

**JOURNAL OF A VOYAGE IN BAFFIN'S BAY AND BARROW STRAITS PERFORMED BY  
HM SHIPS LADY FRANKLIN AND SOPHIA**  
Conversion of Observations to IMMA

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08 October 2014

Updated 31 March 2015 and 31 August 2015  
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**Abstract**

This document describes the field by field translation specification (TRANSPEC) for the data contained in the file "BAFFIN'S BAY AND BARROW STRAITS - 1850.xls" (Microsoft Excel Spreadsheet) digitized as part of the ACRE project by the UK Met Office.

**1 Introduction**

The Microsoft Excel document "BAFFIN'S BAY AND BARROW STRAITS - 1850.xls" contains digitized observations from a journal of a voyage in Baffin's Bay and Barrow Straits in search of the crews of two missing British vessels (Sutherland, 1852a,b). The voyage is chronicled in the 1852, two-volume journal of the ship's surgeon, Dr. Peter Cormack Sutherland. Three hourly and summary meteorological observations are tabulated in Volume 2.

**1.1 The Voyage**

The following summary is derived from the journal published by Dr. Sutherland (1852a,b). In May, 1845, two British exploration vessels, the HMS Erebus and HMS Terror, left to explore the Arctic Sea and establish a Northwest Passage. Contact was lost with the 138 crew under the command of Sir John Franklin after only a few weeks and the British Admiralty offered a sizable reward to anyone locating the missing expedition (Fig. 1), resulting in a multi-year search by no less than 20 parties (Beattie and Geiger, 1989). After several years of unsuccessful attempts to locate the missing expedition, the Lady Franklin and Sophia were privately commissioned, under the command of Mr. William Penny to search and recover the lost crews. The clipper-built ships departed from Aberdeen on 13 April 1850 and traced the believed course of the missing expedition into Baffin's Bay and the Barrow Straits (Fig. 2a,b). The two ships joined with several others in search of the Franklin expedition. Although the search uncovered evidence of the Franklin expedition's winter quarters, they were unsuccessful in locating the expedition, which had likely perished between 1848 and 1851. It was not until 1859 that another

search party located a number of relics and human remains belonging to the missing expedition. Interestingly, as this transpec was being drafted, the Canadian government announced that it had finally located one of Franklin's ships (unknown if it is the Erebus or the Terror) in the Victoria Straits, several hundred miles to the south southwest of where Mr. Penny's expedition was searching.<sup>1</sup>

From 13 September 1850 until 12 August 1851, the rescue expedition over-wintered in Assistance Bay (now Resolute Bay) at Cornwallis Island (in present day Nunavut, Canada). On 17 April 1851, 44 of the crew departed on traveling parties in the Wellington Channel (between Cornwallis and Devon Island), traveling north to Prince Alfred Bay on Devon Island (Fig. 2a). A number of additional parties explored the region around Cornwallis Island until early summer 1851. The expedition returned to London, England in 21 September 1851.

## 1.2 The Observations

Under the direction of, and often by Dr. Sutherland himself, three hourly observations and daily averages of various meteorological elements were made aboard the Sophia between 7 May 1850 and 21 September 1851 (see Fig. 3a,b). These elements were:

- Date (Year, Month, Day, and Hour)
- Daily mean barometric pressure (inches of Mercury to hundredths)
- Three-hourly readings of the thermometer in the shade (Whole Degrees F)<sup>2</sup>
- Mean daily temperature (Degrees Fahrenheit to tenths)
- Sea temperature (Degrees Fahrenheit to tenths)<sup>3</sup>
- Wind direction (16 pt compass headings)
- Wind speed (est. Beaufort scale – Fig. 4)
- Prevailing AM Weather (alphabetical code – Fig. 4)
- Prevailing PM Weather (alphabetical code – Fig. 4)
- Noon position:
  - Latitude (Degrees and Minutes North)
  - Longitude (Degrees and Minutes West)

Of the observed elements, only the following were digitized as part of the ACRE digitization effort:

- Daily mean barometric pressure (inches of Mercury to hundredths)
- Three-hourly readings of the thermometer in the shade (Deg. F to tenths)<sup>2</sup>

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<sup>1</sup> Hetter, K.: "One of the great maritime mysteries may be solved in cold Canadian waters." CNN 10 September 2014. [http://www.cnn.com/2014/09/09/travel/northwest-passage-mystery/index.html?hpt=hp\\_t4](http://www.cnn.com/2014/09/09/travel/northwest-passage-mystery/index.html?hpt=hp_t4)

<sup>2</sup> Three-hourly air temperatures are recorded in the expedition journal in whole degrees Fahrenheit. However, as Sutherland (1852) indicates on page 442 of Vol. 1, the thermometers were capable of being read to a half or quarter degree of precision.

