairly posted up in the literature of Antarctic Exploration during the last twenty years, which from time to time has been so ably summarised by Sir Clements Markham, and other Presidents of the Royal Geographical Society. Previous to this, we were restricted to the data supplied in the early part of the nineteenth century by Biscoe, Bellamy, Dumont d'Urville and Wilkes, ending with the voyages of Captain James Ross, 1841-3, which closed the early history of Antarctic exploration, and was to receive no addition for fifty years. Half a century passed, a nation had arisen in the Australian colonies, almost daily visited by vessels improved to the latest developments of naval architecture, and no longer dependent on the chance winds of heaven for clawing off a lee shore, or beating a hasty retreat from unexpected troubles, and yet it has seemed impossible to awaken any active interest in obtaining further data for our guidance. You will probably allow that I was justified twenty-seven years ago in thinking, that "if any cyclical periods of varying position of the ice-limit exist, we may for ever remain in ignorance of the great natural causes of such oscillation," but my life has been spared long enough to allow me to alter that opinion; the explorations of Lieutenant Peary, United States Navy, in Greenland have shown a gigantic ice cap of unknown depth, 1,000 to perhaps 5,000 feet, covering an area of 25,000 to 30,000 square miles; the present theory appears to be that this great mass, increased every year by successive layers of snow, where rain never falls, and snow never melts, with its superincumbent weight exercises an enormous dynamic pressure on the glaciers and ice-cliffs at its foot, forcing them out to sea in the shape of bergs, which extend some-

times to the banks of Newfoundland, when a period of comparatively equable stability intervenes until the superincumbent pressure has been renewed. Is not the same process, perhaps on a much larger scale, because on a less interrupted area, going on in our Southern Ocean? Ross' ice-barrier has been proved to be a 'floating mass,' at least five times as great below as above sea-level; its recession does not mean that it recedes, but that by pressure or possibly by volcanic action, vast masses are cut away and floated northwards by the prevailing south wind, and the edge that is left remains further back by thirty miles to what it was sixty years ago. Is this a permanent 'set back' or will the gigantic ice-cap behind, renewed by successive deposits of snow, reassert its pressure, and again drive its ice barrier to the position (or even further north) which it occupied in 1841-3?¹

But while we know that this vast withdrawal or 'recession' of the 'Ross Ice Barrier' has occurred since 1841-3, we are entirely ignorant, for lack of continuous accurate measurements, whether it may have taken place, equably, throughout the period of about sixty years, or have been the result of spasmodic efforts of pressure or volcanic agency, confined to within one or more minor portions of that period. Herein is where during almost two generations we have neglected our opportunities, and now find ourselves only on the threshold of a scientific research, in which we should have already accumulated so many valuable data.

¹ "At the South Pole lies a continent surrounded by a great ring of water; gigantic masses of tabular ice come from the continent and slowly melt. Here is a great problem with reference to the difference between the North and South Poles."—Baron von Richthofen.

"The ice-barrier probably 1,600 feet in perpendicular height, of which 150 to 200 feet are above the sea."—Sir Clements Markham, *Geog. Journ.* November, 1899.

Capt. Scott is inclined to reduce this estimate to 1000 or 1200 feet; much would depend on the amount of earthy or saline particles in different bergs, affecting their specific gravity.

At the present stage of our enquiries it appears to me that one of the most important is, as to whether the Great Southern ice barrier consists of 'Palæocrystic ice,' *i.e.*, remains from some long distant Glacial Period, or of 'Recent Ice, *i.e.* in constant formation varying in quantity as the deposition of snow varies from time to time, in cycles of yet unknown period.

The removal from the Ross Ice Barrier of such an almost inconceivable mass of ice as one 30 miles from north to south, and of unknown width, (but the barrier was originally estimated by Ross as 400 miles from east to west), and of probably 1,400 to 1,600 feet in thickness, and if of Palæocrystic formation, not to be renewed under the present conditions of our globe, is very startling, and tends towards Professor Richthofen's rather ominous hints of '*a* (temporary) *general drying up.*'

But this vast change in the 'Ross Ice Barrier,' almost due south of our shores or rather of New Zealand, does not perhaps, more immediately affect them; borne northwards to the Antarctic Circle, by the prevailing south winds, the drift meets the easterly current due to prevailing west winds of the Great Southern Ocean, and is carried towards the American continent, as plainly shown on our diagram. Referring to Sir Clements Markham's valuable paper in Geographical Journal of July, 1901, dividing the Antarctic regions into four quadrants:—

- No. 1 Victoria Quadrant from 90° E. to 180° W.
- „ 2 Ross Quadrant from 180° E. to 90° W.
- „ 3 Weddell Quadrant from 90° W. to 0° E.
- „ 4 Enderby Quadrant from 0° W. to 90° E.

the changes in the Ross Quadrant seem to expend their principal energies far away from our continent, and I am inclined to think that, from the selfish point of view, we should direct our main attention to the more accessible

coastal limits of the Victoria Quadrant, and part of the Enderby Quadrant; it is from these that the easterly drift bears the detached ice towards our shores.

Is there an equal, though at present less known, supply of material in those directions? About midway in the former, Bellamy, in 1839, discovered 'Sabrina Land,' a lofty mountain range covered with snow, Long. 122° E., and the Bellamy islands in Long. 165° E. Between these points Dumont d'Urville in 1840, January 20 (not three weeks out from Hobart) discovered Terra Adélie, Long. 140° E., "lofty land nearly hidden by icebergs."

January 21st, "Surrounded by icebergs, the Corvettes dwarfed by the surrounding masses, seemed to be in the narrow streets of a city of giants. . . sun shining in all its brightness."

January 27th to 30th further west he "discovered Côte Clarie, Long. 128° E., sailed along a vertical wall of ice, 100 to 150 feet high, for twelve hours, its aspects truly prodigious, could detect no land only an Ice Barrier, precipitous towards the sea. Reached the western extremity of this ice barrier trending S.W."

January 31st, "Ice barrier no longer in sight, but many ice islands. Shortly afterwards sighted barrier again to west and north-west, apparently a continuance of the former one and forming a great gulf around us, Lat. 65° 20' S., Long. 128° 21' E. Bore up for Hobart."

