

Discovery of some initial sketches and notes for William Scoresby Junior's *An Account of the Arctic Regions*

Research Note

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Abstract

A scruffy piece of paper covered in notes and dated sketches of snowflake segments has been found caught between the pages of a later book in Whitby Museum's Scoresby archive. The paper had been cut and folded to secure it round the ship *Esk*'s logbook. Close examination shows pencil drawing beneath the 22 ink sketches, which can be linked to entries for May 1817 in the logbook and matched to completed snowflakes from William Scoresby Junior's 1820 book *An Account of the Arctic Regions*. This is almost certainly the first indication of Scoresby's process for drawing snowflakes at sea.

The paper also contains jottings on many topics that Scoresby was considering including in his book. Comparing these with the published work, his later fact checking was clearly meticulous.

Introduction

This article describes newly discovered sketches and notes intended for inclusion in William Scoresby Junior's *An Account of the Arctic Regions with a History and Description of the Northern Whale-Fishery* (hereinafter *Arctic Regions*) (Scoresby, 1820). The article explores the relationship of the notes and sketches to the published book and considers aspects of their broader context.

William Scoresby Junior, 1789 – 1857, was an English whaling captain from Whitby who combined whaling with scientific research. *Arctic Regions* has four pages of snowflake drawings, but until this scruffy piece of paper was found it has not been clear how he produced them. The paper was trapped between the pages of Scoresby's incomplete Book of Diplomas, compiled between his return from Australia in August 1856 and his death in March 1857.

The paper includes precise data relating to the annotated sketches of single segments of snow crystals. Additional notes represent ideas for other topics to be developed in *Arctic Regions*. The sheet has been cut and folded to form the cover for a book, and “Esk's Log Book 1815 – 1816 and 1817” (Scoresby, 1817) is written neatly over the area which once covered the spine. The whole piece of paper is reproduced as Fig. 1. Scoresby's fair copy of the log book, in Whitby Museum, was consulted to find out how the notes and sketches on the cover relate to the information inside it.

The sketches: “beautiful crystallisations of snow”

William Scoresby drew one segment of each snowflake, numbering his sketches from 1 to 21, noting the date and the diameter of each crystal. He made notes about the weather and about the appearance of some snowflakes, transcribed in Table 1. Each sketch has a pencil line through it, perhaps added on completion of the fair copy.

All the new sketches are dated either 2 or 6 May, so those dates were checked for all three years covered by the log book. In 1815 and 1816, no snowfall was recorded on either date; in 1817, it snowed on both days. The relevant parts of the entries for 2 and 6 May have been transcribed by Jackson, (2009) as follows:

Friday 2^d May Lat. 78°5' Lon. 2°50'W E to N. very var. Moderate or fresh breezes with strong squalls, very variable showers of snow. Under the influence of which we plied to the NE^d along the [uneven] edge of a heavy pack of ice . . .

Tuesday 6th May Lat. 79°18', Lon. 3°45'E. SE to SbE.

Continued our reach to the SW or SSW all the day . . . The weather from Morn till night was thick with snow & the wind usually a fresh breeze. The snow was [“Beautiful crystallizations of snow” in margin] beautifully & most variously crystallized. It fell 3 inches deep on the deck every particle of which was probably most exquisitely formed. It was partly lamellar & partly had collateral crystallizations attached to the principal plane in the usual angle of 60°. The greater part was transparent & beautifully marked with fine white lines, but some crystals were spotted & opaque. The variety was immense. The bar stood at 29.85 thermometer 26° to 28° wind SE to SSE. (pp. 17–19).

