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Citation for the original published paper (version of record):

Lantz, B., Uusma, B., Tjernström, M. (2024). The Lost Message of Nils Strindberg: Re-examining an 1897 Andrée Balloon Expedition Mystery. *Polar Record*, 60.
<http://dx.doi.org/10.1017/S0032247424000196>

N.B. When citing this work, cite the original published paper.

Research Article

Cite this article: Lantz B, Uusma B, and Tjernström M. The lost message of Nils Strindberg: Re-examining an 1897 Andrée balloon expedition mystery. *Polar Record* 60(e21): 1–13. <https://doi.org/10.1017/S0032247424000196>

Received: 15 July 2024
Revised: 6 September 2024
Accepted: 2 October 2024



Keywords:

Andrée balloon expedition; Nils Strindberg; Anna Charlier; Fuglesongen; Klovningen

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The lost message of Nils Strindberg: Re-examining an 1897 Andrée balloon expedition mystery

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Abstract

During the ill-fated 1897 Andrée balloon expedition, Nils Strindberg allegedly dropped a small tin containing a last message for his fiancée onto the island Fuglesongen in northwestern Svalbard, as the expedition crew passed over it in their hydrogen balloon, *Örnen*. Despite at least one lengthy search on Fuglesongen, the tin has never been found. This paper investigates the hypothesis that the tin was accidentally dropped onto Klovningen, a neighbouring island similar in size and shape, situated approximately 2.4 km east of Fuglesongen. A re-analysis of Strindberg's original handwritten notes from the balloon flight, along with other primary sources and meteorological analyses, suggests that a targeted search for the tin on Klovningen could be a promising next step in solving this enduring mystery.

Introduction

Fuglesongen (The Bird Song), a small island off of Spitsbergen in northwestern Svalbard covering approximately 4.1 km², was not the site of any significant contributions to the history of polar exploration. Historically known as Vogelsang in the late 1800s and early 1900s, it often appears as a mere footnote in the accounts of polar expeditions. The area around Fuglesongen was first explored by Willem Barentsz in 1596, when he seems to have anchored in the narrow strait between Fuglesongen and its neighbouring island Klovningen (Cloven Cliff) (Conway, 1906, p. 13). During the early 1600s, contemporary explorers (e.g. William Baffin) attempted to push round the north-west corner of Spitsbergen and were probably the first to set foot on Fuglesongen (Conway, 1906, p. 76). In 1818, an expedition under David Buchan and John Franklin shot 40 reindeer on Fuglesongen (Conway, 1906, p. 289). Several other famous polar explorers, including Benjamin Leigh Smith and Adolf Erik Nordenskiöld, also mentioned passing Fuglesongen or anchoring nearby in their narratives.

The most intriguing aspect of Fuglesongen among polar historians is the fact that Nils Strindberg, during the ill-fated 1897 Andrée balloon expedition, allegedly dropped a small tin onto it with a letter to his fiancée Anna Charlier, when the balloon passed over the island (Strindberg, 1897a). Strindberg, together with Knut Fränkel and expedition leader Salomon August Andrée, had departed in their hydrogen balloon *Örnen* (The Eagle) about half an hour earlier from the northern shore of Danskøya (Danes Island), approximately 16 km south-southwest of Fuglesongen. Figure 1 shows the approximate path of *Örnen* during its initial hour of flight, as it was understood in 1930 when the official narrative from the expedition was released, based on the expedition diaries that had recently been found on Kvitøya (White Island) (Andrée, Strindberg & Fränkel, 1930).

After having passed Fuglesongen, disappearing from the view of the expedition support crew on Danskøya, the three aeronauts' fate remained unknown until 1930 when their last camp was discovered, by chance, on the desolate island Kvitøya, the easternmost island in the Svalbard archipelago. The recovered diaries (Andrée et al., 1930) told the story about the erratic balloon flight, which lasted nearly three days, the forced landing on 82°56'N latitude and 29°52'E longitude, the attempted 88 days long return march across the ice and the eventual arrival on Kvitøya where they all perished within a few days.

Before the launch, Strindberg mentioned that, when the balloon passed over Amsterdamøya (Amsterdam Island), just north of Danskøya, he would drop a tin containing a message to his fiancée (Stake, 2022, p. 134). However, in a letter to Anna Charlier written after the balloon flight and found on Kvitøya in 1930, Strindberg admitted that he had forgotten to do so (Strindberg, 1897b), without providing further details about the tin. Naturally, the search for the tin on Amsterdamøya, organised soon after the departure, came up empty (Stake, 2022, p. 134). At the last camp on Kvitøya, Strindberg's diary from the balloon flight was found, consisting of a series of brief notes in his almanac. One isolated sentence in that diary forms the basis for this paper:

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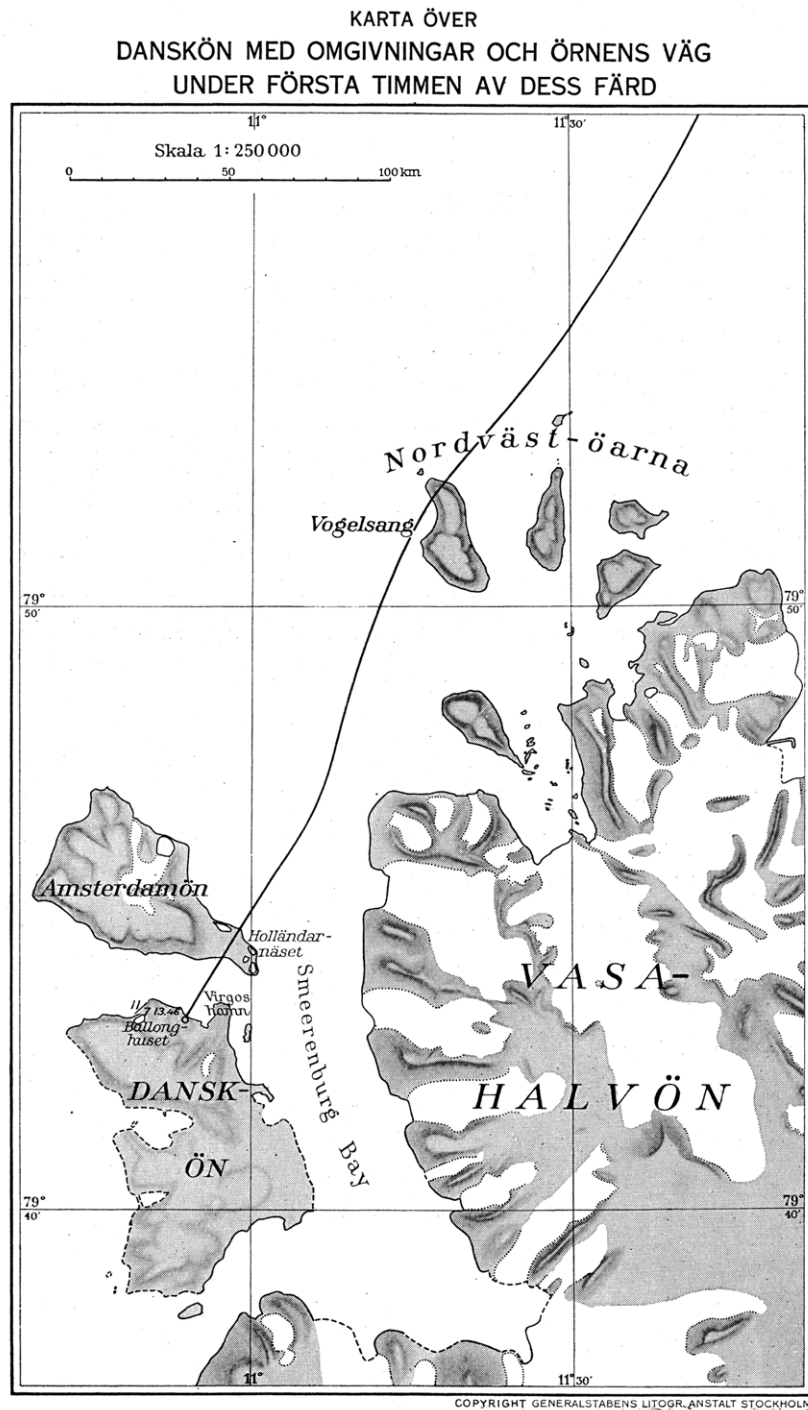