From the time of Dumont D'Urville (1840) we have gained little further information respecting these quadrants; they were visited by the 'Challenger' in 1874, and by the German Exploring Ship 'Valdivia' in 1898, neither of which much more than skirted the Antarctic Circle, but confirmed the existence of the Ice Barrier as far west as Long. 78° 22' E. From indications based on the isotherm of 32° it has been supposed that d'Urville's Terre Adélie and Côte Clarie are only large islands, and that any continental land is far to the south; in fact that there is a space of 250 to 300 miles

between those indications of land near the Antarctic Circle and Victoria Land.—(Sir Clements Markham, July 1901.)

The day must come when our Commonwealth Nation must recognize its duty in assisting scientific research, at least so far as it may intimately concern its own interests. I do not refer to extensive expeditions in search of the South Pole, or the solution of general scientific problems, but of comparatively trifling expeditions from time to time of a few weeks duration, to enable scientists and others to make such records as I have referred to, for the promotion of future knowledge as to the primary causes affecting our Australian climate.

I have far exceeded the limits I had proposed to my pen on this subject, but I hope that the points which have been brought before you, selected from a large amount of accumulated data, will have been of some interest to you. We must all take the heartiest interest in the expedition about to leave New Zealand under Lieut. Shackelton, R.N., with our friend Professor David, but as it is bound for the Ross Quadrant, we cannot expect it, for reasons above given, to fulfil the hopes of the editor of the *Evening News*, to be informed "as to whether the conditions prevailing there will influence our weather during the following year." Deductions from observations to be therein made, as relating to phenomena which have occurred far away to the leeward of our meridian, can only, as I have endeavoured to explain, inferentially apply to what we may assume to be cognate phenomena taking place in 'our Antarctic Ocean' under similar influences. But we feel sure that the learned Professor, wind and weather permitting, will do valuable service to general science, in his geological researches and other scientific investigations, amongst them I hope, on the structure of palæocrystic and recent ice; in the other matter, one man on a short visit can but

be an atom where the collated evidence of observations for a century or centuries may be required.

ADDENDUM, 1st JANUARY, 1908.

FURTHER ANTARCTIC EXPLORATION.

Mr. Du Faur has suggested, through the Tourist Bureau, and Messrs. Burns, Philp and Co., the possibility of organising a *Midsummer's Picnic Excursion* to the Antarctic Circle, at the latter end of December next, drawing attention to papers read by him before the Royal Geographical Society in 1891 and 1892, and before the Royal Society of New South Wales on 4th December last, showing the apparently little personal risk therein involved.

As the most favourable time for starting on such a cruise from Hobart would be about Christmas, returning within the first fortnight of January, 1909, he has pointed out—

1. That this would be the season when many young men could most conveniently afford an absence of three weeks from their business, and scientists from their studies.

2. That there would be time to ventilate the subject in Europe, which might induce some of our visitors to take part therein.

3. That possibly the Admiralty, and the Commonwealth Government, might be willing to arrange for one of the smaller vessels on the station to accompany, as a consort, such first expedition.

4. That the attractions to be put forward, apart from the questions of meteorological and general scientific interest, as fully discussed in the papers above referred to, would be little more than an appeal to the spirit of adventure, not yet extinct—the novelty (to those who have not visited North Cape and the Arctic Circle), of the first experience of daylight throughout the twenty four hours,

and of a glimpse of the "midnight sun," and of the glorious effects of the "Aurora Australis," possibly some sport in sealing, etc., photography of Antarctic land and ice, and the being the first to renavigate seas not visited for nearly seventy years.

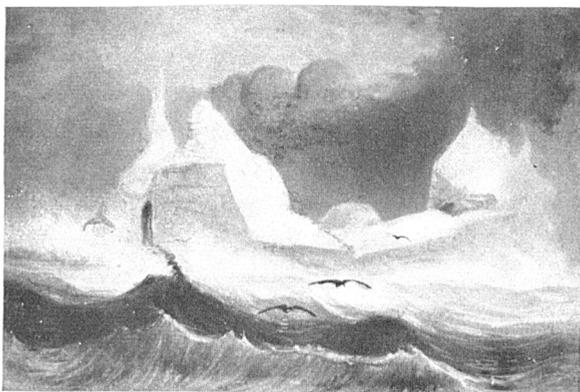
Details of the extent to which the Antarctic Circle may be followed need not, as yet, be considered. Dumont d'Urville passed along about 250 miles of it, calms much impeding his progress (in sailing vessels); from his furthest to where it was touched by H.M.S. "Challenger" in 1874, is 50° of longitude, equal to about 1400 miles, practically unexplored; the early navigators, before Dumont d'Urville, being debarred from approaching, under sail, lands which they sighted from a distance.

Should this proposal evoke any interest in the necessary quarters, a future opportunity will be taken of publicly illustrating, from the log of the "Astrolabe" (Dumont d'Urville), the daily experiences and traverses of that navigator, in the Arctic Ocean (between 16th and 31st January, 1840), after passing through the belt of westerly winds in the lower latitudes of the Great Southern Ocean, which appear to justify the assertion that, under steam and equally favorable conditions, it may be considered as a "*Picnic Excursion.*"

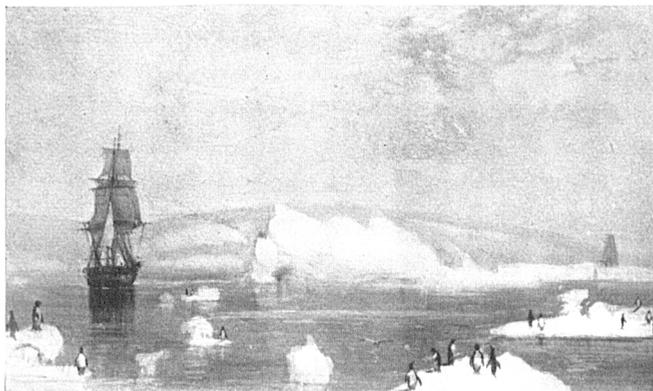
VOYAGE DE 'L'ASTROLABE,' DUMONT D'URVILLE—1840.