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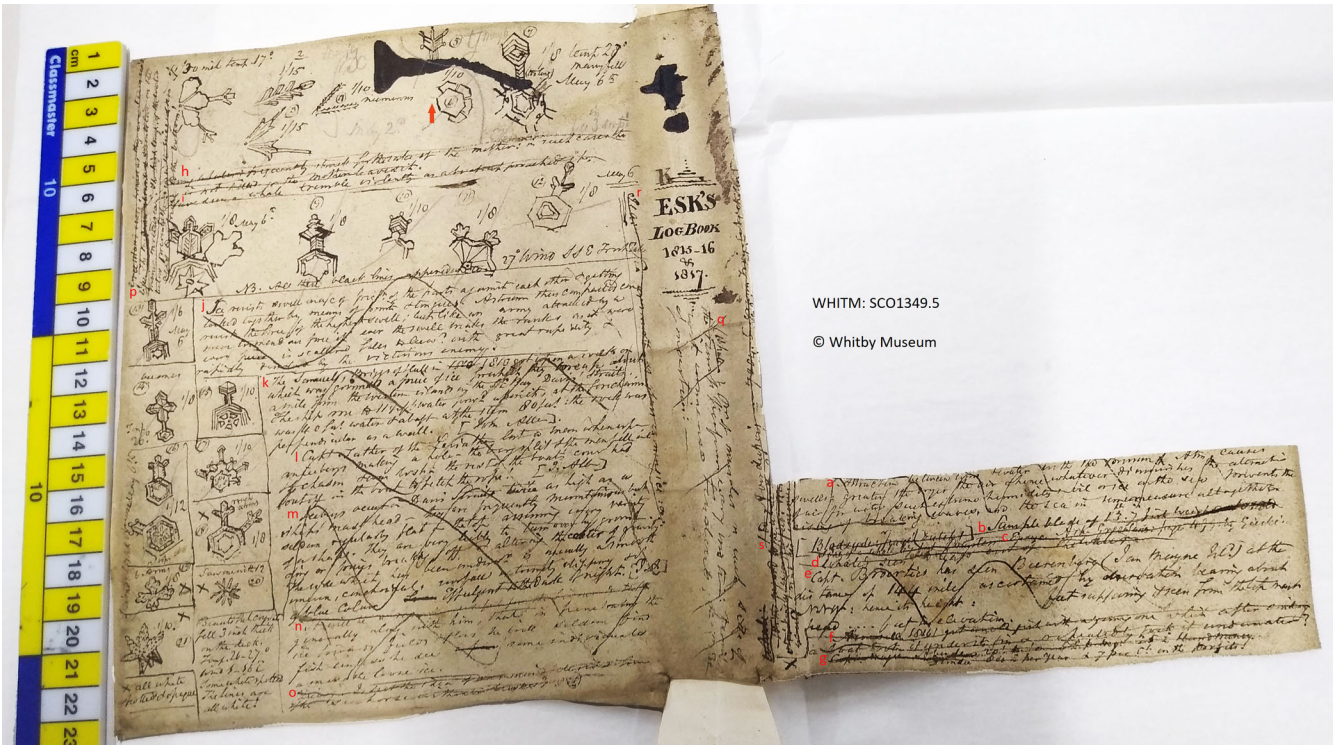


Figure 1. The piece of paper. Sketches number from 1 to 21, starting at the top left and working from left to right for two rows (nos. 1–12), then in two columns down the left of the sheet (nos. 13–21). The preliminary notes are lettered in red from “a” to “s.” The red arrow indicates a pencil line on snowflake 6.

The temperature of 26° to 28° Fahrenheit is equivalent to -2° to -3°C. There is some discrepancy between the entry for 6 May which describes the wind as “usually a fresh breeze” and the note below sketch 12 which reads “Wind SSE Fresh Gale.” The position given for the ship is in the Greenland Sea, about half way between Svalbard and Greenland, at a similar latitude to northern Svalbard.

After establishing that the sketches were from 1817, the next step was to compare them with Scoresby’s completed drawings to find out whether they represented previously unseen snow crystals or were the initial drafts for published drawings. Because he was examining snowflakes to see how different weather conditions might affect their formation, Scoresby noted the size and appearance of each one, together with the date and weather conditions, as recorded in a table on page 433 of *Arctic Regions* Vol. 1. This table shows 2 and 6 May as the only dates in 1817 when snowflakes were drawn. The temperature and weather conditions in the table are a good fit with those on the loose sheet.