Figure 1. Map of Dansköya and its surroundings, showing the approximate flight path of *Örnens* across Fuglesongen (referred to as Vogelsang at the time) during the first hour, as understood in 1930. Source: Andrée et al, 1930, p. 83.

"My tin with farewell words to Anna was thrown at Vogelsang." [in Swedish: "Min burk med afskedsord till Anna kastades på Vogelsang."] (Strindberg, 1897a).

It is unclear what kind of tin Strindberg used as a container for the letter, as the type, size and material are not detailed in any primary sources. Some later narratives, lacking citations, suggest it was a film canister. Although possible, this idea may be derived from Strindberg's letter to his fiancée (Strindberg, 1897b), in which he states in the same sentence that he took some photographs at the launch site before preparing the final letter for her, which he

intends to throw down onto Amsterdamöya. The idea of a film canister also appears to have been influenced by the 1982 Swedish biographical drama film *Flight of the Eagle*, which depicts Strindberg using such a container in a scene set at Fuglesongen. The only primary sources available, aside from Strindberg's own writings from 1897, are Stadling (1897, p. 3), who does not specify the intended container for the letter, and Stake (2022, p. 134), who mentions that Strindberg was supposed to drop a "case" [in Swedish: fodral] containing the letter. However, given the small variety of sturdy tins brought on the expedition, only a few

possibilities remain. These include cylindrical containers; film canisters and tins made of copper, brass or tinned iron sheets used for storing collected samples; and rectangular containers made of copper or aluminium for holding supplies such as provisions and cooking alcohol (Andrée et al., 1930; Edström, 1931). In a 2011 personal communication, Sander Solnes, a former conservator at the Svalbard Museum, mentioned that a tin made of copper or brass on an island in the Arctic would not have corroded significantly during this period; hence, the tin Strindberg used as a container for the letter could very well still exist.

Using Strindberg's diary entry as a reference, the second author of this paper went ashore on Fuglesongen with a group of 13 in 2011 to search for the tin (Uusma, 2013). The group used metal detectors to explore the relevant northern part of the island for over 9 h but to no avail. The literature does not reveal any other documented systematic search for the tin on Fuglesongen. Since the tin has never been found, the contents of the letter from Strindberg to his fiancée remain unknown.

There appear to be only three possible explanations for the failed search for the tin on Fuglesongen. First, the search expedition may simply have been unable to find the tin, even though it still was present on the site. It may have been stuck among rocks or have been concealed over time by organic material. Some areas of the island are both extremely steep and a maze of tumble-down rocks of different sizes. The tin may have been lost under a recent rockfall, as sections of the hillsides in the area may have collapsed due to loosening permafrost caused by climate change. Second, something (or someone) may have relocated the tin. The most likely suspect would then probably be the wind. Third – which is the premise for the analysis in this paper – the tin might have been accidentally thrown onto Klovningen, an island of similar size and shape located approximately 2.4 km east of Fuglesongen (see Fig. 1). Due to dense and thick clouds that substantially limited visibility during the part of the balloon flight over these islands, there could have been some confusion among the crew members regarding their current location.

The expedition support crew on Danskøya witnessed the departure and the balloon's first hour in the air. One of them was G. R. Celsing, a lieutenant on the icebreaking gunboat *Svensksund*, used for the transport of the expedition personnel and cargo from Sweden. Celsing published a paper on the expedition in the scientific journal *Ymer*, in which he described the departure. He noted that the balloon ascended to an estimated altitude of 700 m before disappearing beyond Fuglesongen, only to briefly reappear east of the island before it returned to its more northerly course to eventually vanish from sight at the horizon (Celsing, 1897, pp. 233–234). He also attached a sketch showing the last three positions in which the balloon was visible to him (see Fig. 2).

Although Celsing did not explicitly refer to the sketch in his paper, it is evident that point 1 on Celsing's sketch denotes the balloon's position before it altered its course to a more easterly direction and disappeared in a cloud beyond Fuglesongen. Point 2 must indicate either the location where *Örnen* reappeared, east of the island, or the position of its easternmost location in the area in the vicinity of Fuglesongen. Point 3 probably marks its final sighting before it vanished entirely from sight. Celsing's vantage point, creating the sketch, was at the launch site on Danskøya. By establishing a line on a standard 2D map, from the launch site through point 2 (see Fig. 3), it becomes evident that the balloon must have experienced a notable eastward drift in the vicinity of Fuglesongen, deviating significantly from the representation in

Figure 1. The line clearly intersects the island Klovningen—named after a distinctive cliff near its northern tip, depicted immediately to the left of point 2 in Celsing's sketch—implying the possibility that the balloon traversed over Klovningen before returning to its original, more northerly path.

The aim of this paper is to analyse the possibility that Strindberg's tin was actually dropped on Klovningen rather than on Fuglesongen. The structure of the paper is outlined as follows: It begins with a review of the various eyewitness accounts concerning the balloon's trajectory, in particular regarding the passage of Fuglesongen and its surroundings. Thereafter, Nils Strindberg's original handwritten diary notes from the passage of Fuglesongen and its surroundings are analysed and discussed in relation to prior interpretations of the aforementioned notes. These different accounts are then analysed in relation to meteorological aspects of how Fuglesongen possibly created local effects in the winds in order to derive an understanding and a detailed timeline regarding the passage. The paper concludes with the hypothesis that the tin, despite Strindberg's note, may have been thrown onto Klovningen. Consequently, a targeted search for the tin on Klovningen could be justified.