Reproduction of Sketches taken near Antarctic Circle.

L. LE BRETON, Artist.



No. 1.—View of Ice Island, Lat. 64° S. 18th January 1840.

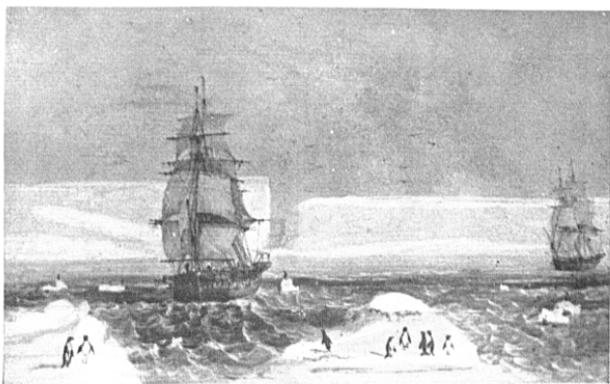


No. 2.—'Terre Adélie,' discovered 19th January, 1840.

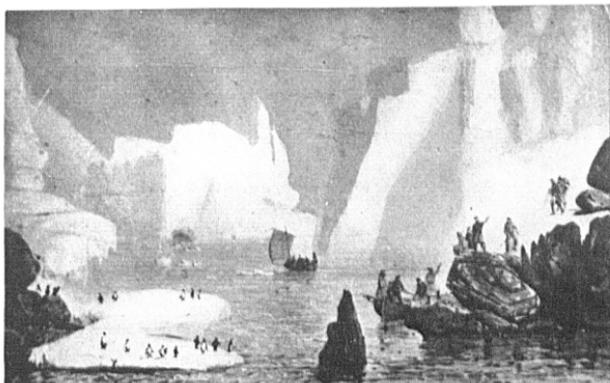
VOYAGE DE 'L'ASTROLABE,' DUMONT D'URVILLE—1840.

Reproduction of sketches taken near Antarctic Circle.

L. LE BRETON, Artist.

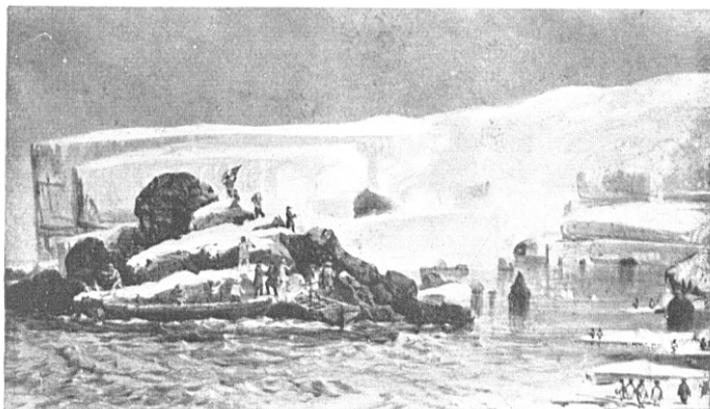


No. 3.—Ice Barrier off 'Terre Adélie,' 20th January, 1840.



No. 4.—Disembarkation on 'Terre Adélie,' 21st January, 1840.

VOYAGE DE 'L'ASTROLABE,' 1840.



No. 5.—Taking possession of 'Terre Adélie,' 21st January, 1840.



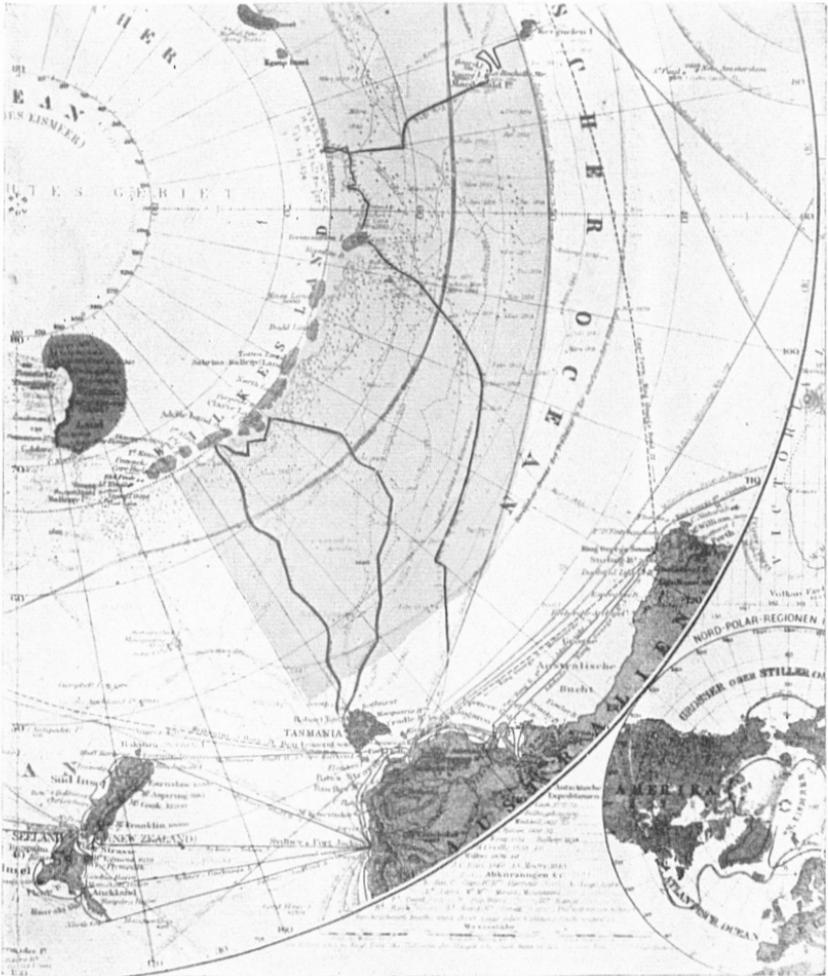
No. 6 —A heavy squall amongst ice, 23rd January, 1840.