A detailed comparison was made between the 22 new sketches of 21 snowflakes (there are two of no.16) and the 25 printed drawings from those dates in *Arctic Regions* Vol. 2, 24 on Plate X (see Fig. 2) and one on Plate XI. It has been possible to identify 18 of the 21 sketches reasonably confidently with the corresponding published drawings and to make tentative suggestions for the other three (see Table 1). This leaves four published drawings (nos. 50, 64, 68 and 71 on Plate X) with no clear corresponding sketch. One explanation could be that there were more sketches elsewhere, perhaps on the portion cut out of the right-hand side of the sheet, or on the missing side flaps.

Not all the pencil notes accompanying the sketches have been inked over, which led to closer scrutiny and the realisation that the snowflakes, drawn on deck when the ship was under way,

were sketched in pencil first. This is clearest on snowflake 6 (arrowed in Fig. 1) where a pencil line suggests a further segment on the upper left. The fraction 1/10 above the sketch represents its diameter as a fraction of an inch. The completed drawing of snowflake 6 is Scoresby’s number 49, at the top left on Plate X of *Arctic Regions* (Fig. 2).

The paper

As found, the paper measures 22 cm high × 36 cm wide, with most of the right-hand side cut away. There are two 4 cm tabs, once tucked inside the spine, making the maximum height about 30 cm. It is likely that the paper was once wider, as the left side is unevenly cut and the edges are slightly bowed, as if it originally had folded side flaps like a book jacket. The outside looks dirty and weathered, but the reverse is clean.

On close examination, the paper has neither watermark nor chain lines, suggesting it is hand rather than machine-made. It is strong, thick paper with an uneven texture and a faint impression of fine mesh beneath. To the naked eye, the colour is off-white with greyish speckles. Examined with a hand lens, the matrix is a rather lumpy pale cream, with random strands of blackish fibre. The rough absorbent texture has caused feathering of the ink. Both sides of the two clean tabs look identical in colour and texture, with no special finish. Although the finish looks the same on both sides, Scoresby did not use the reverse, even letting later writing overlap two sketches.

A sample of Scoresby’s other drawings held in Whitby Museum was examined for comparison: all but one was on smoother, thinner, machine-made paper with a variety of watermarks. The only drawing on similar, but not identical, paper is undated and is on the back of a scrap torn from a list.

Table 1. Links between Scoresby's numbered snow crystal sketches (Fig. 1) and his published drawings (Fig. 2), with a transcript of his original annotations

Sketch no.	Diameter of sketched crystal	Plate X fig. no. and annotations	Notes: Temperature is in degrees Fahrenheit. 1 inch = 25.4 mm. Plate X fig. nos. include diameter and a date letter: r = 2 May 1817 and s = 6 May 1817.
1	Not seen	53 r 1/20	[Barometer] 30 mil temp 17° written above [-8°C].
2	1/15 inch	51 r 1/15	
3	1/15 inch	54 r 1/15	
4	1/10 inch	52 r 1/10	"numerous."
5	Not seen	66 s 1/10	
6	1/10 inch	49 r 1/10	Pencil outline of further segment seen on left.
7	1/8 inch	60 s 1/8	"(too long)" written beside arm as drawn.
"temp 27° many fell 6 th May" written to right of sketch 7, [-2.8°C].			
8	1/8 inch	55 s 1/8	
9	1/8 inch	67 s 1/8	
10	1/10 inch	?72 s 1/10	
11	1/8 inch	57 s 1/8	
12	1/8 inch	65 s 1/8	"May 6 th " written above to the right.
Written on the line drawn below sketches 8–12 is: "NB. All these black lines appeared white." "27° Wind SSE Fresh Gale" [-2.8°C].			
13	1/6 inch	69 s 1/6	"May 6 th " written to the right.
14	1/8 inch	?62 s 1/8	["warmer?"]; "temp 26°" [-3.3°C].
15	1/10 inch	61 s 1/10	
16	1/12 inch	58 s 1/12	2 sketches of this snowflake. "12 loops."
17	1/10 inch	70 s 1/10	
18 X	1/8 inch	59 s 1/8	"rough arms."
19 X	1/8 inch	?56 s 1/8	"6 arms."
20 X	Not seen	93 s	"Saw one with 12." On Plate XI, not shown.
21 X	1/10 inch	63 s 1/10	
"X all white spotted and opaque" is written in the box below sketch 21.			
"Beautiful Crystals fell 3 inch thick. Temp 26°–27° [-3°C] Winds S–SbE. Some white spotted. The lines are all white!" is written in the box below sketch 20.			