Eyewitness accounts

The events during the start and the first part of the flight of *Örnen* are well documented (Andrée et al., 1930; Ekholm & Svedenborg, 1922; Sundman, 1968). After waiting for stable southerly winds at Danskøya for nearly two weeks, the morning of 11 July 1897, finally provided favourable conditions for the Andrée expedition to attempt a flight to the North Pole; there was a moderate breeze from south-southwest (Strindberg, 1897b). Following thorough discussions among Andrée, Strindberg and Fränkel, as well as with the expedition support crew, the decision was made. They penned their final letters, and at 1.41 p.m., they boarded the gondola, bidding farewell at 1.43 p.m. The mooring lines securing the balloon in the balloon house were severed, and at 1.46 p.m., the hydrogen balloon *Örnen*, which had never been test flown, ascended (all times in UTC, based on Strindberg's real-time diary entries). Critical events unfolded during the next few minutes. The intention was to achieve some level of manoeuvrability for *Örnen* using guide ropes, which were intended to slide behind the balloon on the ice, and a sail. However, upon launch, the lower sections of all three guide ropes were lost, resulting in *Örnen* becoming an uncontrollable free-flying balloon. The balloon suddenly lost altitude and briefly dipped into the sea, prompting Andrée, Strindberg and Fränkel to jettison eight bags of ballast to regain elevation.

At 1.56 p.m., 10 min after departure, the balloon flew over the flat headland at the eastern part of Amsterdamøya, where Strindberg had intended to drop the tin containing the letter to Anna Charlier, on the expected (given the wind) roughly north-northeast trajectory. Eighteen minutes later, at 2.14 p.m., apparently having increased speed, the balloon was flying directly west of Fuglesongen at an altitude of about 600 m. In the following moments, *Örnen* veered in over Fuglesongen and temporarily vanished from view from Danskøya, both becoming obscured by clouds and by descending below the highest point of Fuglesongen.

Several members of the expedition support crew who witnessed the departure of *Örnen* from Danskøya documented their experiences and memories from the event. Below is a review over these narratives, with respect to *Örnen's* passage of Fuglesongen and its surroundings.



Figure 2. Sketch showing the final three positions in which the balloon was visible to Celsing after reaching Fuglesongen. The island in the middle is Fuglesongen, and the island to the right is Klovningen. Source: Celsing (1897, p. 234).

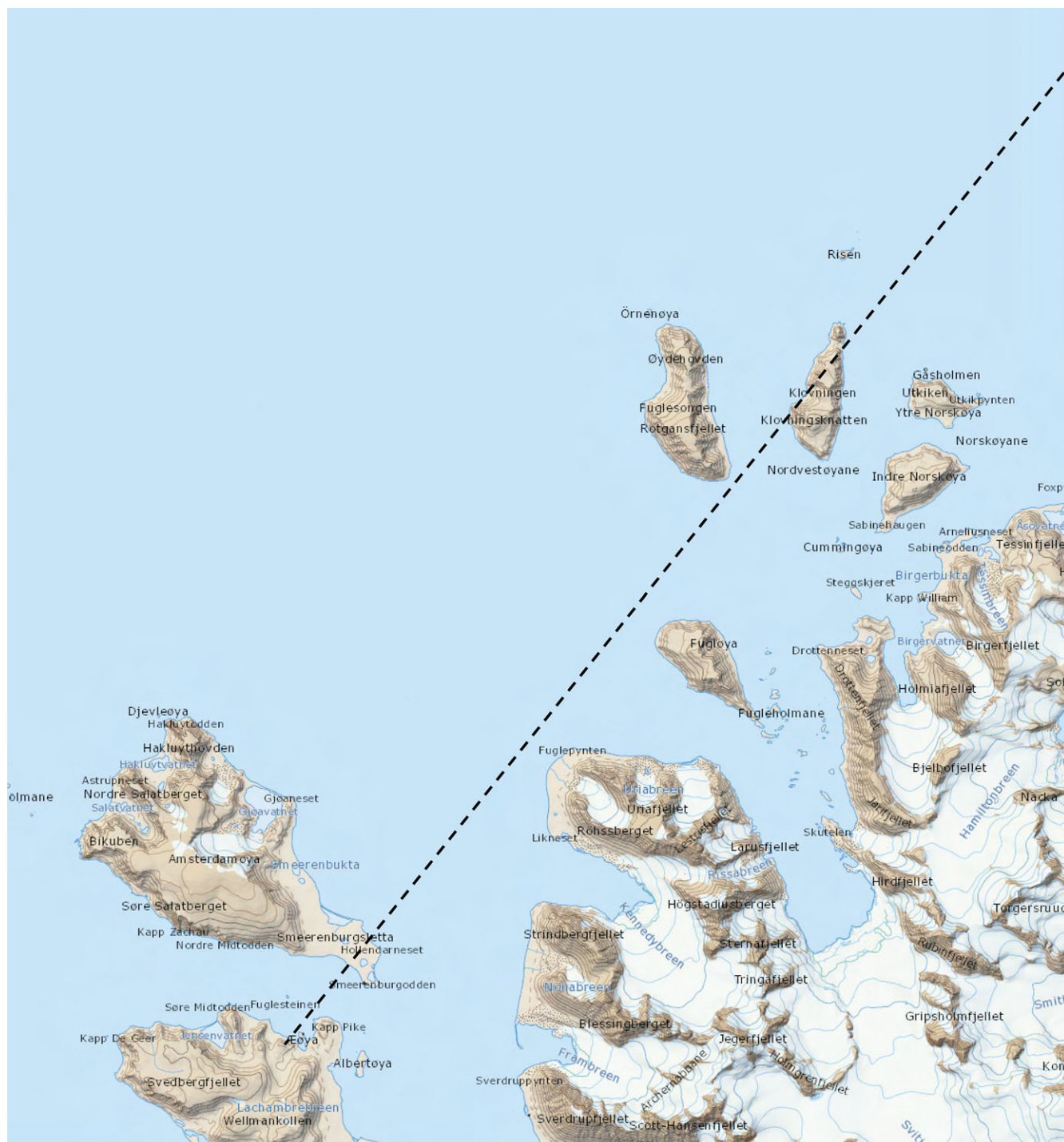


Figure 3. A line from the launch site on Danskøya through Celsing's point 2. Created by the authors. Map from Norwegian Polar Institute.

Lieutenant G. R. Celsing (1897, pp. 233–234) wrote in the scientific journal *Ymer*: “The balloon finally disappeared behind Vogelsang, only to reappear for a moment east of this island, after which it again moved north and disappeared.” [In Swedish: “Ballongen försvann slutligen bakom Vogelsang för att åter visa sig ett ögonblick öster om denna ö, hvarefter den åter drog sig åt norr och försvann.”].

Lieutenant G. V. E. Svedenborg, the designated alternate crew member in case Andrée, Strindberg or Fränkel became unable to participate in the balloon flight, described his observations from the launch in an article in the Swedish newspaper *Aftonbladet*, on 27 July 1897 (Svedenborg, 1897): “We saw the balloon, after just over half an hour, go behind Fogelsang. In the lee of this island, it seems to have moved slightly eastward, but then appeared to resume its previous direction.” [In Swedish: “Vi sågo ballongen efter något öfver en half timme gå bakom Fogelsang. I lä om denna ö tycks den ha dragit sig något åt öster, men syntes sedan återtaga sin förra riktning.”]. It is worth noting that Svedenborg also published a more extensive piece about the Andrée expedition 25 years later (Ekholm & Svedenborg, 1922) but did not provide any details about the passage of Fuglesongen at that time.