No. 7.—Discovery of 'Côte Clarie,' 26th January, 1840.

VOYAGE DE 'L'ASTROLABE,' DUMONT D'URVILLE, 1840.

Map showing the Victoria Quadrant of the Antarctic Circle, reduced from the 'Sud Polar Karte,' by Von. A. Petermann.



Portion tinted blue shows an area of about 5 1/2 million of square miles of the great Southern Ocean, which has virtually never been traversed since Dumont d'Urville's voyage in 1840. (Partially visited by H.M.S. 'Challenger' in 1874.)

The tracts of the 'Astrolabe' and the 'Challenger,' and also of such vessels as pass south of Kerguelen's Land, are shown by firm dark lines.

"ANTARCTIC EXPLORATION."

By E. DU FAUR, F.R.G.S.

*Read before the Royal Geographical Society of Australasia, Sydney,
September, 1891.*

So many present have had the advantage of attending the lecture given by Professor Wilde in April last, on the same subject, illustrated by diagrams and transparencies, that I have felt rather at a loss to know what to bring before you, on a subject so far removed from the sphere of daily cablegrams and last intelligencies, without trespassing on ground so recently traversed; you will at least have the advantage that my remarks must occupy much less of your time than might otherwise have been the case.

Exploration to Antarctic regions holds quite a different position as compared to that in almost every other part of our globe. The little knowledge we have on the subject is owing to the efforts of navigators of the last century and the early half of the present one. The records of their daring adventures in those inhospitable latitudes were the delight of the boys of my time, when imaginative stories of perils by flood and field were not daily produced for the young, as at present; and most of my contemporaries, I suppose, read and re-read the works of Cook, Ross, and others, and hoped some day to follow on their tracks.

The earliest approach to the Antarctic circle: lat. $66\frac{1}{2}$ S., was made by Dirk Gheritz, about A.D. 1600, who in rounding the Horn was driven far to the south, and unintentionally discovered the New South Shetland Isles; but it was not until about 1770 that the first expedition was fitted out from Europe with the intention of penetrating it. Captain James Cook (to whom we owe so much), in January, 1774, advanced as far south as lat. 71., fourteen years before the first settlement was made in Botany Bay, and the colony of New South Wales founded.

Again an interval of 45 years elapsed without adding anything to our knowledge of Antarctic seas, then, the New South Shetlands having been a second time accidentally re-discovered by a whaler, a period of activity in Antarctic exploration ensued, lasting from 1820 to 1843.

In 1820 the Russian Government sent out Bellinghausen, who discovered Paul and Alexander Islands in lat. 69° S., being more southern land than any that Cook had visited.

During 1821 to 1824 Weddell, after re-visiting New South Shetland Islands and the South Orkneys, penetrated as high as lat. 74° 15' S. in meridian 33° W. He encountered many ice islands between lat. 58° and 61½° when within 100 miles of land. He then entered an open sea, so open that he came to the conclusion that "land does not extend further south than lat. 73° S; if so, and there is no more to the southward, the Antarctic Ocean may be found less icy than the Arctic, and a clear field for discovery, even to the pole, may be anticipated." We shall see later on that Ross met with a different experience on the same meridian. This daring adventure of Weddell's, in which the highest latitude in that hemisphere was attained, was carried out in a small brig, the *Jane*, accompanied by a cutter, the *Beaufoy*. Verily the old Norse spirit was not extinct 70 years since.

In 1831 Biscoe discovered Enderby and Graham Lands, both intersected by the Antarctic Circle, but distant 110° of longitude apart.

All the above discoveries were in the opposite hemisphere to that in which we are most interested, and situated between the meridians of Madagascar and of Cape Horn.

In 1839 Bellamy discovered the islands which bear his name, and a long line of coast named Sabrina Land, both intersected by the Antarctic Circle; the former on about the meridian of New Zealand, the latter on that of Cape Leuwin; and in the following year Dumont d'Urville performed a voyage of perhaps greater interest to us than any other in those seas. Leaving Hobart on January 1, 1840, he made land to the south on the 19th idem, just inside the Antarctic Circle, traced it for 150 miles on that parallel, between meridians 136° to 142°.

E., and named it *Terre Adélie*. He then coasted eastward for 60 miles further, along a solid wall of ice 150 feet high, which he named *Côte Clairée*, when he found it trending to the southward; and on February 1 was obliged to return, and reached Hobart on the 17th, after an absence of only seven weeks.

The record of Dumont d'Urville's voyages, extending from 1837 to 1840, is a notable example of splendid patronage bestowed by France on her distinguished scientific men—comprised in 18 vols., 8vo., accompanied by 5 vols. Imperial 4to. of very high class engravings. It constitutes an enduring monument—"ære perennius"—to the skilful navigator and his scientific companions.

In the same year Commodore Wilkes, of the U.S. Navy, reported the discovery of a line of icebound coast along the parallel of the Antarctic Circle, along which he sailed for 1500 miles. A controversy ensued as to the existence of this land, and whether Wilkes had not mistaken an ice barrier for land; but it is unnecessary to enter further into this.

To great Britain was reserved the honour of despatching the expedition which reached the highest southern latitude ever yet attained, and discovered the only continental land yet known within the Antarctic Circle—about due south of New Zealand.

On January 1, 1841, Captain James Clark Ross, in command of the *Erebus*, and James Crozier, in command of the *Terror*, crossed the Antarctic Circle. On the 11th, sighted the lofty mountains of Victoria Land, and, proceeding southward along the coast, first set foot on it on the 27th in lat. 76°3'; in 77°5' they discovered the magnificent active volcano, now named Mount Erebus, towering 12,400ft. above the sea, and witnessed an eruption, during which the column of fire and smoke rose 2000ft. above its summit. An adjacent mountain, named Mount Terror, reaches an elevation of 10,900ft.; but as a volcano is extinct.