Scoresby's snowflake drawings in context

The hexagonal symmetry and variability of snowflakes had been known for several centuries and would have been familiar to Scoresby, who had studied natural philosophy under Professor Jameson at Edinburgh. He probably knew Hooke's *Micrographia* (1665) which included drawings of snowflakes under a simple microscope. Hooke examined more than a hundred and found them all different, but thought that, like other crystals, all snow crystals should be identical. He therefore postulated that their irregularity was caused by thawing and breaking during the fall to earth rather than to a defect in their creation. Scoresby's view of snow crystals was also coloured by his faith:

... the particular and endless modifications of similar classes of crystals, can only be referred to the will and pleasure of the Great First Cause, whose works, even the most minute and evanescent, and in regions the most remote from human observation, are altogether admirable. (Vol. 1, pp. 426–427).

Scoresby corresponded with Sir Joseph Banks about his work in the Arctic, so letters between them held in Whitby Museum have been reviewed, without finding any mention of snowflakes. Scoresby may have been aware of drawings published in the Royal Society's

Philosophical Transactions by George Adams in 1747, John Nettis in 1755, and others. Scoresby certainly knew Frederick Marten's "Voyage into Spitzbergen and Greenland" (1694) (Marten, 1694) which he referenced several times in *Arctic Regions*. Marten also examined snowflakes in the Arctic and, like Scoresby, was trying to link different types of snow to particular weather. In January 1818, Scoresby wrote to Professor Jameson that when in London in December 1817 he had at last succeeded in obtaining his own copy. (Jameson, 1818).

Scoresby's *Arctic Regions* was popular and his drawings contributed to the 19th century fascination with snowflakes. In 1863, The American Tract Society published "Snow-Flakes: A Chapter From the Book of Nature" (Warren, 1863), where Scoresby's drawings appeared alongside those of Nettis and Glaisher. Snow was portrayed as a sign of God's forgiveness: a blanket of snow covering a multitude of sins.

William Scoresby Junior made his last Arctic voyage in 1823 but was active in the scientific community until his death in 1857, so he may have discussed his method for drawing ice crystals directly with later scientists, such as James Glaisher. Glaisher became Superintendent of the new Magnetical and Meteorological Department at Greenwich Royal Observatory in 1840 and would