J. Stadling, a correspondent for the newspaper *Aftonbladet* with the assignment to report from the expedition, published an article covering the launch of the balloon, on 23 July 1897 (Stadling, 1897): “Here, *Örnen* made a new turn eastward over the northern tip of the island Fogelsang, whereupon it disappeared into a cloud. After a while, it became visible again in a north-northeast direction between the islands Fogelsang and Cloven Cliff, whereupon it once again veered westward and finally disappeared from our sight approximately one hour after its ascent.” [In Swedish: “Här gjorde *Örnen* en ny svängning mot öster öfver ön Fogelsangs norra udde, hvarpå den försvann i ett moln. Om en stund blef den åter synlig i nordnordostlig riktning mellan öarna Fogelsang och Cloven Cliff, hvarvid den ånyo svängde mot vester och slutligen försvann ur vår åsyn cirka en timmes tid efter dess uppstigande.”]. Thus, Stadling’s narrative clearly indicates that the balloon zigzagged across the area, rather than following the straight course depicted in Figure 1. It is worth noting that Stadling also published a longer article about the Andrée expedition in 1898 in *The Century Illustrated Monthly Magazine* (Stadling, 1898), but he also did not reveal any further information about the passage of Fuglesongen in that piece.

A. Stake, the engineer responsible for the hydrogen production in Danskøya, recorded in his diary, which remained unpublished until 2022 (Stake, 2022, p. 131): “... then proceeded in a straight line between Pike’s Point [a landmark on Danskøya close to the point where the balloon was launched] and the northwestern corner of Vogelsang, over which it ascended and disappeared among the clouds. We observed it for about 1 h.” [In Swedish: “... gick så i rak linje mellan Pikes udde och nordvästra hörnet av Vogelsang över vilken den höjde sig och försvann bland molnen. Vi sågo den ca 1 timme.”]

A. Machuron, a mechanic and representative for the balloon manufacturer, H. Lachambre, documented the passage of Fuglesongen in his book about the expedition (Lachambre & Machuron, 1898, p. 302–304): “We see it clear the top of the hill, and stand out clearly for a few minutes against the blue sky, and then slowly disappear from our view behind the hill. Scattered along the shore, we stand motionless, with full hearts and anxious eyes, gazing at the silent horizon. For one moment then, between two hills we perceive a grey speck over the sea, very, very far away, and then it finally disappears.”

Dr. G. Violet, a correspondent for the German newspaper *Lokal-Anzeiger*, conveyed details about the expedition in a telegram, reproduced in the Swedish newspaper *Svenska Dagbladet* on 20 July 1897 (Violet, 1897): “... it looked as though it was being pressed against the cliffs at Vogelsang, but with the aid of binoculars, we could see how it hovered a few meters above them and now completely free, continued northward. At exactly 3 o’clock, the balloon disappeared at the horizon.” [In Swedish: “. . . Det såg ut, som om den trycktes mot klipporna vid Fågelsång, men med beväpnade ögon kunde vi se, hur den sväfvade några meter öfver dem och nu alldeles fri fortsatte mot norr. På slaget 3 försvann ballongen vid horisonten.”]

Yet another eyewitness, supposedly an officer on *Svensksund* according to Ekholm and Svedenborg (1922) and apparently also a correspondent for the newspaper *Stockholms Dagblad*, wrote anonymously an article about the departure in the paper (*Då Andrée steg upp*, 1897), but with no further details about the passage of Fuglesongen. (Most likely, Celsing was this anonymous writer.)

Among the other main members of the expedition support crew who witnessed the departure, Captain C. A. Ehrensvärd did not produce any personal writings about the event, yet he pointed out in an interview (Andrée: *Svensksunds återkomst*, 1897) that Violet’s prior account regarding the departure was inaccurate. Similarly, Lieutenant C. G. Norselius, having not authored any personal documents relating to the departure, highlighted inaccuracies regarding Violet’s narrative in an interview (*Svensksund åter hemma*, 1897). The surgeon aboard *Svensksund*, Dr. Lembke, while not having published any personal accounts, was also interviewed (*Svensksund åter hemma*, 1897) but did not specifically address any details of the departure.

As shown, the eyewitnesses at the launch site in Danskøya did not perfectly agree on the details of how the passage of Fuglesongen occurred. However, in a summary of the course of events during the departure of *Örnen*, Ekholm & Svedenborg (1922) emphasised that Celsing’s, Svedenborg’s and Stadling’s accounts were portrayed in a consistent and believable manner, but that neither the account by Violet nor the narrative by Machuron were reliable, since they differed in several aspects from the Swedish authors’ relatively uniform description. Consequently, Ekholm relied primarily on Celsing’s account in his chronicle. It should be noted that this analysis by Ekholm was conducted eight years before the final camp on Kvitøya was discovered and, thus, was not in any way biased from Strindberg’s diary notes.

Sundman (1968), who compiled an otherwise magnificent collection of source material about the Andrée expedition, relied solely on Celsing (1897) in his description of *Örnen*’s passage over Fuglesongen and its surroundings. Thus, the consensus among scholars seems to be that the most reliable eyewitness accounts are Celsing’s, Svedenborg’s and Stadling’s. Stake’s diary, recently published, also supports these accounts.

Strindberg’s diary notes

Several diaries and notebooks were discovered scattered at the final campsite of the Andrée expedition on Kvitøya in 1930. Among these findings was Nils Strindberg’s annotated almanac from 1897, located at the tent site. In this almanac, comprising 142 pages in total, Strindberg made his diary entries. The notes in the almanac have been analysed by the authors of this paper, with particular attention given to the entries spanning pages 57–58 (see Fig. 4). These pages cover Strindberg’s notes on the events surrounding the balloon launch and the initial 77 min of the flight, including the