<sup>3</sup> Based on journal entries, the author concludes that Sea Surface Temperature was taken multiple times per day at the same time as the three-hourly air temperature, and reported as a daily mean.

- Mean daily temperature (Degrees Fahrenheit to tenths)
- Sea temperature (Degrees Fahrenheit to tenths)<sup>3</sup>
- Noon position:
  - Latitude (Degrees and Minutes North)
  - Longitude (Degrees and Minutes West)

In addition, while the vessels were at winter stations, a traveling party was dispatched to explore to the north along the Wellington Channel, Baring Bay and Prince Alfred Bay. Three-hourly air temperature observations were taken, but only daily maximum, minimum, and mean temperatures were recorded and transcribed. Pressure and water temperature were not observed by the traveling party.

### *1.2.1 Journal notations concerning environmental observations*

Sutherland (1852a, p. 148) notes that the water temperature at anchor was “always varying according to the rapidity of the tide and the quantity of the ice or icebergs on it. If the tide is very rapid and the ice in a manner fixed and not permitted to move along with it, the temperature of the water will be considerably lower than it would have been, had the ice been at liberty to drift about.”

Sea surface temperature observations were terminated on 1 October 1850 and did not recommence until 12 August 1851. Corresponding to the journal entry for 3 December, Sutherland (1852a, p. 442) notes “ The temperature of the sea-water could not be ascertained with anything like precision, owing to the defective state of our thermometers, which ought to have been such as would indicate within half or a quarter of a degree of Fahrenheit’s scale. Some of them were ascertained, by means of the freezing point of water with the barometer at 30 inches, to have errors of two or three degrees; and none could be read to a lower division than half a degree. Ever since the harbor became frozen over, we found the temperature to be about 29.5° or 30°.” Although not documented, it is likely that surface water observations were made with a self-registering thermometer, most likely James Six’s instrument invented in 1782 and in common use during the pre-HMS Challenger period.

Air temperatures were taken both with Mercury and alcohol filled thermometers. In the entry for January 13<sup>th</sup>, Sutherland (1852a, p. 451) states “Up to this time the temperature had not been sufficiently low to freeze mercury, but now it was down to -39° by Pastorelli’s spirit of wine thermometer, and the mercury was as solid as a leaden bullet.” (See also Figure 5)

With respect to the barometric pressure reported in the meteorological register, Sutherland’s 1852 journal indicates that the barometer used was of an aneroid type, and that the value recorded in the meteorological register is the mean value of eight 3-hourly readings. A review of the journal revealed only one reference to an actual observation made of the barometer, that

of an observation of 28.95 inches of Mercury at the 0300 observation on 12 July 1850. The journal also provides no indication if any corrections were applied to the barometric pressure observations.

### 1.3 Structure of this document

Section 2 describes the preparation of the data and the software used to perform the translation. Section 3 describes the mapping of the Excel native format to the IMMA format. Section 4 describes the outcome of the translation effort, including any changes made to the data or issues that arose during processing. Section 5 contains references, including figures, tables and a bibliography of works cited herein.

## 2 PREPARATION AND SOFTWARE

### 2.1 Software used

To process the data in Baffins\_Bay-1850.xls file, the author used fortran code and the IMMA1 program as documented.

## 3 IMMA VARIABLE ALLOCATION

### 3.1 Observed Variables

The variables documented by the Sophia (hereafter “native”) translate to IMMA format as follows:

Year:	Reported as 1850 or 1851. No conversion needed. Placed in IMMA Element 1 (YR), ASCII Positions 1-4.
Month:	Reported in alphabetical format, but converted to 2-digit numerical equivalents during transcription. No conversion needed. Placed in IMMA Element 2 (MO), ASCII Positions 5-6.
Day:	Reported in numeric format. No conversion needed. Placed in IMMA Element 3 (DY), ASCII Positions 7-8.
Hour:	Reported in 3- or 4-digit (24hr) local time (i.e., 300, 600, 900, 1200, 1500, 1800, 2100, 2400). Applies only to three-hourly observations. Conversion needed to UTC. Placed in IMMA Element 4, ASCII Positions 9-12.
Daily mean barometric pressure:	Reported in inches of Mercury to hundredths. Conversion necessary to hPa to tenths. Placed in IMMA Element 25 (SLP), ASCII Positions 60-64.
Three hourly readings of the thermometer in the shade:	Reported in whole degrees F, but transcribed to degrees F to tenths. Conversion needed to degrees C to tenths. Placed in IMMA Element 29 (AT), ASCII Positions 70-73.