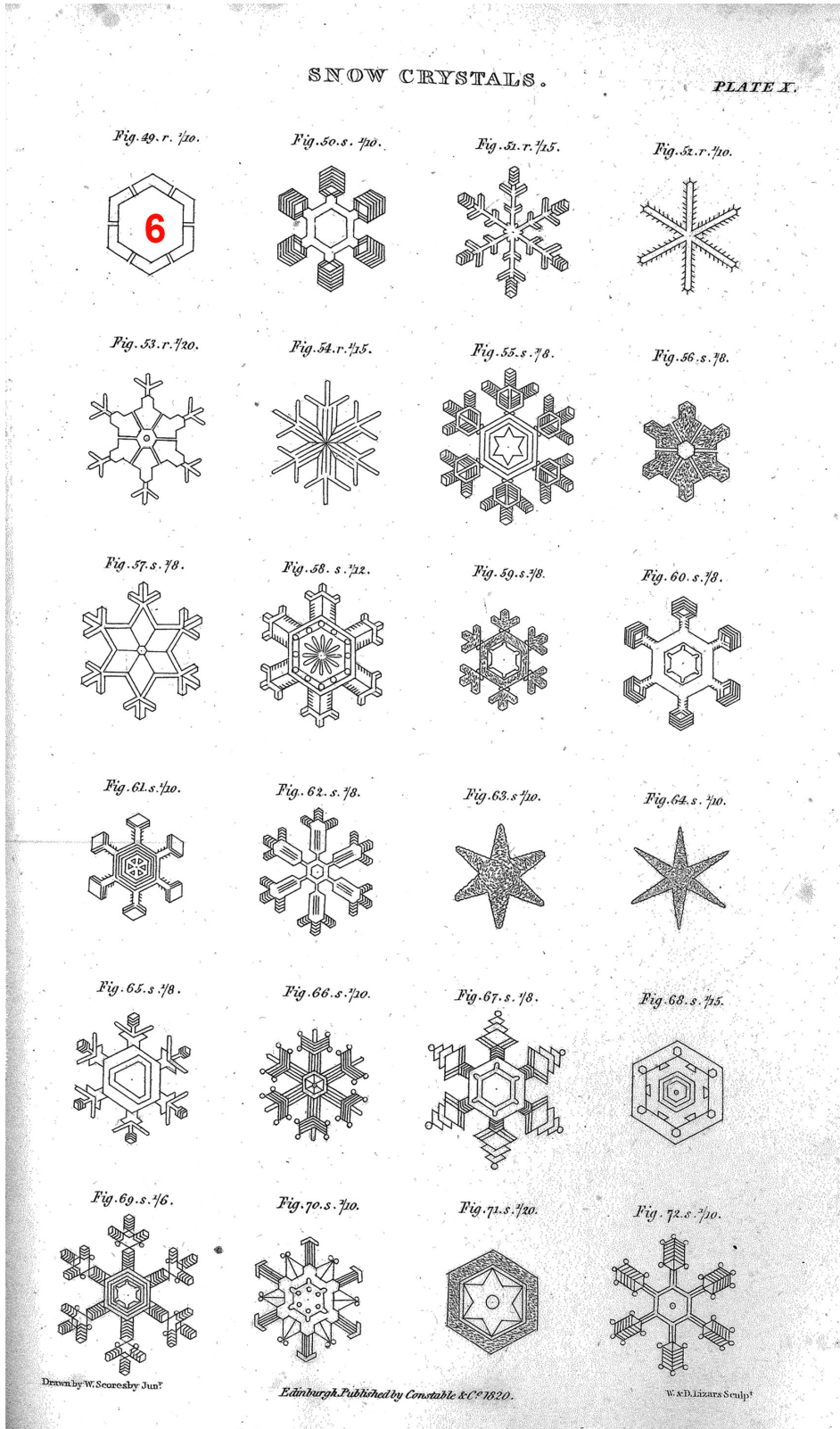


Figure 2. Plate X from Scoresby (1820) *Arctic Regions* Vol 2. Each crystal has its own fig. no., followed by the date letter, followed by the diameter of the crystal as a fraction of an inch. The red "6" on the top left crystal refers to Scoresby's sketch 6, arrowed in Fig. 1.

have known Scoresby's work, but they may also have met because in 1840 Scoresby provided a large compound magnet to the Observatory, to be mounted in the new building. (Airy, 1837–1840).

Like his predecessors, Scoresby found that each snowflake was different. Later in the 19th Century, Wilson Bentley fixed a camera to his microscope and photographed more than five thousand without finding two the same. Research on snow continues and details of both historic and recent publications can be found online in "Snowflakes: A Resource Guide" in the Library of Congress Research Guides series (Smith & Harbster, 2020).

Preliminary notes for *Arctic Regions*

Notes not relating to the drawings crowd the rest of the paper, covering many topics later included in the book. There is no trace of pencil beneath the ink, so it is likely they were first written in ink in the relative comfort of Scoresby's cabin rather than on deck. Scoresby was always economical with paper, which was expensive. He habitually wrote to the very edges of the page, and, with limited space for supplies on the voyage, he has squeezed later notes in at varying angles to cover any remaining space.