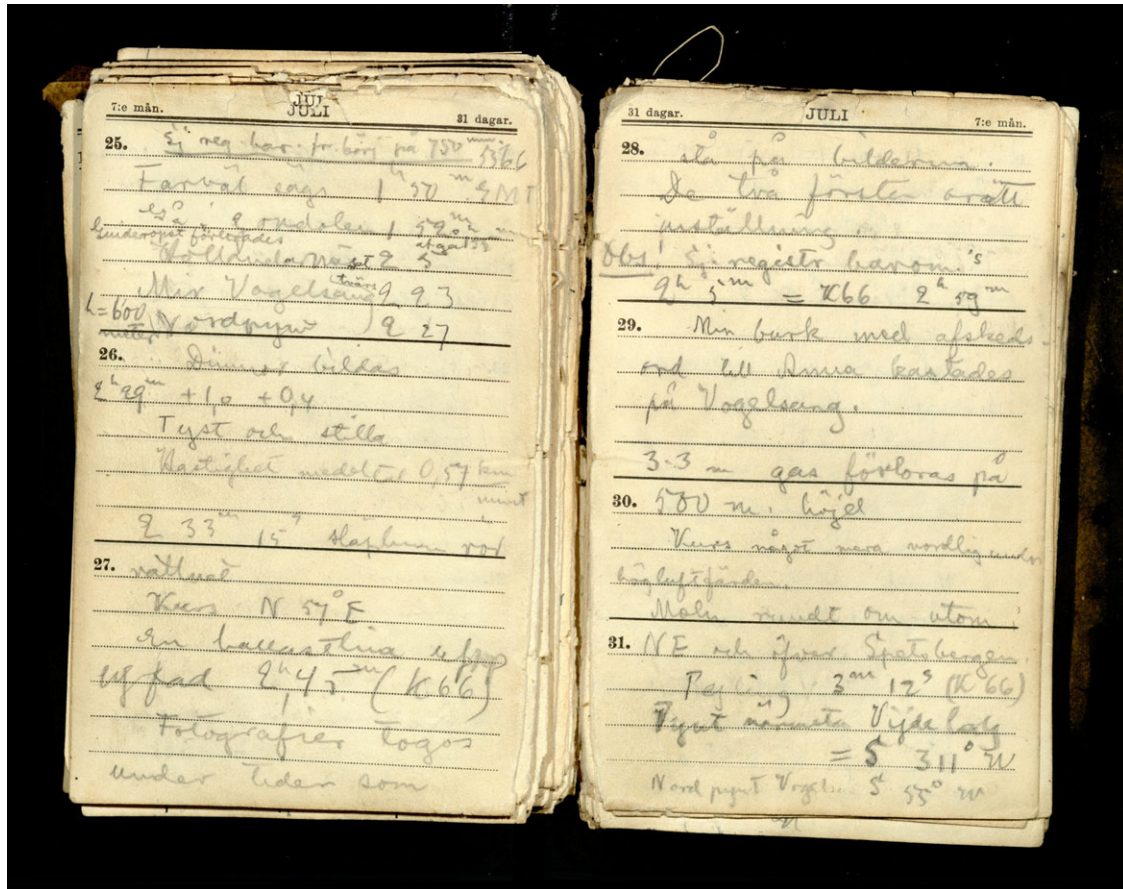


Figure 4. Nils Strindberg's handwritten diary notes from the first 77 minutes of the balloon flight. Courtesy of The Swedish Society for Anthropology and Geography.

notation about dropping the tin at Fuglesongen. Notably, the pre-printed dates on the spreads do not correspond to the dates of Strindberg's handwritten entries.

Strindberg's diary notes were already published in 1930 (Andrée et al, 1930), but the re-analysis in this paper has revealed some previously overlooked details. By studying all handwritten entries within the entire almanac, a discernible pattern emerges: it becomes evident that Strindberg begins almost every new paragraph with an indentation, followed by text lines starting at the far-left margin. This structural understanding allows for the identification of which lines of text were written in sequence: those beginning at the far-left margin are consequently linked to a preceding, indented line. In addition, some previous interpretations of the diary notes made upon their initial publication (Andrée et al., 1930) were found to be incorrect. For example, there is, in fact, no period on line 9 after Strindberg's note about forming fogs, which alters the understanding of lines 9–10. Using these insights, the authors of this paper have also conducted a new translation of the diary notes into English.

Tables 1–4 present the translated version and analysis of the content of pages 57–58 in Strindberg's diary. The complete Swedish version, which notes inaccuracies in previous interpretations, is included as an appendix. Note that Strindberg's chronometer, known as Kullenberg 5566, was initially not accurately set, running 9 min ahead of the correct time. He only became aware of this problem 64 min post-launch, as indicated by a notation on the right page, line 25. Therefore, both Strindberg's indicated time and the corrected time are referenced in Tables 1–4.

The next step is to examine Strindberg's account of his observations with regard to the passage over the Fuglesongen area. In lines 7–8, Strindberg describes his observations of the northernmost part of Fuglesongen from an altitude of 600 m, which corresponds to point 1 on Celsing's sketch ("h = 600 m North Cape 22"). At this point, the elevation of the island is about 300 m. Thus, if the tin had dropped there, it would have traversed through the air for approximately 300 m. Given the average speed of the balloon, the current wind speed can be estimated to somewhere around 10 m/s, indicating that the tin may not have landed where Strindberg had intended. When the tin left Strindberg's hand, it had the same horizontal velocity as the balloon, and the wind likely supported its velocity rather than slowing it due to air friction. Thus, the tin could even have landed in the water without Strindberg noticing it from a relatively large distance.

In the following paragraph (lines 9–10), Strindberg mentions the formation of fog ("Fogs are forming 2.29"), corroborating eyewitness accounts of the balloon disappearing into clouds at this time. In line 11, Strindberg notes: "Quiet and still." This is noteworthy, given that the act of documenting this particular observation here implies that he has not previously experienced the journey as quiet and still. Given the aerostatic nature of Örnén, a hydrogen balloon flying freely with the speed of the wind, the gondola conditions could have been completely calm, provided sufficient height. Due to the friction of air against the surface, the airflow near the surface is always turbulent. This is characterised by rapid fluctuations in the wind in all three dimensions, much faster

Table 1. Nils Strindberg's handwritten diary notes from the departure

Line	Text, including placement on the line	Analysis and comments	Noted time (P.M.)	Corrected time (UTC)	Time since launch
1	<u>Self reg. bar. init at 750^{mm}</u> . 5566	Abbreviation of "Self-registering barometer initially at 750 ^{mm} . Kullenberg 5566."			
2	Farewell being said 1 ^h 50 ^m . GMT	Written in present tense. Note that GMT is the former name for UTC.	1.50	1.41	-5 min
3	Enter gondola 1 52 ^m	Written in present tense.	1.52	1.43	-3 min
4	Guide rope lost depart 1 ^h 55 ^m	This line has been inserted between two pre-printed ones and has thus been written afterwards, in past tense. It is noteworthy that Strindberg stated only one guide rope was lost, whereas, in fact, the lower parts of all three were lost.	1.55	1.46	0 min
5	Hollandarneset 2 5	Written in present tense. In the late 19th century, it was common to write 2.5 when referring to 2.05. Lines 1, 2, 3 and 5 are written in one sequence. Thereafter, line 4. Hollandarneset, Amsterdamøya, is the location where Strindberg was supposed to have dropped the tin, although he forgot to do so.	2.05	1.56	10 min

Table 2. Nils Strindberg's handwritten diary notes from the passage of the Fuglesongen area

Line	Text, including placement on the line	Analysis and comments	Noted time (P.M.)	Corrected time (UTC)	Time since launch
6	Sighting Vogelsang \ abeam 2 23	Written in present tense.	2.23	2.14	28 min
7	h = 600 North Cape 2 27	Lines 7 and 8 are connected. Written in present tense. "h" means "height." "North Cape" means Fuglesongen's most northerly point. "h = 600" is connected to "metres."	2.27	2.18	32 min
8	meters				
9	Fogs are forming	Indentation, that is, new paragraph. Lines 9 and 10 are connected. Written in present tense. They brought two thermometers: one "wet" and the other one "dry." "1,0" is the temperature measured with the wet one; "1,4" is measured with the latter.	2.29	2.20	34 min
10	2 ^h 29 ^m + 1,0 + 1,4				
11	Quiet and still	Lines 11–13 are connected. Written in present tense. Strindberg knew the distance between Danskøya and Fuglesongen, 18 km, and was therefore able to calculate the average speed of Ørnen. He also prioritised doing so above making notes about a tin drop.		Between 2.20 and 2.24	Between 34 and 38 min
12	Speed average 0,57 km/				
13	minute				
14	2 33 ^m 15 ^s drag rope touches	Indentation, that is, new paragraph. Lines 14–15 are connected. Written in present tense. At this time, the balloon was positioned over water, not land. Strindberg has now changed the name of the rope he initially referred to as "guide rope" (line 4). He is using "drag rope" in the singular form, indicating that the longest one of the three guide ropes (shortened accidentally at launch) is now touching the water's surface. The length of the longest guide rope is 105 m. Hence, their vertical visibility is at least 105 m since they can see the water surface.	2.33	2.24	38 min
15	the water				

than the inertia of the balloon would allow it to adjust. The intensity of the turbulence typically decays with height up to, here, typically a few hundred metres. Apart from the tumultuous events during and immediately after the launch, when the balloon was

close to the surface, the journey ought to have been quiet and still all the time up to this point. However, the only external circumstance that was documented to have changed at this time, which may have prompted him to make the note, is the formation