Daily Maximum Air Temperature:	Reported by Traveling Party only, in whole degrees F, but transcribed to degrees F to tenths. Element is not included in IMMA – no conversion needed.
Daily Minimum Air Temperature:	Reported by Traveling Party only, in whole degrees F, but transcribed to degrees F to tenths. Element is not included in IMMA – no conversion needed.
Mean Daily Air Temperature:	Reported to degrees F to tenths. Conversion needed to degrees C to tenths. Placed in IMMA Element 29 (AT), ASCII Positions 70-73. Note: IMMA records containing this element will not contain reference to a specific hour of observation.
Sea Temperature:	Reported to degrees F to tenths. Conversion needed to degrees C to tenths. Placed in IMMA Element 35 (SST), ASCII Positions 86-89. Note: This is a daily average value. Observations from which this value was derived were not recorded. IMMA records containing this element will not contain reference to a specific hour of observation.
Noon Latitude:	Reported in degrees and minutes. Conversion needed to IMMA format latitude in degrees east of 0 to hundredths. Placed in IMMA Element 5 (LAT), ASCII Positions 13-17. Note: Although the position was observed at local noon, the position will be included in all hour-specific IMMA records for that date.
Noon Longitude:	Reported in degrees and minutes. Conversion needed to IMMA format latitude in degrees east of 0 to hundredths. Placed in IMMA Element 6 (LON), ASCII Positions 18-23. Note: Although the position was observed at local noon, the position will be included in all hour-specific IMMA records for that date.

### 3.2 IMMA Elements Included

In addition to the observed, native variables, IMMA format allows for a number of parameters associated with the observations and the vessel to be included. The following IMMA Elements, listed by their abbreviation (ref. R2.5-imma\_short.pdf), contain such information and are included in the final IMMA record:

IMMA Element Included					
Element Number	Abbreviation	Name	Field Position	Value	Value Meaning
7	IM	IMMA Version	24-25	1	IMMA Version
8	ATTC	ATTM Count	26	2	ATTM I and Supplement.
10	LI	Latitude/Longitude Indicator	28	4	Degrees and

					Minutes
14*	II	ID Indicator	33-34	10 / 0	Composite information from early ship data / unknown
15	ID	Ship Identification/Call Sign (right blank fill)	35-43	SOPHIA	Vessel Name
16	CI	Country Code	44-45	GB	Great Britain
28	IT	Indicator of All Temperatures	69	7	Degrees F whole or to tenths †
34	SI	SST Measuring Method	84-85	7	Others (other type of measurement method). ‡
49	ATTI	ATTM ID	109-110	1	Attachment I
50	ATTL	ATTM Length	111-112	65	Length Attm I
54	DCK	Deck	119-121	246	ACRE Data
55	SID	Source ID	122-124	168	ACRE Historical Digitised (expeditionary and other spreadsheets)
56**	PT	Platform Type	125-126	5 / 9 / 'blank'	Ship / Ice Station / Known but not listed
197	ATTI	ATTM ID	373-374	99	Supplemental Attachment
198	ATTL	ATTM Length	375-376	0	Supplemental ATTM length (default value)

\* ID Indicator (II) is set to "10" for the observations made on the vessel, and "0" (ID present, but unknown type) for observations made by the traveling party aboard their ice sled.

\*\* Platform Type (PT) is set to "5" (Ship) when the ship was underway. It is set to "9" (ice station) when the ship was overwintering in the ice. PT is set to " "[blank] for data collected by the traveling party which employed a towed sled across the ice (platform type is known, but no PT option exists for classification).

† 3-hourly air temperatures were recorded to the whole degree Fahrenheit. Daily means of air temperature and sea surface temperature were recorded to the tenth of a degree Fahrenheit. Sutherland (1852) indicates on page 442 of Vol. 1, the thermometers were capable of being read to a half or quarter degree of precision.

‡ *There is no direct reference in Sutherland (1852) to the method by which sea surface temperatures were obtained. The journal does indicate that the SST recorded in the meteorological register were averages derived from observations taken at 3-hour intervals, and that the observations were most likely taken directly in the water column using a mechanical, liquid-in-glass thermometer.*

All remaining IMMA1 Fields are set to missing (left blank). Certain fields will be occupied by flags and coding set by the ICOADS dupelim and trimming QC checks.

### 3.3 Supplemental Data Attachment

In addition to the translation from native format to IMMA1 format, the data as originally reported in the XLS file are included in the IMMA record as a supplemental data attachment. For ease of interpretation and reading purposes, the native data have been converted to comma delimited (CSV) format prior to be included in the supplemental attachment. The native data record is in the order specified in Section 3.1, with the addition of the particular ship's name provided at the beginning of each supplemental record. There are two formats for the supplemental data. Records containing daily summary data (e.g., mean pressure) will not contain an hour entry or any of the three-hourly observations. Records containing three-hourly data will not contain daily summary data.