Arrested by an ice barrier rising to a height of 180ft., Ross and Crozier coasted along it to the eastward for 450 miles without an opportunity of penetrating it, and proceeded further south; on February 13 were obliged by the fast approaching winter to make their escape, and after encountering great dangers reached

and wintered at Hobarton. At commencement of the following year the intrepid navigators renewed their efforts in the same direction, encountered the dangerous ice much further north than previously, and, after meeting with and overcoming even greater difficulties than in 1841, reached on February 22 the highest southern latitude yet attained—78° 11'—within one and a-half mile of the same great icy barrier. In the next season, 1843, Ross and Crozier attempted to follow up the discoveries of Weddell in 1821-4, but found his "open sea" so blocked by pack ice that they failed to reach further south than 71° 30' (in long. 15° 0' W.), or 2½ degrees short of their predecessor's extreme limit.

Here virtually terminates the history of Antarctic exploration. Half a century has passed, a nation has arisen in the Australasian colonies almost daily visited by vessels improved to the latest developments of naval architecture, and no longer dependent on the chance winds of heaven for clawing off a dangerous coast or beating a hasty retreat from unexpected troubles; and yet it seems difficult to awaken any active interest in its further prosecution.

I have given this very short resume of the leading points in Antarctic exploration in past times not only so as to trespass as little as possible on your patience this evening, but in the hopes that some of my hearers, especially the younger ones, may be induced to enter more fully into the study of the question, fraught with interest as illustrating the pluck and endurance of former generations of their race; and that, under the far more favourable conditions of these later days, future exploration may result in a large and lasting benefit to the commerce of the Australian colonies.

There are two points in connection with our subject on which I would dilate, but as shortly as possible, viz. :—

1. The possibility of a revival of the whaling and fur-sealing industries in the great Southern Ocean by these colonies.

2. The possible effect of the varying position of floating ice and ice-fields in those waters on the meteorology of the southern portion of our continent.

1.—The whales most valuable in commerce are the “right whale” (*Mysticetus*) and the “sperm whale” (*Macrocephalus*). The former, the right whale, is that furnished with laminae, whalebone, by which it filters out the infusoria on which it subsists. The right whale increases in size in higher latitudes, and not unfrequently yields 180 barrels of oil and over half a ton of whalebone (at present worth over £2000 a ton) to the fish. It used to be plentiful off the coast and bays of Cape Horn, in the months of March and April, and at all times is to be sought for near the land. It cannot exist in the warmer seas, as, Colonel Maury says, “the tropical regions of the ocean are to the right whale as a sea of fire, through which he cannot pass, and into which he never enters,” also, “the right whale of the Northern hemisphere is a different animal from that of the Southern.”

The sperm whale has teeth, and feeds mainly on the medusa and squid. Their food, known as “brist,” is abundant in different localities at different periods of the year, to which they resort with unerring instinct. They frequent the deep seas, and keep far from land generally.

Weddell met many whales S.E. of Cape Horn; in passing thence to lat. $61\frac{1}{2}$ S. great numbers of finned* and humpbacked whales were constantly accompanying the ships. Captain Cook reported vast numbers of sea elephants and fur seals about Sth. Georgea Island, east of Cape Horn, but in 1823 they had become almost extinct from ruthless destruction in the close season. At least 20,000 tons of oil were sent thence to the London market. The Americans took fur sealskins thence to China, at from 5 to 6 dol. apiece, to the extent of at least 1,200,000 skins. During the time these islands were worked the trade supported a tonnage of 2000 and two to three hundred men annually. He observed the sperm whale off the New South Shetlands; the sea elephant and fur seal (only) in abundance at these islands in 1821-2; at least 320,000 fur seals and 940 tons of sea elephant oil were obtained, but here also they were at that time almost exterminated by ruthless treatment during close season. Sir James C. Ross reported in lat. 66° S., long. 156° W., whales of large size, but not very numerous; in lat. 63° S., long. 55° W., Darwin Inlet,

New South Shetlands, great numbers of the largest black whales, very tame; could obtain cargo of oil in a very short time.

These are only hurried extracts referring to a few isolated spots. About the time when exploration was active, the whaling industry appears to have flourished, but to have been conducted on such lines as to lead to extermination. The commercial question appears to be as to how far the almost total cessation of whaling and fur-sealing for many years may have led to the replenishing of the worked-out grounds, and as to the large area of hunting-grounds which have never been worked at all.

I would refer my audience, who might wish to study the past history of the whaling industry, to the "History Whaling Cruise," etc., by J. Ross Browne, published in 1846. The recent closing of the Behring Straits fur-seal fishery for three years would point to an extensive opening in our Southern seas for that industry, to which the attention of America appears to be already directed.

I make the above remarks, now that the present opportunity has arisen, with great diffidence, and solely in the hope that, should the proposed Antarctic Expeditions be carried out and a field for such enterprise is found to exist, our southern colonies may not allow, in their apathy, that a commercial enterprise so close to their doors should be forestalled by other nations from the uttermost parts of the earth.

2.—With respect to the possible effect of the varying position of floating ice and ice-fields in the Great Southern Ocean on the meteorology of the southern portion of our continent, I would record that, on supplying the "Sydney Morning Herald," February 7, 1881, with a translation of a minute received from the Geographical Institute of Berne respecting the then proposed Italian expedition, I prefaced it with a few remarks of my own, and ventured to express the opinion that "it is from investigation into the sources and direction of Antarctic oceanic currents, and into the varying disposition of Polar ice in higher or lower latitudes in different years, or during more lengthened periods, that we may ultimately hope to arrive at some knowledge of the laws under which our climate is directed. In the constant struggle for mastery which we know to be carried on

between the winds generated in those Polar regions, and by those causes, with equatorial and westerly winds, due to the rarification of the air from the heated surface of this vast continent, in this grand struggle between forces generated altogether beyond her limits, New South Wales must eventually look for the solution and governing laws of periodic successions of dry and moist seasons."

Ten years ago such a movement was, I suppose, in advance of the times, as it received some harmless ridicule from another correspondent, and was dropped. As it now appears to be more in favour, and a leading article in the "S.M. Herald" of April 24 last remarked that "the meteorology of the Antarctic Circle may be otherwise of deeper interest to us, for there is not the least doubt that in our climatic changes we are closely linked with the meteorological and magnetic conditions of the great Polar region so close to our doors," I should like to refer to some circumstances which many years previously to 1881 led me to the opinion then expressed.