Transcription of the notes is physically problematic because each one has been crossed out in ink, obscuring some text. This is exacerbated by the thick absorbent paper which has caused the ink to flow unevenly. In parts, the writing is squashed and some notes overlap. Apart from the practical challenges, the text is hard to understand because these jottings, some very brief, were never intended to make sense to anyone but the writer. Whether a line is crossed out horizontally, or a whole paragraph has a wavy line through it, makes no difference to the likelihood of finding the information in *Arctic Regions*.

Most of the right-hand side of the sheet, once over the front of the log book, has been cut off, clipping the top of the remaining writing; it must therefore have been removed after the notes were written. It seems likely this missing part was also covered in drawings and/or notes. In the partial transcriptions below, asterisks in square brackets indicate unreadable words, while words in square brackets with a question mark indicate an uncertain reading. Round brackets are Scoresby's own. Transcriptions are accompanied by a note on their context and place in the final text of *Arctic Regions*.

For ease of reference, the top left of each note has been lettered in red in Fig. 1, starting with note "a," the first note on what remains on the right-hand side of the sheet.

(a) "Attractions between wind and water with the [* of*] causes swells greater the dryer the air and hence whatever diminishes the attraction of air for water such extreme humidity [*] oil or ice on the sea prevents the [*] of breaking waves, and the sea in some measure altogether [*]."

This garbled note corresponds to *Arctic Regions*, Vol. 1, p. 222: "Thus oil scattered on the sea, soon spreads over a great extent of surface, intercepts the attraction between the wind and water, and by its smoothness diminishes the friction between the two elements, so as to prevent the formation of the rudiments of waves."

(b) In Scoresby's own square brackets, he notes that the term blade comes from the Dutch. He indicates that the size of the sample (largest) blade of baleen, is used to calculate the total yield of baleen, as described in Vol. 1, p. 458.

(c) "Encyc. Art. page [499?] by Giesecké" refers to Sir Charles Giesecké's "Description of Greenland" published in the Edinburgh

Encyclopaedia in 1816 and referenced in *Arctic Regions* Vol. 1, p. 452 in relation to the size of the longest whales.

(d) "Whales seen to leap out of the water." Vol. 1, p. 467 mentions that *Balaena Mystecetus* has been seen to leap out of the water.

(e) "Capt. Broerties has seen Beerenberg (Jan Meyne Isld.) at the distance of 144 miles ascertained by observation bearing about [NNW?] hence its height: [blank space] feet supposing it seen from the top masthead [blank space] feet [*] elevation."

Esk's log for 30 May 1817 records that Captain Jacob Broerties of the *Greenland* of Amsterdam and his son dined on board, together with Scoresby's brother-in-law Captain Jackson of the *John*. Scoresby noted in his log how impressed he was with Broerties' knowledge of Spitzbergen. In *Arctic Regions*, the only mention of Broerties is in Vol. 1, p.149 in relation to a slab table made from Spitzbergen marble.

Captain Broerties' information on Beerenberg is probably left out because on 3 August Scoresby landed for a few hours on Jan Meyen Island, measuring the height of Mount Beerenberg and gathering other material for the book. Another influence on his decision to land may have been that 1817 was a doubly disappointing season for Scoresby, who may have wanted to finish a poor voyage on a positive note. Firstly, he had only caught two whales: not enough to meet the owners' expenses for the voyage. This annoyed the owners, particularly as Scoresby Senior, sailing nearby, caught them fourteen. The owners may have suspected that Junior was spending too much time on science (Jackson, 2009 p. xix). The second misfortune was that, on 28 June, Scoresby was devastated by the loss of his "marine diver" apparatus when the rope broke as he was investigating the effects of water pressure at a depth of more than 1700 metres.

Captain Broerties' information on Spitzbergen is omitted from *Arctic Regions* presumably because Scoresby has preferred information from his own and his father's annual visits to its waters over many years. The following year, 1818, Scoresby landed on Spitzbergen, map making and collecting rock and plant specimens, as described in his book.

