THE HALDDE OBSERVATORY

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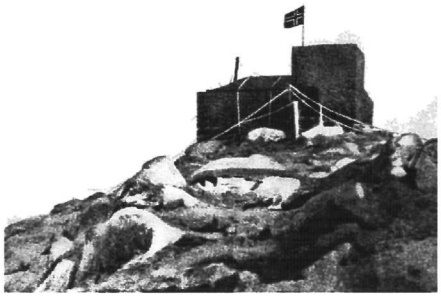
Abstract

In 1899 professor Kristian Birkeland (1867-1917) established two auroral observatories at the mountain peaks Haldde and Talvik in Finnmark, Norway. Based on observations from these observatories and later also from stations further north in the Arctic, he deduced the current systems related to the formation of the aurora. The electrical currents carried by the cathode rays (electrons) along the magnetic field lines are named Birkeland currents in honour of this pioneer. The Haldde Observatory was in operation until 1926 when the research activity was moved to the Geophysical Institute and later to the Auroral Observatory in 1928 in Tromsø.



Historical background

As time was about to turn the old century into a new, a young Norwegian professor, Kristian Olaf Birkeland (1867-1917) was in full swing with plans for his northern lights´ research. He had already in 1896 introduced his auroral theory where he claimed that cathode rays emitted from the Sun would be captured by the Earth's magnetic field and forced to penetrate deep into the atmosphere in two parallel belts around the poles. According to Birkeland, when these cathode rays or electrons as we would say today, collided with atoms and molecules in the air, these became excited and emitted lights, the Aurora Borealis and Australis. This he also was able to demonstrate by his famous Terrella experiment in the laboratory. To further support his theory he wanted to do real observations of the aurora himself and therefore set out to find a suitable place for doing that.

During the winter of 1838-39 a French expedition settled in Bossekop in Kåfjord, in Finnmark, the northernmost region of Norway, to observe the northern lights and determine the height of the phenomenon by triangulation. One reason for choosing Bossekop was that the sponsor of the expedition, King Louis Philippe, had spent some time travelling in cognito in Finnmark when expelled from France after the revolution in 1789. Another reason was that at the Kåfjord copper mines, the British owners had established an intellectual community that had good contact with the outside world. By this the so called "Recherche" expedition had brought the attention to Bossekop as an advantageous place for auroral research.

During the First International Polar Year (1882-83) the Norwegian Meteorological Observatory established a station in Bossekop partly for auroral and geomagnetic observations. In 1892 the German physicist Martin Brendel (1862-1939) went to Bossekop in attempt to photograph the northern lights, and he did. His photos are the first known ever taken of this phenomenon.

Establishing the Haldde Observatory

When Birkeland in 1897 was looking for a suitable place to observe the northern lights, Kåfjord became the natural community. In the fall of 1899 he was able to set up two observatories in the mountains of Kåfjord about 900 m above the sea level, one at the Haldde peak and the other at the Talvik peak about 4 km apart. He built two observatories because he wanted to

establish the height of the aurora by triangulation. The Haldde observatory was however the main observatory. During the last winter of the old century, Birkeland spent some time with his assistants at Haldde. The triangulations were not successful, however, partly because the distance between the observatories was too short and partly because the cameras were not suitable. In parallel to the observations of the visible aurora, Birkeland also made measurements of the Earth current and variations in the Earth's magnetic field. By comparing these measurements from Haldde with similar measurements from other stations in Europe, he realised that the aurora was associated with a gigantic current system. His conclusion was that the cathode rays from the Sun carry with them electric charges and as they penetrate the polar atmosphere along the magnetic field lines, they form electrical currents along these lines. As such a current has to form closed loops, Birkelad suggested that these currents turns horizontal in the atmosphere at auroral altitudes and follow the auroral arcs. According to Birkeland, it is then these horizontal segments of the currents that create the magnetic disturbances on the ground. Birkeland wanted to study these currents more in details and realised that he needed a network of observatories in the Arctic region where the currents actually were located. He therefore in 1902-03 established 4 observatories in the Arctic where the Haldde Observatory formed the central station. The other stations were Dyrafjord on Iceland, the Axel Island on Spitsbergen, Svalbard and Matochkin Shar on Novaya Zemlya. Partly based on observations from this campaign, Birkeland tried to estimate the magnitude and height of these currents and reached values that are reasonable even compared to standards of today.

Expanding the Haldde Observatory


Fot. Olga Gierer.
Borgen pa toppen av Haldde.