In the early fifties I happened to take an interest in the Great Circle Route, and in collating the logs of the ocean clippers then competing for the fastest passage to Port Phillip, of many of which summaries were from time to time published in the Melbourne "Age." I have also a distinct recollection of ice charts being occasionally published in those years, showing the varying latitudes in which ice had been encountered. (My collection of cuttings and extracts on the subject has, unfortunately, long since been mislaid or destroyed.

In those days the Marco Polo and her rivals went into high latitudes, seldom, I suppose, visited now; and that was a comparatively dry period in Southern Australia. Later on, in the latter fifties, the obstructive ice was met with in much lower latitudes, so that great circle sailing was virtually abandoned, on account of its danger; and '57 (the "Dunbar year") and several following years formed a comparatively wet period in these colonies, and the conclusion appeared to me reasonable that, when the ice was confined to high latitudes, the northerly and westerly dry winds would have the pre-dominance; when it encroached into lower latitudes (further north), the southerly polar winds would obtain the mastery.

If any such cyclical periods of varying position of the ice limit exist, we may for ever remain in ignorance of the great natural causes of such oscillation; but we can observe and record them for the benefit of posterity, if not for our own. Had the observations which led to the publication of the simple ice-charts of the early "fifties" been methodically maintained, we should now have nearly 40 years' records to show, and might hope to begin to know something on the subject. Unfortunately, the higher latitudes in the parts of the Great Southern Ocean to the immediate southward of this continent are now never visited. Whalers there are probably unknown, and steam has practically for ever closed the Great Circle route. Something might be done by collating the experiences of homeward vessels rounding the Horn, but these only enter high latitudes when many degrees eastward of Australia; but should the present movement prove a success, and Antarctic exploration become the fashion, and commercial enterprise follow the right whale to his supposed habitat in the Antarctic ice, would it be too much to expect that a tender or some fitting vessel of our colonial navy (when we have one) should, say, twice a year when visiting Hobart (lat. $41\frac{1}{2}$:S.) take a dive further south for a few degrees, and record, in spring and autumn, in the same months, and on the same meridian, year by year, the limits where dangerous ice is first met? I have already shown how Dumont d'Urville, in January, 1840, left Hobart, and penetrated south for 25 degrees, about 1750 miles, coasted for 210 miles, and returned to Hobart in seven weeks, meeting with no obstruction from land between that port and the Antarctic Circle. In these days, with steam as an auxiliary, the voyage might almost be said to be reduced to less than a month's pleasure trip.

Such records, supplemented by all information on the subject obtainable from mercantile and whaling vessels, and the deductions therefrom, would be as valuable to future generations in these colonies as a similar record for the past 40 years, above referred to, would have been to ourselves.

Quoting again from the leading article above mentioned:—"It may be at once admitted that such an enterprise is of the kind that does not appeal very forcibly

to that class of mind which asks, What is the use of it? regarding any proposal which does not promise a direct return in pounds, shillings, and pence"; and, speaking only as an amateur, not as a scientific meteorologist, my suggestion may elicit many cavils; but after the patient investigation which our scientists have given to lunar theories, sun-spot theories, and other universal theories (if I may use the expression), which, if of any force, must apply equally to all parts of our globe, it does not seem too much to ask them, as Australians, to give a portion of their attention and their best influence towards carrying out a methodical and scientific investigation into the secrets and changes of the gigantic refrigerator which we have comparatively "close to our doors," in constant conflict with the semi-tropical heated currents generated within our own continent, and into the laws and periods by which either predominating influence affects the climate of Southern and Eastern Australia.

Our Society might commence some useful work by endeavouring, through its kindred Society in Victoria, to verify my personal recollections of earlier years—there must be records in some of the old shipping offices in Melbourne bearing on the subject—the early files of the "Age" would supply many a clipper's log, and there must be enough of my contemporaries still in existence who were interested in shipping matters in those days to make it probable that some copies of the ice-charts, which I so well remember, might be brought to light again, which would relieve us from beginning again, in these later days, with quite a clean sheet.

In conclusion, while thanking you for a patient hearing, I trust that many of you will do your best to support our Society in its efforts to bring the Swedish-Australian Antarctic Expedition, under the auspices of Baron Nordenskoild, to a start. That you will cordially welcome any vessel arriving in our port, on such an errand, no matter what her nationality, there is no question of doubt. Should I have led the thoughts of any business man to go more fully into the question, as to its commercial aspect, and the probable benefits to accrue to our port from such an expedition, I shall be well satisfied.

	U. S. DEPT. OF AGR., WEATHER BUREAU, WASH., D. C.
	Recd A M FEB 17 1910

Flowton,
Tarramurra, N.S.W.,
Jan. 16, 1910.

Du Faur, E.

Incloses pamphlet on
"Effect of Polar Ice on the
Weather"; remarks. Please have
it criticised.
2 incls.

Chief of Bureau. *W. H. M.*

Asst. Chief of Bureau. *W. H. M.*

Chief Clerk.

Library. Ack. Feb. 19, 1910. G. F. J.

'Houston'

Dorraverra. New South Wales.

16.1.10

Willis L Moore Esq

Chief - U.S. Weather Bureau - Washington

D.C.

Dear Sir

I have been suffering from such continuous & severe illness for some months past, that I was entirely unable to reply to your favor of 12 Oct^r 09 by prompt return: more especially as I wished to add some further remarks to my pamphlet - "On the effect of Polar Ice on the Weather", which I now enclose.

I would ask you to append such "further remarks" to the Pamphlet, if placed in your Library of the U.S. Weather Bureau; & also, if possible, to bring them under the notice of any of your Scientists, who are discussing the proposed route of any further Expedition; some of whom seem to favor my view of attacking the Southern Continent from the direction of Wilkes' Sea.