For example, the supplemental record for both 0300 local time and for the daily mean IMMA record on 1 June 1850 will be formatted as follows:

**SOPHIA,1850,6,1,30.07,22.0,36.0,40.0,36.0,39.0,32.0,34.0,31.0,,,33.7,30.0,72,25,56,0**  
[ID,YR,MO,DA,SLP,AT300,AT600,AT900,AT1200,AT1500,AT1800,AT2100,AT2400,ATmax,  
ATmin,ATavg,SST,LAT(deg.),LAT(min.),LON(deg.),LON(min.)]

While a supplemental record from the traveling party on 23 April 1851 will be thus:

**SOPHIA-TP,1851,4,23,,,,,,,,,-13.0,-30.0,-23.2,,74,58,93,45**  
[ID,YR,MO,DA,SLP,AT300,AT600,AT900,AT1200,AT1500,AT1800,AT2100,AT2400,ATmax,  
ATmin,ATavg,SST,LAT(deg.),LAT(min.),LON(deg.),LON(min.)]

To avoid traveling party records being flagged as duplicate based on Ship ID, the Spring 1851 traveling party is given the ID: SOPHIA-TP. Because these traveling party observations were made via dog-towed sledges across the ice, this ID is given the ID Identifier (II) of '0' indicating an ID is present but of unknown type. Platform Type (PT) is set to ' ' (blank) since no platform type is available to correspond to an ice sledge.

## **4 SUMMARY OF TRANSLATION EFFORT**

### **4.1 Preparation of Input Data**

Before subjecting the keyed data to the translation program, the original keyed data file was copied and the copy was modified in the following ways:

- Dates on which no environmental observations were taken were stripped from the file.
- Missing Latitude and Longitude positions were added where they could be identified from elsewhere in Sutherland (1852a,b). In most cases, latitude and/or longitude was not reported when the ship was not under sail.
- Year and month were filled in for every entry of the meteorological register.
- Latitude and Longitude values were separated into separate columns for degrees and minutes to make processing calculations easier.
- Ship ID was added as first column of data.
- Columns were added to accommodate the maximum and minimum daily air temperature collected by the traveling party. These entries are left blank in the ship observation rows, and are not imported into IMMA except as part of the supplementary data attachment.
- Monthly mean records (derived from daily data) were removed.
- Traveling party data was parsed to match columns of ship data.
- File was converted to CSV (comma separated values) format.
- Input CSV data file given the name: BAFFIN-BAY-BARROW-STRAITS-1850.csv

In addition, in one instance an important sea level pressure observation was discovered in the journal narrative (Sutherland, 1852a) of 28.95 inches of Mercury at 3 AM (local) on 12 July 1850. This value was incorporated into the 3 AM (local) record for that date during translation.

### **4.2 Output**

Every input line from the .csv file was read in as a complete line. Daily summary values were parsed into a single output IMMA record. A separate IMMA record was produced for each of the 8 3-hourly air temperature observations. Thus, each input line accounts for 9 output records. IMMA Attachments that contained no information were not included in the output record.

## **5 REFERENCES, FIGURES, AND TABLES**

### **5.1 References**

Beattie, O. and J. Geiger, 1989: Frozen in Time: unlocking the secrets of the Franklin expedition. Western Producer Prairie Books, Saskatoon. 192 p.



Sutherland, P.C., 1852a: Journal of a Voyage in Baffin's Bay and Barrow Straits, in the Years 1850 - 1851, Performed by H.M. Ships Lady Franklin and Sophia, Under the Command of Mr. William Perry, In search of the Missing Crews of H.M. Ships Erebus and Terror - Vol. 1. Longman, Brown, Green, and Longmans, London.

[http://books.google.com/books/about/Journal\\_of\\_a\\_Voyage\\_in\\_Baffin\\_s\\_Bay\\_and.html?id=zshCAAAAYAAJ](http://books.google.com/books/about/Journal_of_a_Voyage_in_Baffin_s_Bay_and.html?id=zshCAAAAYAAJ)

Sutherland, P.C., 1852b: Journal of a Voyage in Baffin's Bay and Barrow Straits, in the Years 1850 - 1851, Performed by H.M. Ships Lady Franklin and Sophia, Under the Command of Mr. William Penny, In search of the Missing Crews of H.M. Ships Erebus and Terror - Vol. 2. Longman, Brown, Green, and Longmans, London. 633 p.