Birkeland himself did not return to Haldde until 1910 when he wanted to study the passage of the Halley comet. During this visit he became convinced that the Haldde Observatory ought to be enlarged and given a more permanent status. He asked the Norwegian government for economical support and argued that a more permanent observatory at Haldde would be of great importance for weather forecasting in the northernmost region of the country. Of special concern were the fishermen and seal and whale hunters who were living there at high risk for being taken by surprise by heavy storms on open sea. In 1912 the living quarters were ready and Ole Andreas Krogness (1886- 1934), an assistant to Birkeland, was installed as superintendent from July 1st the same year, a position he had until 1918. In 1915 another of Birkelands assistants, Olaf Devik (1886-1987) was installed at Haldde being responsible for systematising the meteorological observations for Northern Norway. Krogness and Devik as well as one of their assistants brought their families to Haldde and several children grew up under extreme living conditions at the summit. Under their stay at Haldde Krogness was occupied by auroral and geomagnetic observations while Devik worked to establish meteorological observatories along the cost of Northern Norway. Krogness and Devik, however, both left Haldde with their families in 1918 when the Geophysical Institute was established in Tromsø. October 1st in 1918 a Swedish geophysicist Hilding Köhler (1888-1982) was appointed new superintendent at Haldde, a position he held until August 31 1926. At that time the Norwegian parliament decided to close down the Haldde Observatory. This was done partly of economical reason and partly because it was not practical to keep the observatory at such a remote place any longer as modern meteorology implied a centre were data could be brought in daily from all the stations in the region. The observatory in Tromsø already served this function and Haldde was left behind. Köhler who was an expert in the formation process of clouds, found Haldde to be a perfect place for his research and fought for keeping the observatory running. He was also the first person to introduce studies of atmospheric ozone to Norway. Köhler argued for the Haldde Observatory to become an academy for natural studies where studies of the northern light as well as meteorology could continue side by side with activities in the field of botany, geology, mineralogy and zoology. This was an idea that became a reality when the University Centre at Svalbard was established in 1993.

The fate of the Haldde Observatory

For Haldde however, the doors were closed on August 31. 1926. The buildings were preserved and in good shape until the last days of the second World War when the Germans fled Finnmark and set all houses on fire East of the Lyngen fjord. Also Haldde was hit by this tragedy and destroyed. In the 1980's however the local authorities of Finnmark were able to rebuild the very first observatory on Haldde that was built in 1899 and today it is open for people who would like to take the hike along the trail from Bossekop to the summit about 30 km away.

A retrospective glance

The Haldde Observatory was established at a time when several such observatories were built, and one of the more famous was Ben Nevis in Scotland established in 1883. It is likely that the observatory on Ben Nevis has played a model for Birkeland's ideas. C. T. Wilson the physicist, famous for his cloud chamber, based on observations from Ben Nevis in the late 1890's, studied the possibility of ions that was created in the atmosphere by X-rays could be forming condensation nuclei during fog formation. Birkeland also discussed the possibility of cathode rays playing a role in cloud formation, and he claimed that he often saw clouds in the afternoon that were situated at the same place in the atmosphere and had the same shape as the aurora observed later at night.

Det nedlagte nordlysobservatorium.

For the studies of the Aurora Borealis, the Haldde observatory has played an important role as it gave Professor Kristian Birkeland the opportunity to study this phenomenon under natural circumstances and it gave observations helping him to establish a theory for the northern lights that to a large extent are valid even to day. The electrical currents that now are known to exist along the Earth's magnetic field lines will carry the name of Birkeland in generations thanks to his and his assistants efforts to carry through campaigns under the most extreme conditions at an isolatied mountain peak far above the polar circle at the rim of the Arctic Sea.

Tromsø June 1, 2003

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Photo source: Olga Gicever, Fjellanger Widerø

Die folgenden Temperaturinformationen und Bildunterlagen über Hallde wurden uns vom Norwegischen Meteorologischen Institut, Gustav Bjørbæk (Gustav.Bjorbak@met.no) zur Verfügung gestellt.

Klimatabelle Hallde, 893 m Seehöhe:

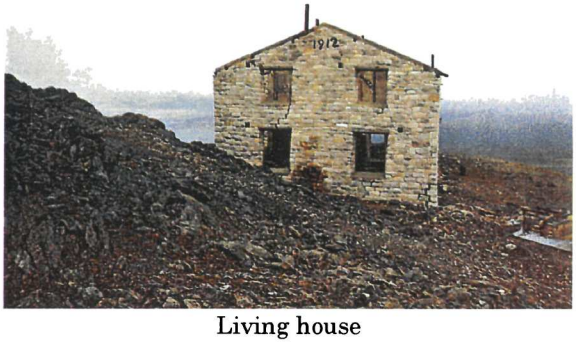
	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez	Jahr
Lufttemperaturmittel (°C)*), 1901-1930													
	-9,2	-10,0	-9,0	-6,8	-3,1	3,0	7,7	5,9	0,9	-3,9	-7,1	-8,8	-3,4
absolutes Temperaturmaximum (1916-1925)													
	6,4	5,4	5,4	9,1	12,7	20,3	22,3	20,3	15,7	11,5	8,9	5,1	22,3
absolutes Temperaturminimum (°C), 1916-1925													
	-26,7	-28,0	-23,2	-19,1	-13,9	-8,0	-2,6	-2,0	-7,0	-13,2	20,5	-29,9	-29,9

*): Erst im Jahre 1914 und danach wurden die Messungen in einer Wetterhütte durchgeführt.