I fully appreciate the trouble you have paid me by your request, and remain

Yours very Respectfully

E. DeFaut

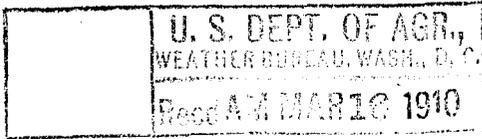
P.T.O.

P. S.

My typist has not been able to supply me with copy of Addenda for today's Mail, 2 pm. So I post letters & Pamphlets & the rest will follow

As my supply of Pamphlets is exhausted, I am leaving them Reprinted, & shall be happy to send you half a dozen more for distribution in furtherance of my views as explained above.

ED
17.1.10



Turrumurra, N.S.Wales
Feb. 12, 1910.

Du Faur, E.

Inclodes additional
paper of his on "Effects of
Polar Ice on the Weather".
1 incl.

'Houston'

Turramurra

N. S. Wales. 12.2.10

Willis L Moore Esq

Chief U. S. Weather Bureau

Washington D. C.

Dear Sir

As promised in my letter by last mail,
I enclose type copy of "Addenda" to my paper
on "The effect of Polar Ice on the Weather"
already in your hands.

The it I have, perhaps unnecessarily, re-
fistulated the heads of my former papers, so
as to make it more complete, as a single
paper on the subject, brought up to date:
but I have put in hand a reprint of those
of 1891 & 1907, with this, under one cover,
of which I will send you a dozen copies,
by next mail, if ready; which I hope you
will distribute in the proper quarters,
in accordance with my previous request:

Thanking you, in anticipation for doing me
such kind service - I remain

Yours Very Respectfully

E. Whitford

F.R.G.S.

FURTHER ADDENDA

to paper on "The Effect of Polar Ice on the Weather"
read before the Royal Society of N.S.Wales
on 4th Dec. '07, by E. Du Faur, F.R.G.S.

ORIGINAL
RECEIVED
1910

At the time of originally writing the above paper, I was not aware that the "Nimrod" Expedition would touch at Sydney outward-bound - it had been set down for reading on 4th December, when it was suddenly decided that the "Nimrod" would come here in a few days. I endeavoured to have it temporarily withdrawn from the agenda, which proved to be impracticable. I amended a few of the later paragraphs to meet the circumstances, but, being followed, in a few days, by the enthusiastic reception given to Mr. Shackleton and Professor David, and public interest being centered on the floating of the British flag at the South Pole, the paper of course remained unnoticed.

My enclosed papers show that, during a long life in Australia, 54 years, I have taken a close interest in its meteorology, and that, in the question of Antarctic Exploration, I ventured as early as in 1881, to express my opinions in the public press thereon - again in 1891, in a paper read before the Royal Geographical Society of Australia, after recapitulating the main points of earlier expeditions, and my previous remarks, I endeavoured to excite the public interest in prosecuting such researches further, by occasional visits to the ice lands nearest to our coasts, a work involving comparatively little danger and expense, and thus providing a progressive record of the

S. M.
Herald.

Proceed-
ings Vol.
V No.1
21. 27

with Map.

varying conditions, and state of the ice in those parts of the Antarctic Ocean, presumedly most affecting our climate.

Proceed-
ing Vol.V.
No.6.
Sep.91
139,143

About the same time, I reported to the same Society that I had appealed to a leading Steam Ship Company, as to possibility of carrying out the same project through them, with the assistance of a few scientific friends, but it came to nothing.

Finally on 4th December '07, I recapitulated my former papers before the Royal Society of N. S. Wales - as first above related - but particularly insisted that the enormous extrusion (not recession) of ice from Ross' Sea, amounting to ~~to~~ billions (English) of tons since 1842, could not practically affect our climate; as, borne Northwards to the Antarctic Circle by prevailing South Winds, the drift reaches the Easterly current due to prevailing Westerly Winds in the Great Southern Ocean, to the Eastward even of New Zealand, - and 2,000 miles to leeward of Australia - and against 2,000 miles of "The brave West winds, in the roaring forties" no effect from even a continent of ice could be reflected back to our shores.

Now there can be no doubt that there exists a ^{Barrier} ~~Barrier~~ of equal importance to that of Ross, and probably of far greater length, comparatively close to, and to the Westward of Australia, along the Antarctic Circle, from which, inferentially, as great an extrusion of ice has taken place - but, somewhat to our disgrace, the investigation of which has been neglected for the last half century.

In our Maps and Ice-berg charts, every iceberg shown represents a ship's observation. Between Cape Horn and The Bluff, New Zealand ships are compelled to navigate a course between 56° and $47\frac{1}{2}^{\circ}$ S. Lat: and between Cape Horn towards Cape Leeuwin, between 56° and 46°

Say 300 miles long, in lieu of Ross' 450 miles
30 - broad - amount of extension of ice

5 | 9,000 sq m \div 1150 ft depth - $\frac{1}{5}$ of a mile
estimated by Sir G. Markham at 1600 ft. by Capt. Scott at 1000 to 1200 ft)

1800 cub miles extended since 1842 (^{Scott} ~~Ross~~)

One cubic mile = 147,197,952,000 cub feet
 $\times 1800 \div 38$ (cub ft in 1 ton of ice) gives
gives nearly 7 billions (English) of tons extended.
7,000,000,000,000.

E. W.

S. Lat. as far as the 60° Meridian, therefore those parts of the Great Southern Ocean are shown as studded with icebergs, observed by innumerable ships. But from Kerguelen's Land to the Easternmost Meridian of Australia from Lat. 50° to the Antarctic Circle, that enormous waste of waters, containing some six millions of square miles South of about Lat. 50°, has virtually never been traversed, since the days of Wilkes - Dumont d'Urville-and Ross, except by H.M.S. "Challenger" in 1874, on whose course icebergs are shown from the Antarctic Circle to about 50° S. Lat: that is, in the 70 years which have elapsed from the date of those early explorers, no other ships have passed, and no icebergs have been recorded, and the casual inspector of such maps infers that no ice exists in those waters. But we have records of exceptional seasons, when very heavy ice has advanced within a few hundred miles of Cape Leeuwin, while generally it appears not to extend Northward beyond Lat. 45°.