(f) "Aimwell 1816 got an old fish with a young one which after sinking a boat took it under its fin and repeatedly took it underwater?" *Aimwell* was a Whitby ship. Scoresby must have checked the story because an amended version, with a date of 1810, appears in Vol. 2, p. 362. After the whale overturned it, the boat was repeatedly submerged not because it was under the whale's fin but because the harpoon lines attached to the whale were entangled with the boat.

(g) "Captain's wages Aberdeen [20L? per? ton? * £? Per keg? 25£ Hand money. Dundee [814£?] per year and 7 per cent on the profits." The wages of the crew of a whale ship are discussed in Vol. 2, pp. 200–201, but no specific examples are given. Hand money was an advance before the start of a voyage.

(h) On the left-hand side of the sheet, the deleted lines between the two top rows of snowflakes read: "[A?] young whales [is?] frequently struck for the sake of the mother: in such cases the young is not killed or the mother leaves it." Vol. 1 pp. 471–2 describes the practice of catching a young whale as a snare for its mother.

(i) "I have seen a whale tremble violently as a boat approached it." No mention has been found of a whale trembling violently when a boat approached.

(j) "Ice resists swell on a/c of friction of the parts against each other and getting locked together by means of points and tongues. A stream thus compacted can resist the force of the highest swell;

much like an army attacked by a more tremendous force if ever the swell breaks the ranks as it were every piece is scattered falls [taken]? with great rapidity and rapidly dissolved by the victorious enemy.” This observation is developed in Vol. 1, pp. 304–305, where Scoresby retains the military metaphor.

(k) This note has the name John Allen after it in square brackets. *Esk's* muster roll for the 1817 voyage, held by Whitby Museum, shows a John Allen as a harpooner on the ship, so it is likely that he was Scoresby's informant. The two following notes are marked J Allen and JA, respectively. Probably, they too are from John Allen. Whitby Museum's incomplete muster roll database has no other entries for John Allen so it may be that his previous voyages were in Hull ships sailing to the Davis Strait, as suggested by the information he provided.

The first note reads: “The Samuel, Briggs of Hull in 1810 got upon a rock on which was grounded a piece of ice from which they bore up about a mile from the Western Islands in the [SE?] Bay Davis' Straits. The ship rose to 11 feet water forward [upon? It?], at the forechains was 40 feet water and abaft at the stern 80 feet. The rock was perpendicular as a wall.”

There was a Hull whaler called *Samuel* (Lubbock, 1937) but she is not named in *Arctic Regions*. Scoresby did mention the following incident:

In 1812 the Thomas of Hull, Captain Taylor, lay moored to an iceberg in Davis' Strait, a calf was detached from beneath, and rose with such tremendous force, that the keel of the ship was lifted on a level with the water at the bow, and the stern was nearly immersed beneath the surface. (Vol. 1, pp. 257–8)

The interpretation is ambiguous, but it appears that Scoresby is making the point that the depth of water was very different between the bow and the stern.

(l) Allen's second note reads: “Capt Tather of the Leviathan lost a man when upon an iceberg making a hole –the berg split and the man fell into the chasm [* *] the rest of the boat's crew had [put?] off in the boat to fetch the rope!” Captain Tather did command the *Leviathan* of Hull for several years (Lubbock, 1937) but he is not mentioned in *Arctic Regions*. Scoresby remarks on the fragility of icebergs in Vol. 1, p. 257, without citing any specific incident. Men were put on an iceberg either to attach an anchor or to collect ice to replenish the ship's freshwater supply.

(m) The third of John Allen's contributions is incorporated in (*Arctic Regions*) Vol 1, pp. 251–255: “Icebergs occur in Davis Strait twice as high as a ship's masthead – they are frequently mountainous but seldom regularly flat at the top assuming every variety of a shape. They are very liable to turn over by grounding or pieces breaking off and altering the centre of gravity. The side which has been underneath is usually a smooth uneven, conchoidal surface extremely slippery and a blue colour. Effulgent in the dark of night.”