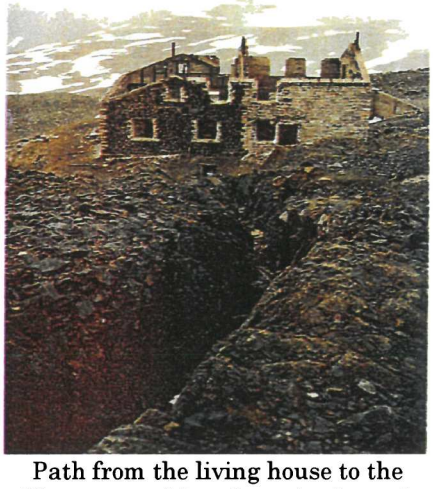
The Observatorium (background)
House where the scientists lived with
their families (in the front)

The Observatorium
now restored

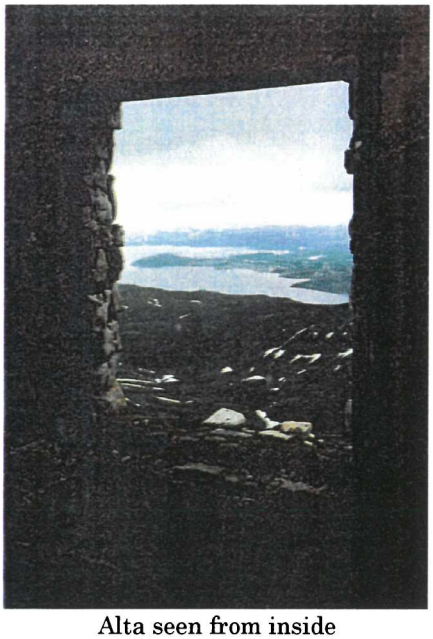
HAL´DI (Lappname for the top), 904 m a.s.l.
Polarlightobservatory
Founded by Kristian Birkeland 1899
Working until 1927
Burned by the Germans in 1944
Restored in 1983



Living house



Path from the living house to the
Observatory blast down in the rock
in order to prevent the observer not
to blow away



Alta seen from inside
the living house

Zwei Artikel über das Haldde Observatorium wurden bereits im XXXV. Jahresbericht des Sonnblick-Vereines für das Jahr 1926 auf den Seiten 11-16 und 16-17 veröffentlicht.

Auszug aus dem 35. Jahresbericht des Sonnblick-Vereines

Das Haldde-Observatorium

Von O. KROGNESS, Tromsö

Im Jahre 1910 machte Professor Kr. Birkeland den Vorschlag zur Gründung eines geographischen Observatoriums im nördlichen Teil Norwegens. Früher, um die Jahrhundertwende, hatte er selbst drei kürzere Expeditionen in diese Gebiete unternommen; besonders deshalb, um das Nordlichtphänomen zu erforschen. Bei diesen Expeditionen wurden auch, obwohl in ziemlich beschränktem Maßstabe, meteorologische und luftelektrische Messungen vorgenommen.

Die Aufgabe des Haldde Observatoriums kann man kurz folgend zusammenfassen: Es sollte die Arbeiten, die Birkeland auf diesen Gebieten aufgenommen hatte, auf einer breiteren Basis weiterführen; besonders war es die Voraussetzung, daß man nun größeres Gewicht auf rein meteorologische Untersuchungen legen sollte, teils, wenn möglich, um zu einer Entscheidung der Frage zu kommen, ob es zwischen den Nordlichterscheinungen und den gewöhnlichen meteorologischen Vorgängen irgendwelchen Zusammenhang gebe, teils, um durch Studium an Ort und Stelle die Möglichkeit für einen Wetterwarnungsdienst in diesen Gegenden zu untersuchen.

Hauptsächlich aus meteorologischen Gründen wurde das neue Observatorium auf denselben Gipfel, Haldde, verlegt, wo Birkeland im Winter 1899/1900 beobachtet hatte.

Im Jahre 1899 wurde das erste Haus direkt auf dem höchsten Punkt des Gipfels angelegt. In den Jahren 1911 - 1913 wurde ein größeres Haus auf einem kleinen Plateau, etwa 50 m entfernt von dem ersten Hause, gebaut.

Das ältere Observatorium Birkelands enthält drei Zimmer. Das neuere Hauptgebäude hat eine Grundfläche von 8x18 m^2 enthält etwa 15 Zimmer und acht ziemlich große Räume im Keller. Die Anlage erhielt elektrische Energie von einem Elektrizitätswerk in Kaafjord. Diese Energie wurde vom Tal auf einer Hochspannungsleitung von 10.000 Volt zum Observatorium überführt. Eine doppelte Telephonleitung ist auch gebaut.

Ein magnetisches Registrierhaus ist im Felsen eingesprengt, weiters ist ein kleines Haus für absolute magnetische Messungen sowie ein Lagerhaus, ein Transformatorhäuschen und eine große meteorologische Hütte gebaut.

Die Häuser haben unterirdische Verbindung.

Die Beobachtungen, die beim Observatorium ausgeführt wurden, umfassen gewöhnliche meteorologische, magnetische und einige luftelektrische Aufzeichnungen und Registrierungen, ferner Spezialuntersuchungen verschiedener Art.

Abb. 2. Die Observatoriumgebäude