Table 3. Nils Strindberg's handwritten diary notes from the continuing flight, still within sight from Danskøya

Line	Text, including placement on the line	Analysis and comments	Noted time (P.M.)	Corrected time (UTC)	Time since launch
16	Course N 57° E.	Strindberg had time to chart the course. He also had the opportunity to do so, indicating favourable visibility. Hence, the balloon was not enveloped in fog at this time. The course N 57° E differs significantly from the one reported by the observers, and the balloon is now heading in a more easterly direction. However, the course does not seem to be established by measuring against fixed points on land and therefore has some questionable reliability.		Between 2.24 and 2.36	Between 38 and 50 min
17	A ballast line up	Indentation, that is, new paragraph. Lines 17–18 are connected. Written in past tense. They lifted one of the ballast lines to later attempt to splice it with one of the shortened guide ropes, in order to try to regain some degree of steering control over the free-flying balloon.	2.45	2.36	50 min
18	lifted 2 ^h 45 ^m (K 66)				
19	[Blank line]				
20	Photographs taken	Indentation, that is, new paragraph. Lines 20–24 are written as one paragraph. Written in past tense, passive voice. The first photographs from this roll of film, found in 1930 at Kvitøya, were damaged and cannot provide any information about their position. The balloon must have been entirely clear of clouds/fog when the photographs were taken, hence Strindberg would not deem it worthwhile to photograph them. However, the past tense could indicate a previously conducted event, that is, that the photographs were not taken at this point.		Between 2.36 and 2.50	Between 50 and 64 min
21	at times				
22	given on pictures.				
23	The first two incorrectly				
24	set				
25	Nb! Self-regist barom' ^s	Lines 25–26 are connected. After taking the first photographs from this roll of film (see lines 24, 25), Strindberg realised that the chronometer time (Kullenberg 5566) is 9 min off.	2.59	2.50	64 min
26	2 ^h 5 ^m = K 66 2 ^h 59 ^m				

Table 4. Nils Strindberg's handwritten diary notes from the continuing flight, no longer within sight from Danskøya

Line	Text, including placement on the line	Analysis and comments	Noted time (P.M.)	Corrected time (UTC)	Time since launch
27	My tin with farewell-	Indentation, that is, new paragraph. Lines 27–29 are connected. Written in past tense, passive voice. The sentence is written approximately 30 min past the tin drop.		Between 2.50 and 3.03	Between 64 and 77 min
28	words to Anna was thrown				
29	at Vogelsang.				
30	[Blank line]				
31	3.3 m gas is being lost at	New paragraph. Lines 31–34 are connected. Written in present tense. Strindberg meant cubic metres but forgot to include the exponent 3. The balloon had once again ascended to 500 m at this point.			
32	500 m. altitude				
33	Course slightly more northerly during				
34	the high-altitude journey.				
35	Clouds all around except in	Indentation, that is, new paragraph. Lines 35 and 36 are connected. At this moment, the balloon cannot be positioned just northeast of Fuglesongen, obscured by the island, since they were able to see Spitsbergen.			
36	NE and over Spitsbergen.				
37	Bearing 3 ^m 12° (K 66)	Indentation, that is, new paragraph. Lines 37–40 are written in one paragraph. Strindberg determined their position by measuring bearings against fixed points on land, "Vijdebay" and the northern tip of Fuglesongen ("North point"). At this moment, there was thus a clear line of sight from the balloon to these two landmarks. Using this information and knowledge of the magnetic declination at the time, the balloon must have been located at 80.00 N latitude and 12.02 E longitude at this time.	3.12	3.03	77 min
38	Cape nearest Vijdebay				
39	= S 311° W				
40	North Point Vogels. S 55° W				

of fog. It is easy to imagine that Strindberg in this situation became more aware of the stillness when he was deprived of his visual impressions and had to rely solely on hearing and the sensation of movement. If the fog was dense around *Örnen* with a loss of visibility it is possible that Strindberg also lost the ability to orient himself. This is further supported by the fact that Strindberg was neither making any notes at this time about the balloon significantly losing altitude nor was he noting that the course was simultaneously deviating significantly to the east. When visibility cleared again, it is possible that the balloon was over Klovningen, the island closest in proximity. This is about 2 km further east, and at an approximate speed of 10 m/s, this would have taken about 3 min. This opens up the possibility that the tin may have been dropped there, under the mistaken belief that they were still situated above Fuglesongen.

Should the tin indeed have been dropped at Fuglesongen, this event would have occurred at a time between lines 7 and 13 in the diary notes (i.e. between 2.18 p.m. and 2.24 p.m., corrected time). It is worth noting that Strindberg refrained from documenting this important event in real-time, despite having the opportunity, as it was calm and quiet. Instead, he prioritised calculating and documenting the balloon's average speed at lines 12–13, noted as “*Speed average 0.57 km/minute.*” Could this discrepancy imply that the tin was not dropped during these minutes, possibly due to poor visibility, preventing Strindberg from seeing the ground?

It was not until approximately 30 min after the tin drop that Strindberg made a note of it, as seen in lines 27–29: “*My tin with farewell words to Anna was thrown at Vogelsang.*” This is one of the few sections on the spread written in past tense. It should also be noted that it is written in passive voice. Could this suggest that either Andrée or Frænkel threw the tin, while Strindberg was making navigational computations, perhaps doing so with less attention to recording which island it was dropped on?

Analysis

The purpose of this section is to analyse the passage over Fuglesongen and its surroundings, based on comparisons of Strindberg's notes and the eyewitness accounts, in order to deduce a detailed timeline of the passage thereby providing a deeper understanding of the likelihood of either Fuglesongen or Klovningen being the actual target for Strindberg's tin.

First, *Örnen*'s altitude when they had just swung in over Fuglesongen at 2.18 p.m. was, according to Strindberg, approximately 600 m. This estimation seems relatively reliable; Celsing (1897) estimated the altitude before the crossing of Fuglesongen to be 700 m, Stadling (1897) mentioned 800 m and Svedenborg (1897) 500 m. However, we know that the balloon must have begun to descend rapidly once it had flown in over Fuglesongen, even though Strindberg never mentioned this explicitly in his notes since both Celsing (1897) and Svedenborg (1897) agreed that the balloon disappeared *behind* Fuglesongen, and the highest peak on the island—Rotgangs fjellet—is only 387 m high. Lachambre and Machuron (1898) also mentioned that the balloon disappeared behind Fuglesongen. Furthermore, at 2.24 p.m., Strindberg wrote that a guide rope touched the water. The remains of the longest guide rope, after its lower part had been lost at departure, was 105 m (Ekholm & Svedenborg, 1922); thus, the altitude of the balloon at this point was probably about 100 m. Thus, they must have descended approximately 500 m in 6 min, and once again, the balloon was positioned over water, not land, at that time. It is

remarkable that Strindberg never mentioned this rapid descent in his notes, given that he had time to write that he perceived the journey as still and quiet during these minutes. Could the reason be that he did not realise the balloon was descending so rapidly due to the lack of visibility from the fog he had just mentioned?