<http://books.google.com/books?id=qKwNAAAAQAAJ>

5.2 Figures and Tables

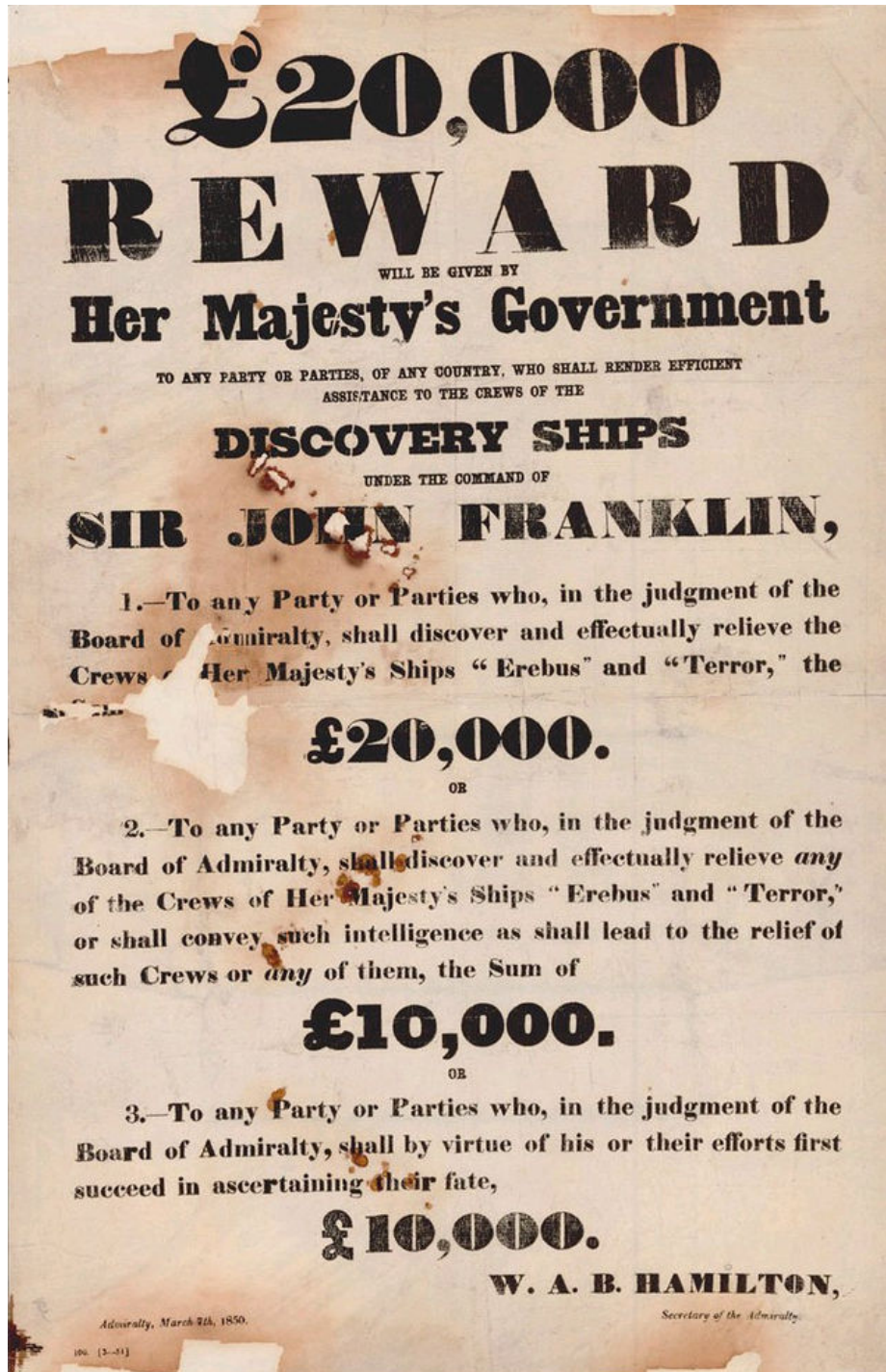


Figure 1. Reward poster from 1850, issued by the British government for the discovery and/or rescue of the ill-fated Franklin expedition.