(n) This is probably about where a ship is most likely to find whales in relation to the position of the ice, described in Vol. 2, pp. 217–221. “It will be a [* * useful? for? the? fisher? * *] generally, along with him, that in penetrating the ice towards fields and floes he will seldom find fish [* the? sea?] some individuals among the loose ice.” The words “a few” are crossed out in the text.

(o) “Query. Is not the idea of [a?] mermaid derived from the sea horse without tusks?”, followed by a small drawing of a face. Sea horse is an old name for walrus. In Vol. 1, p. 504, Scoresby recounts that his ship's surgeon once reported seeing a man's head just above the water, which turned out to be a tuskless juvenile walrus.

(p) The final note on the left of the sheet has been squeezed into the top left-hand corner, at right angles to and slightly overlapping other writing and touching two ice crystal sketches. It reads: “Greenland seas: [frigid?] as they are teem with life. The [*] abound and [seem?] to live on the minor [mollusca?]. The high temp. of the water below prevents [* *] in the [succession? of? * and? *] to the bottom!”

Vol. 1, p. 544 has, “The Greenland Sea, frozen and extensive as it is, teems with life.” Vol. 1, pp. 546–548 describes the quantity of plankton, its role in the food chain, and the likely effects of the currents and temperature gradients in the ocean on its distribution.

(q) The curved spine of the book presented a difficult writing surface. The title is written neatly across the top, with jottings at right angles to it.

Down the centre facing left is written “Whale a pair of muscles on each side of the rump perform every motion [furnished?] with numerous tendons, [* *] of [*]:” Whale anatomy is described in Volume 1, but these words have not been traced.

(r) “Ice: Sea as smooth as glass among ice: [&c?].” This has not been found in the final text.

(s) Most of the spine's right-facing text has been cut away. All that is legible is “lb avoirdupois – 7004.5 grains Troy.” This figure was used when calculating water pressure at depth, explained in Vol. 1, p. 196, footnote.

Summary and conclusions

The primary aim of this article is to describe the newly discovered holograph as accurately as possible so that others may make their own interpretations.

The ship left Whitby on 1 April, returning on 15 August. The earliest datable items are the snowflakes on the back cover of the log book, dated 2 and 6 May. Captain Broerties' visit on 30 May is four-fifths of the way down the front, and by then, half the back was taken up with snowflakes. The writing becomes increasingly cramped, with notes running into each other, but the paper was not turned over to use the reverse. One possible reason for this is that the uneven texture made writing difficult. Perhaps Scoresby replaced this cover with a clean one, or maybe any further notes were made elsewhere. The thick, rough paper seems more suitable as a protective cover than as a writing surface. It looks so weathered that it may have remained in place throughout the 1817 voyage.

There is an immediacy to these hasty sketches on the paper outer cover of *Esk's* logbook. The sketches show that Scoresby mitigated the difficulties of working on a ship in strong winds and freezing temperatures by using pencil to draw just one segment of each snowflake before it melted under his breath. He has later inked over the pencil segment, probably while the detail was fresh in his mind. Later still, perhaps on land, he has used his notes and his innate understanding of hexagonal symmetry, to extrapolate the rest of the snowflake. There is no evidence of the type of microscope or drawing equipment used, but William Scoresby Junior left a large archive to Whitby Museum, little of it transcribed, so more information about his methods, equipment and contacts may yet come to light. All the material on this piece of paper was being gathered towards publication in *Arctic Regions*: none of it refers only to the contents of the log book. Only Captain Broerties and the snow crystals are mentioned both inside the log and on its cover.

From this one, accidentally preserved, sheet of paper it has been possible to work out not only Scoresby's process for drawing snow crystals but also something of how he compiled his classic book.

The ideas jotted down here were later checked, corrected, amplified, generalised or discarded. *Arctic Regions* has stood the test of time and is still consulted after 200 years.

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