Second, Stadling (1897) mentioned that *Örnen* disappeared *into a cloud* rather than becoming obscured from view behind Fuglesongen itself. Neither Celsing (1897) nor Svedenborg (1897) included the cloud in their narratives, but Stake also mentioned that the balloon disappeared *among clouds*. The cloud(s) apparently match Strindberg's observation at 2.20 p.m. in the balloon that *fogs were forming*.

Third, it seems clear that they swung in over Fuglesongen somewhere at the northern part of the island. Stadling (1897) wrote that the balloon made a new turn eastwards over the northern tip and Stake (2022) mentioned that it flew to the northwestern corner of Fuglesongen. Strindberg noted at 2.18 p.m. in connection with an estimated altitude of 600 m that he could see the northern tip of the island. However, the island is small, and without clouds at an altitude of 600 m, one can easily see the northern tip of the island even from the southern tip. Thus, Strindberg's note does not necessarily mean that they flew over or even close to the northern tip.

Moreover, the turn eastwards over Fuglesongen must have been substantially sharper than what the flight path in Figure 1 suggests; otherwise, the balloon could not have been seen to the east of Fuglesongen by eyewitnesses on Danskøya, which Celsing (1897), Svedenborg (1897) and Stadling (1897) all agree that they could. In addition, Svedenborg (1897) mentioned explicitly that the balloon seemed to have veered eastwards over Fuglesongen, and Stadling (1897) stated that it was visible between Fuglesongen and Klovningen. Finally, point 2 in Celsing's sketch (see Fig. 2) shows that the line along which he saw the balloon when it became visible after having crossed Fuglesongen crosses Klovningen. Thus, the balloon must at this point have been located either at a much more easterly flight path than what Figure 1 indicates, either north of Klovningen or over Klovningen itself. A more realistic path is indicated in Figure 5.

Since *Örnen* essentially became a free-flying balloon—having lost the lower sections of the guide ropes—the winds dictated its course. We know that the balloon became embedded in a cloud when it reached Fuglesongen and then experienced a rapid descent of 500 m in 6 min. The rapid descent and changes in the path indicate significant shifts in the local winds.

There is no way to reconstruct the winds as they were on the day of the expedition's departure. Today—unlike at that earlier time—it is well understood that both wind speed and direction vary with height within the so-called boundary layer, the lowest portion of the atmosphere where the flow always becomes turbulent due to its interaction with the solid surface. First, wind speed increases with height, approaching a free atmosphere velocity at the top of the boundary layer, at the region of Andrée's departure likely only a few hundred metres. But the wind also systematically changes direction with height. It was in fact Fritjof Nansen, who during his *Fram* expedition first observed how sea ice tended to drift to “the right of the wind” (when standing with the wind in the back). During a visit to Stockholm, he mentioned this to the then student Vagn Walfrid Ekman who derived the theory behind the so-called Ekman spiral for the ocean currents (Holton, 2004, pp. 127–129); it became his PhD thesis in 1902 (Ekman, 1902), and it has later been confirmed that the same applies to the lower atmosphere. According to this, the wind direction near the



Figure 5. A possible flight path across the Fuglesongen and Klovningen area which does not contradict the observation by Celsing. Created by the authors. Map from Norwegian Polar Institute.

surface would, under the influence of the Earth's rotation, on the northern hemisphere be lower than that in the so-called free troposphere above the turbulent layer. As the wind speed must be zero at the surface, the wind speed would simultaneously increase with height up to the free atmosphere, where the airflow would be smooth, steady, and not turbulent (Holton, 2004, pp. 115–116). The simultaneously increasing and turning wind with height is what today's hot air balloonists, who can regulate their altitude, use to somewhat steer their vehicles.

Hence, assuming everything else was horizontally homogeneous and stationary if the airflow close to the surface indicated a southerly flow, it could well have been southwesterly and significantly stronger a few hundred metres above the surface.

Furthermore, complex orography such as mountainous islands may affect the airflow strongly, especially when the lowest atmosphere is negatively buoyant (stably stratified), as it would be with warm air flowing over a colder Arctic surface; the documented southerly airflow may be indicative of such

conditions. Depending on both terrain height and the depth of the turbulent atmospheric boundary layer, this can lead to dramatic alterations in both wind direction and speed (Holton, 2004, pp. 284–289). If a shallow boundary layer, which is capped by a temperature inversion where the temperature increases with height, is located at a height comparable to the highest terrain, this can have dramatic effects on the flow. The boundary layer, below the inversion, accelerates and diverges to flow around the sides of the island, and the wind direction can therefore change dramatically over short distances in an archipelago. The air aloft, inside the inversion and higher, may instead form a single wave-like feature, where the air rapidly accelerates over and descends on the lee side of the island. A balloon trapped in the inversion at a few hundred metres would experience an acceleration, followed by a loss in altitude. Some distance downstream, a so-called hydraulic jump, may appear, where the boundary layer suddenly deepens, and the flow decelerates back to its background speed. A very similar analogy can easily be found in a stream where water is flowing over a rock that is just barely submerged.

In addition to the obvious effects on visibility, the documented fog may complicate the situation. The fog is likely to be more turbulent, and liquid water may deposit on the balloon. This situation worsens if the temperature in the fog is slightly below freezing (temperature typically decreases by approximately 1° C per 100 m), so-called super-cooled conditions, as fog droplets would freeze into ice on the balloon surface immediately. The added weight of water and ice would impact the balloon's altitude.

In summary, the effects of orography on the larger Svalbard scale and the Ekman spiral make it quite possible that the free flow at some height west of Svalbard was more westerly than southerly, but terrain blocking at low altitude west of the islands led to the observed south-southwesterly flow. As this flow interacts with the very northwesternmost islets of Svalbard, this can lead to both intense changes in wind speed and direction and fog formation. Therefore, it is plausible to infer that the suggested changes in path and altitude may have been brought about by local topography in combination with atmospheric static stability. Consequently, the distinct eastward deviation in the balloon's flight path over Fuglesongen while obscured from the observers on Danskøya is plausible.

Discussion

Based on our re-analysis of Nils Strindberg's diary notes, eyewitness accounts and modern meteorological knowledge, we have found that the previously accepted flight path of the balloon depicted in Figure 1 is incorrect. Instead of following a straightforward trajectory, the balloon traversed the area around Fuglesongen and Klovningen in a pronounced zigzag pattern. This new understanding challenges the established narrative and suggests that the balloon's journey was more erratic and influenced by immediate environmental factors than previously thought. This revised flight path is crucial for accurately reconstructing the events of the expedition. The zigzag pattern observed in the balloon's flight was primarily caused by meteorological effects on the local wind patterns created by Fuglesongen's topography. It is plausible that the eastward turn taken by the balloon led it over Klovningen, unnoticed by Strindberg due to the dense cloud cover at the time. The cloud, perceived by Strindberg as fog, and the resulting limited visibility likely caused confusion about the balloon's exact position. This possibility suggests that the balloon's actual flight path may have included a crossing over Klovningen,

which has implications for understanding the balloon's journey and planning future searches for the tin.