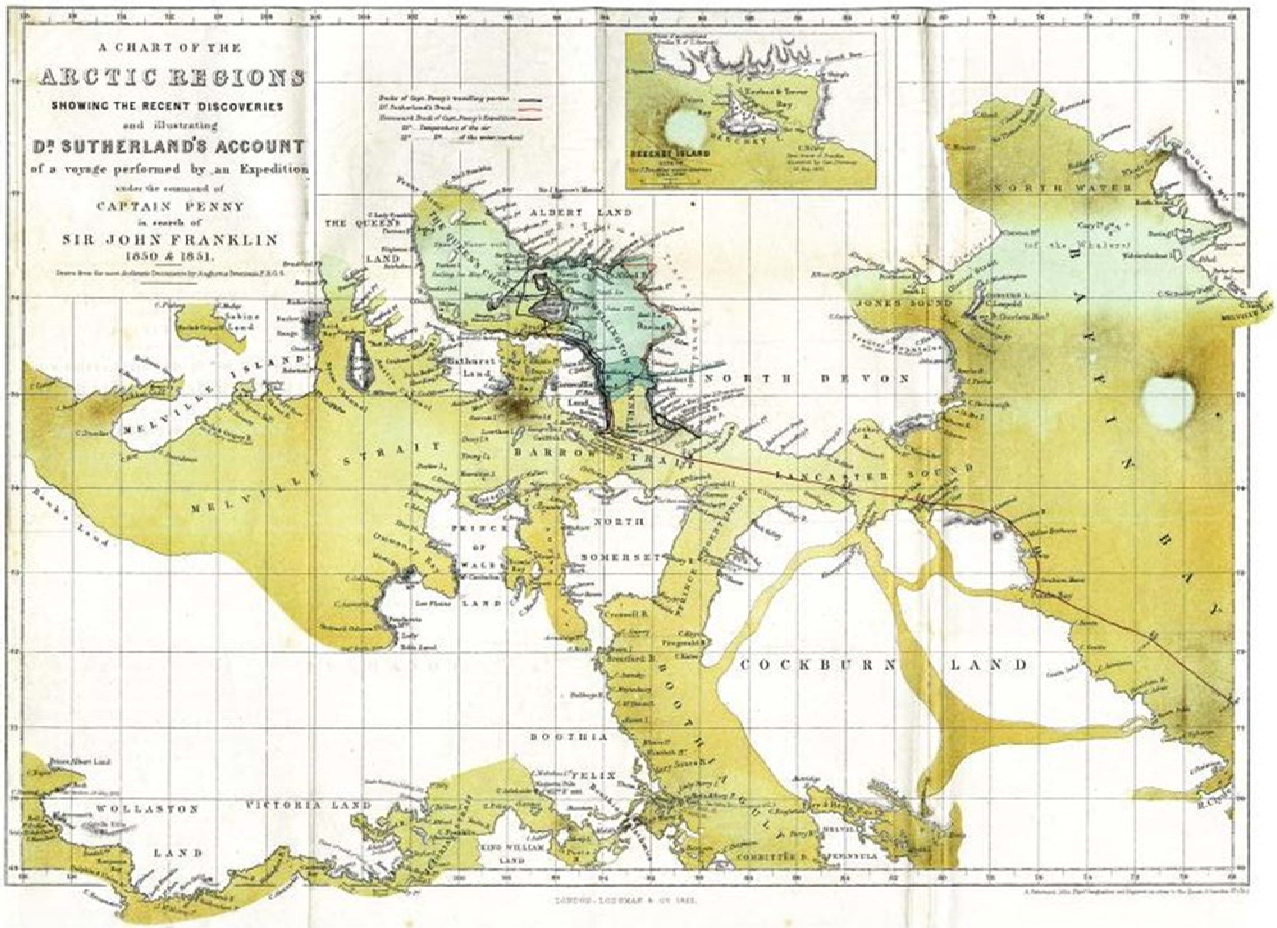


Figure 2a. Map of the Arctic regions explored by the Sophia and Lady Franklin in 1850 and 1851 (Sutherland, 1852a). The ships' course is indicated by the red line.