In what appears to have been an exceptional season, Jan. 1840, d'Urville seems to have encountered no dangerous ice, until nearing the Antarctic Circle, in Lat. 64° S, (See Sketch No. 1 in Pamphlet) while in 1874 H.M.S. "Challenger" carried it as far North as Lat. 45°, as stated above.

Recently, in May 1904, we had reported, a sensational account of enormous masses of ice freed further West, encountered by Ship Maletta, 14 days after leaving La Plata. She sailed for 343 miles through ice, surrounded by bergs, some estimated at 600 feet high? This in a comparative low latitude, showing that, probably by some cataclysm, unusually enormous masses had been freed, to join further Eastward, in the Easterly current, the general aggregation of ice Eastward of

"Kerguelan's Land", passing through unknown seas, to the Southward of our continent.

The Area tinted blue, on accompanying map, shows the "Waste of Waters"-virtually unexplored since 1842,-extending Westward to "Enderby Land", in all for 90° of Longitude, the ice in which, drifting North, into the Easterly current, to the Windward of Australia, is melted, except in exceptional seasons, between 50° and 45° S. Lat., and is therefore never observed. This is the "Gigantic Refrigerator, comparatively close to our shores", referred to in my paper of 1891, above quoted - by which I have contended, for so many years, that our climate is affected, more or less, as it extends further North towards our shores, or is restricted to more Southern limits, and it is to this Quadrant, (parts of the "Victoria" and "Enderby" quadrants), that I have so repeatedly endeavoured to draw attention - not only as affecting the direct practical question of Australian Weather and its forecasts, but as containing problems of great geographical, and scientific interest, the solution of which still lies before us.

The glamour of floating the first flag at the axial pole has influenced the collection of noble contributions, from time to time, for the purpose of following mainly in the steps of Ross; in that direction - some half dozen expensive expeditions have so followed them in recent years, and that of Sir Ernest H. Shackleton has solved all the difficulties of reaching that point, and apparently settled the question of the position of the Pole, on a land plateau. The failure in the achievement of his full expectations, was due solely to an underestimate of the number of food depôts required.

Another 40 or £50,000 are to be spent in following in his tracks, and bridging the few miles of which he was obliged to forego the traverse - and, barring the possibility of an exceptionally bad season, this would appear, apart from a very large amount of important scientific work, proposed to be carried out, ^{at Ross' Barrier, & elsewhere,} to be almost "a walk over", if, profiting by his experience, a few more depôts are established on the road.

Few will place Sir Ernest, and his gallant party, second to those who finally hoist the flag on his objective. His and their pluck and endurance solved all the problems of real importance, in traversing, for 400 miles, unknown dangers, and untrodden wastes, and thus securing the success of those who follow in their footsteps, with a larger supply of food.

The Magnetic Pole.

The Axial Pole may be considered virtually, though not absolutely, as a fixed point. Once accurately determined, its position will serve, at any rate, for a few hundreds of years. But with the Magnetic Pole it is not so. In the Northern Hemisphere it has been determined that its declination librates between $11^{\circ} 20'$ E. and $24^{\circ} 30'$ W. = $35^{\circ} 50'$, while the corresponding Secular change in the Dip = about 4° ; that is, it librates in an ellipse of which the major, or longitudinal axis, is $35^{\circ} 50'$ and the minor, or latitudinal axis, is about 4° , while the whole libration each way occupies about 240 years, or an annual variation of $7'$ in the one case, and about $1'.5$ in the other, (See the well-known Diagram prepared by Dr. L. A. Bauer) - and ^{it is supposed} with ^{that} the Magnetic Axis of the earth is rotating round the Geographical Axis in a direction opposite to that of the earth's rotation.

For the present it may be assumed that the South Magnetic Pole is subject to a similar libration, and an equal one, if the Earth may be considered as a true magnet, but in reverse directions. This assumption is borne out, so far as our limited data for computation allow.

The early navigators, such as Wilkes, d'Urville, Ross and Moore, appear to have generally determined their crossings of the Meridian of no variation, about or between Terre Adélie, and Côte Chairée, in about ^{143°} 145° E. Long., but varied in their estimates as to distance South at which the Pole should be located, - of the more recent observers. *Ross' determination of it was 76° S Lat & 145° 20' E Long (Imperial Do Kenady)*

Gauss, by theory, locates it at about	72° 15' S. Lat.	&	152° E. Long.
Chetwynd - ("Discovery")	72° 51' "	&	156° "
David - (Nimrod)	72° 25' "	&	155° 16' "

If these premises are confirmed by closer investigation into the data^a than I am able to make, (having been prevented by illness for some months past from consulting any library but my own), it will be abundantly proved that the secular declination librates in an ellipse, as in the Northern Hemisphere - though Chetwynd's estimate of an annual progress of 26', in lieu of 7', is startling - it will also appear that some time previously to the observations on the "Discovery", or at about that time, the libration had reached its extreme Eastern limit, and Professor David's observation showed that it was returning on its Westward track.

Now should a permanent meteorological observatory (not for permanent occupation, but for visitations from time to time by scientists) be ever erected, it is manifest that there would be no object in locating it at the vagrant Magnetic Pole, which, in 4 years, would have shifted $\frac{1}{2}^{\circ}$ from it, (or, according to Chetwynd, $1\frac{1}{2}^{\circ}$) - any suitable spot, preferably within the ellipse referred to, which in future years,

that Pole would approach, pass over, pass by, and return to, would meet the requirements of the case, and, as our data increase, its position at any time could be ascertained by computation, but it must be, as far as possible, to the Westward, i.e. to Windward of Australia, if observations on its climate are to be of real service to that continent.

As the scientists of the United States of America appear to be turning their attention towards this neglected quadrant, their first work would necessarily be to prove whether the lands already known to exist more or less along the Antarctic Circle, from Enderby's Land to Terre Adélie, are insular or continental; and, if shown to be the former, as to amount of sea between them and the mainland. In the course of such investigations, the possibilities of finding some such suitable locations seem to be great, and, if successful, my 30 years of interest and work in the matter will not have been thrown away.

Turramurra, N. S. WALES,

January 1910.

E. DU FAUR.