So, what can we deduce from this regarding the likely location for Strindberg's tin drop? We suggest that Fuglesongen, after all, probably remains the prime candidate. Strindberg's diary entry mentioning the tin was dropped there cannot be overlooked. However, the analyses in this paper introduce several doubts, offering grounds for considering a focused search on Klovningen as justified:

- Given the current understanding of atmospheric dynamics and wind conditions near complex terrain, it is quite possible that the balloon turned more sharply to the east during its flight near Fuglesongen and Klovningen than previously believed. This also suggests the balloon could have been above Klovningen following its passage over Fuglesongen.
- The cloud, perceived by Strindberg as fog, likely complicated navigation for *Andrée, Strindberg and Fränkel*. Dense fog significantly reduces visibility, and while the exact thickness of this particular cloud is unknown, poor visibility may have prevented Strindberg from noticing changes in the trajectory. It is possible that during this period of limited visibility and altered course, the balloon crossed the relatively narrow strait between Fuglesongen and Klovningen unnoticed by Strindberg.
- Strindberg's passive voice in noting the drop of the tin on Fuglesongen leaves open the possibility that the actual drop was made by *Andrée* or *Fränkel* while Strindberg was busy with something else. As a result, if this was the case, Strindberg could have misinterpreted where the drop was actually made. However, given the personal nature of the item, it seems likely that Strindberg dropped the tin himself.
- Strindberg penned the note about the tin approximately half an hour after passing the supposed drop area. While he recorded most of his diary notes and reflections in real-time, such as their average speed and the quietness while enveloped in the cloud (despite a rapid descent), other details, such as the drop of the tin with the letter to his fiancée, were added to his diary retrospectively.
- The sole evidence of the tin's drop location is Strindberg's solitary note, thereby unverifiable unless the tin is discovered.
- Despite some dedicated efforts, the tin remains undiscovered.

Conclusion

In closing our analysis of this 1897 *Andrée* balloon expedition mystery, it is important to approach the final conclusion with caution and openness to new possibilities. While the prevailing narrative suggests that Strindberg dropped a message for Anna Charlier on Fuglesongen, our study introduces several uncertainties that challenge this notion. These doubts stem primarily from a critical examination of the sole source indicating the tin's intended location—Strindberg's own notation—which itself lacks external confirmation and is complicated by subsequent events and observations not fully aligning with the initial account.

Given these considerations, and the fact that a search on Fuglesongen has not yielded the tin, our analyses suggest that an alternative location, Klovningen, merits attention. This hypothesis is not without its own set of uncertainties; however, it is informed by a reevaluation of the balloon's trajectory, based on modern meteorological knowledge, potentially leading it closer to Klovningen than previously believed. Therefore, while we maintain a cautious stance regarding the definitive location of Strindberg's

message, the insights garnered from our analysis indicate that a targeted search on Klovningen could be a worthwhile endeavour.

On a more general level, our analyses in this paper underscore the importance of revisiting historical data with fresh perspectives, highlighting the potential for new discoveries in the quest to piece together the past. By questioning established beliefs and considering other possibilities, we might uncover overlooked aspects of history, enhancing our grasp of polar heritage.

Acknowledgements. This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Competing interests. The authors declare none.

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Appendix: Nils Strindberg's reinterpreted diary notes in Swedish

Table 5. Nils Strindberg's reinterpreted diary notes in Swedish. Courtesy of The Swedish Society for Anthropology and Geography

Line	Original text (including placement on the line)	Comments regarding previous interpretations
1	Sj reg. bar. fr börj på 750 ^{mm} . 5566	This line is excluded in a previous interpretation (Andrée et al., 1930). A previous interpretation incorrectly indicates the presence of a period after "börj" (Sundman, 1968).
2	Farväl sägs 1 ^h 50 ^m . GMT	Previous interpretations incorrectly indicate the presence of a period between "G" and "M" (Andrée et al., 1930; Sundman, 1968). A previous interpretation incorrectly indicates the absence of a period after "1h 50 m" (Andrée et al., 1930).
3	Gå i gondolen 1 52 ^m	Previous interpretations incorrectly indicate the presence of the letters "G. M T" after "1 52 m" (Andrée et al., 1930; Sundman, 1968).
4	Guideropet förlorades afgang 1 ^h 55 ^m	Previous interpretations have incorrectly switched the order of the two events at this line (Andrée et al., 1930; Sundman, 1968). Previous interpretations have also incorrectly excluded "h" and "m" from "1 h 55 m" (Andrée et al., 1930; Sundman, 1968).
5	Holländarnäset 2 5	
6	Mir Vogelsang \ tvärs 2 23	"Mir" is an old term used in connection with astronomical navigation meaning "sight" or "sighting point." "Vogelsang" is the former name for Fuglesongen. "Tvärs" means that the balloon is drifting perpendicular to the (western) coastline of Fuglesongen.
7	h = 600 Nordpynt 2 27	"h" means "height." "Nordpynt" means Fuglesongen's most northerly point. "h = 600" is connected to "meter."
8	meter	
9	Dimmor bildas	Previous interpretations incorrectly indicate the presence of a period after "bildas" (Andrée et al., 1930; Sundman, 1968), but there isn't one, and line 9 correlates with the time at line 10.
10	2 ^h 29 ^m + 1,0 + 1,4	
11	Tyst och stilla	Previous interpretations incorrectly indicate the presence of a period after "stilla" (Andrée et al., 1930; Sundman, 1968.) Previous interpretations also incorrectly indicate the presence of a period after "minut" (Andrée et al., 1930; Sundman, 1968).
12	Hastighet medeltal 0,57 km /	
13	minut	
14	2 33 ^m 15 ^s släplinan rör	
15	vattnet	
16	Kurs N 57° E.	
17	En ballastlina upp	
18	lyftad 2 ^h 45 ^m (K 66)	
19	[Blank line]	
20	Fotografier togos	
21	under tider som	
22	stå på bilderna.	
23	De två första orätt	
24	inställning.	
25	Obs.! Sj. registr. barom.' ^s	
26	2 ^h 5 ^m = K 66 2 ^h 59 ^m	
27	Min burk med afskeds-	
28	ord till Anna kastades	
29	på Vogelsang.	
30	[Blank line]	
31	3.3 m gas förloras på	
32	500 m. höjd	
33	Kurs något mera nordlig under	
34	högluftfärden.	
35	Moln rundt om utom i	Previous interpretations incorrectly indicate the absence of a period after "Spetsbergen" (Andrée et al., 1930; Sundman, 1968).
36	NE och öfver Spetsbergen.	
37	Pejling 3 ^m 12 ^s (K 66)	Previous interpretations incorrectly indicate the absence of a period after "Vogels" (Andrée et al., 1930; Sundman, 1968).
38	Pynt närmsta Vijdebay	
39	= S 311° W	
40	Nordpynt Vogels. S 55° W	