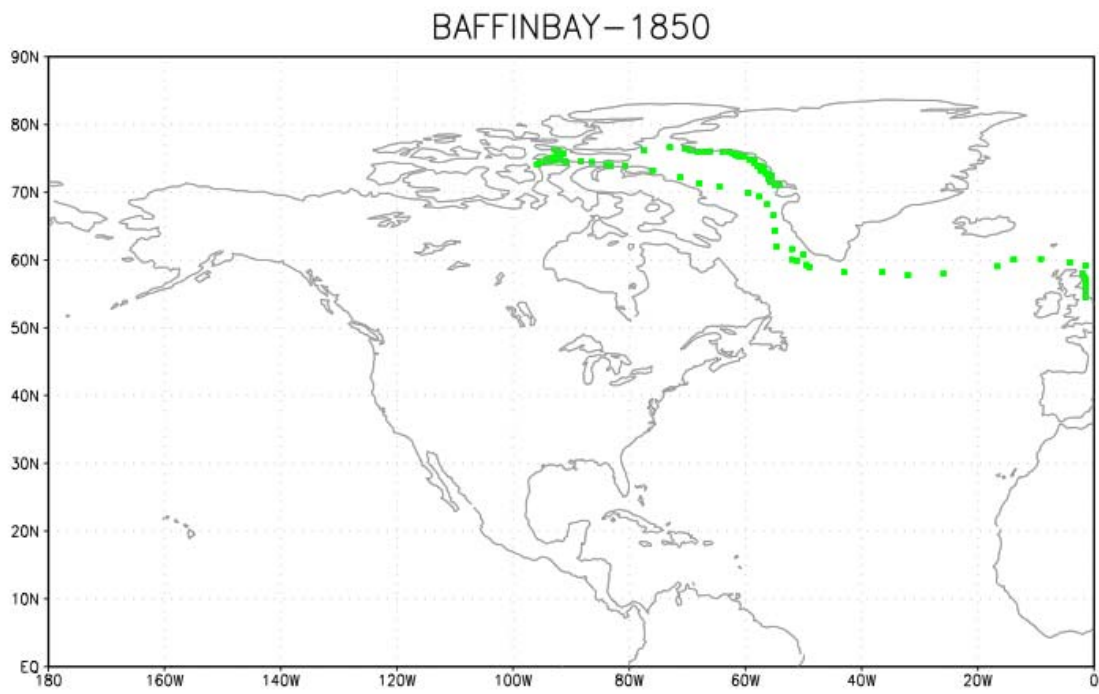


Figure 2b. Plot of geographic positions (green dots) corresponding to observations taken by HMS Sophia and the travelling party.

**ABSTRACT OF THE METEOROLOGICAL JOURNAL KEPT ON BOARD  
HER MAJESTY'S SHIP SOPHIA. — *Davis Straits.***

1850. Month and Day.	Mean of Eight Readings of the Aneroid Barometer.	Reading of the Thermometer in the Shade at								Mean Daily Temp.
		3 A.M.	6 A.M.	9 A.M.	Noon.	3 P.M.	6 P.M.	9 P.M.	Mid- night.	
June 1	30·07	+ 22	+ 36	+ 40	+ 36	+ 39	+ 32	+ 34	+ 31	+ 33·7
2	·13	30	31	40	44	49	44	37	33	36
3	·12	33	33	34	39	43	44	41	39	38·2
4	29·98	37	39	40	44	46	46	45	31	41·1
5	·86	32	39	41	42	40	31	31	28	35·5
6	·75	29	29	30	44	50	46	37	31	37
7	·69	32	36	52	52	52	43	38	32	42·1
8	·75	32	38	47	47	51	46	36	32	41·1
9	·79	33	36	37	38	38	38	35	33	36
10	·82	32	34	38	45	46	36	34	31	37
11	·89	31	32	44	47	50	37	35	28	38
12	·89	29	36	44	46	40	35	32	32	36·7
13	·79	41	41	39	39	40	36	33	32	37·6
14	·82	34	34	34	34	34	33	32	30	33·1
15	·93	26	32	32	32	34	33	33	29	31·3
16	·84	32	34	34	34	31	34	32	31	32·7
17	·83	33	33	33	33	34	34	33	28	32·6
18	·76	34	37	36	36	34	33	33	32	34·3
19	·78	28	29	31	32	32	31	29	26	29·7
20	·79	27	27	30	33	34	30	29	27	29·6
21	·64	27	33	35	37	38	38	39	43	36·2
22	·60	37	32	34	37	38	39	34	33	35·5
23	·66	33	34	36	36	37	36	36	35	35·4
24	·60	36	36	37	36	34	35	36	35	35·6
25	·68	35	33	33	34	35	34	32	32	33·5
26	·94	33	36	37	37	37	35	35	32	35·2
27	·77	35	37	38	39	41	42	42	44	39·7
28	·55	45	45	47	44	47	45	38	38	43·6
29	·63	40	41	40	39	39	39	39	38	39·4
30*	·74	38	39	40	46	41	44	40	40	41
Means	29·80	32·6	35·7	37·7	39·7	40·1	37·6	35·4	32·6	36·3

\* During this month the ships were rarely beset, but the ice was always so close and so much broken up that little advance could be made.

Figure 3a. First page of a 2-page monthly table for June 1850 from the Meteorological Register kept aboard the Sophia.

**ABSTRACT OF THE METEOROLOGICAL JOURNAL KEPT ON BOARD  
HER MAJESTY'S SHIP SOPHIA.—Davis Straits.**

1850. Month and Day.	Mean Temp. of Sea at its Surface.	WINDS.		WEATHER.		Position at Noon.	
		Direction.	Esti- mated Force.	A.M.	P.M.	Lati- tude.	Longi- tude.
	0					0	0
June 1	30	N.N.E.	1-2	v. : o.v.s.		72 25	56 0
2	30.5	S.E. to N.E.	3-0-4	o.s.v.c. : b.o.s.		72 30	55 45
3	31.5	E.	3-0	o.b.s. : c.v.		72 40	56 12
4	31	N.E.	1-2	v.c.		72 45	56 0
5	31.2	N.E.	3-1	v. : m.o.s.		72 48	56 6
6	30	W.S.W.	2-0	m.s. : v.		72 50	56 30
7	31	N.N.E.	2-1	v.		73 5	57 12
8	30.5	N.E.	0-4	v.		73 6	
9	30.5	N.E.	3-1	v. : o.b.		73 8	
10	30	S.S.W.	1-2	o.b. : m.o.		73 10	
11	29.5	N.N.E.	2-1	m.o. : v.		73 20	57 16
12*	29.5	N.N.E.	4-1	v.		73 22	
13	29.5	N.N.E.	3-4	v.			
14	30	N.N.E.	3-5	v. : m.			
15	30	N.N.E.	4	f.v. : v.			
16	30	N.E.	4-5	f.v. : v.			
17	30	N.E.	4-1	v.			
18	30	N.E.	2-4	v.			
19	30	N.E.	3-2	f.			
20	30	N.E.	3-5	f.			
21†	31	N.E.	3-1	f.m. : c.v.			
22	32	N.E. to W.	1-0-2	v.f. : f.		73 20	57 5
23	32	W.S.W.	2-8	f.m.s. : c.b.			
24	32	S.W.	1-10	b.c.r. : o.r.s.b.			57 0
25	31.2	S.W.	10-6	o.c.s. : c.o.b.			
26	31.2	W.S.W.	9-4	o.s.q.r. : c.v.b.			57 20
27	32	S.S.E.	3-10	c.o.g. : o.r.s.			57 0
28	32.2	SOUTHERLY.	7-1	c.o.v.		73 10	57 15
29	33	W.S.W.	1-6	o.r.c. : o.b.		73 20	57 0
30‡	33.2	NORTHERLY.	2-1	c.v.b. : c.v.		73 22	56 55
<b>Means</b>	<b>30.8</b>					<b>73 10</b>	<b>56 56</b>

\* In the vicinity of Berry Island. Sea fowl abundant; older ducks' eggs found upon the islands.

† Solar rays at noon, 61°.

‡ Solar rays at 3 P.M. 86°.

Figure 3b. Second page of a monthly (June 1850) table from the Meteorological Register kept aboard the Sophia.

THE following is an explanation of the abbreviations used in the METEOROLOGICAL REGISTER kept on board Her Majesty's Ship "Sophia," according to Admiral Sir Francis Beaufort's system.

In the column with the heading Winds and sub-column Estimated Force ;—

- 0 denotes *calm* ;
- 1, *light air*, just perceptible ;
- 2, *light breeze*, in which a ship, clean full, in smooth water, would go from one to two knots ;
- 3, *gentle breeze* (from two to four knots) ;
- 4, *moderate breeze* (from four to six knots) ;
- 5, *fresh breeze*, in which a ship could just carry on a wind royals, &c. ;
- 6, *stormy breeze* (single-reefed topsails and top-gallant sails) ;
- 7, *moderate gale* (double-reefed, &c.) ;
- 8, *fresh gale* (triple-reefed and courses) ;
- 9, *stormy gale* (close-reefed, &c.) ;
- 10, *whole gale* (close-reefed main-topsail and reefed foresail) ;
- 11, *storm* (storm staysails) ;
- 12, *hurricane* (no canvas can stand) ;

In the column with the heading Weather :—

- b denotes *blue sky*, be the atmosphere clear or heavy.
  - c, *clouds* (detached passing clouds).
  - d, *drizzling rain*.
  - f, *foggy*.
  - g, *gloomy*, dark weather.
  - h, *hail*.
  - l, *lightning*.
  - m, *misty*, hazy atmosphere.
  - o, *overcast*, (the whole sky covered with thick clouds).
  - p, *passing*, temporary showers.
  - q, *squally*.
  - r, *rain* (continued rain).
  - s, *snow*.
  - s.dft. *snowdrift*.
  - t, *thunder*.
  - u, *ugly*, threatening appearance.
  - v, *visibillity* of objects (clear atmosphere).
  - w, *wet* (dew).
- Any letter in *italic* denotes a great degree.

Figure 4. Page clxxviii from Vol. 2 of Sutherland (1852) documenting the Beaufort wind speed scale used in the Meteorological Register, as well as the alphabetical code used to describe the prevailing weather conditions. Neither wind nor sky conditions were transcribed by the ACRE project, but could be added to the ICOADS records at a later date if resources become available.



Figure 5. Plate from Sutherland (1852) showing the ships Lady Franklin, Sophia and Felix in Assistance Bay on 24 February 1851, noting “The coldest day Mercury Frozen”.