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Roald Amundsen and his Ambiguous Relationship to Science

A Look at Outcomes of his Six Expeditions

ABSTRACT Roald Amundsen's active life as an explorer coincided with a period of important changes in the earth sciences. The purpose of the present paper is to situate some of his endeavours in relation to those trends. On the one hand there was a continuation of empirical traditions in field sciences driven by the same inductivist approach that motivated the First International Polar Year 1882–1883. On the other hand there were major advances in instrumentation, plus a strong professionalization of research. The latter involved new mathematical methods used by hypothesis-minded geophysicists who probed the dynamics of physical processes. In this context Amundsen was what Fridtjof Nansen called a "scientific explorer." The paper traces some of the tensions engendered in this role midway between two scientific trends while at the same time the explorer's public image followed the tradition of popular geography steeped in nationalism and prestige that drove the steeplechase of being first to set one's foot on and attach names to hitherto undiscovered places. It is shown how several of Amundsen's expeditions resonated strongly with contemporary trends and interests in scientific societies, especially in Norway. At the same time he was pulled between loyalty to Fridtjof Nansen and science and an unending quest for recognition and media visibility as a dashing explorer. Since much has been written about Amundsen's sportive and adventurous side, not least in connection with the dramatic race to the South Pole, the focus in the present paper is chiefly on his relationship to science, an aspect often glossed over. First

Amundsen's position as a reflective practitioner is characterized and highlighted. Secondly, the Norwegian and international scientific contexts of his expeditions are sketched, and, third, an assessment is made of the scientific outcomes of the projects he initiated and their uneven reception over time in a number of disciplines, since he left it to others to translate data into science while he himself restlessly moved on to the next challenge. It is found that although never a scientist himself, Amundsen's initiatives generated considerable amounts of empirical data that was of value once it was reduced, analysed and interpreted by professional scientists. Perhaps even more importantly, his expeditions or projects helped further the scientific careers of a number of brilliantly resourceful persons.

KEYWORDS R. Amundsen, F. Nansen, H. U. Sverdrup, polar science, explorers, Northwest Passage, polar history, race to the pole

Expeditions Roald Amundsen was involved in
(for overview and highlights, see Barr & Ekeberg 2005)

Date	*Expedition on*	*Amundsen's role*	*Location*
1897–1899	*Belgica*	2nd mate	Antarctic Peninsula
1901	*Gjøa*	leader	Norwegian Sea
1903–1906	*Gjøa*	leader	North West Passage
1910–1912	*Fram*	leader	Antarctica/South Pole
1918–1920	*Maud*	leader	North East Passage
1922–1925	*Maud*	absent leader	Bering Str & Siberian coast
1925	N24 & 25 hydroplanes	leader	Spitsbergen to near N Pole
1926	*Norge* airship	leader	Spitsbergen–N Pole–Alaska

1. Introduction

On Friday 14 December 1911 Roald Amundsen (1872–1928) reached the South Pole. With him he had his faithful expedition companion Oscar Wisting (1871–1936) and three other men. When less than twelve years later Amundsen flew over the North Pole in a dirigible, Wisting was there too—they were the first two persons to reach both poles. When he died in 1928 Amundsen went to history as a legendary explorer, one of the last belonging to the heroic age.

Amundsen's arrival at the South Pole and Robert Falcon Scott's (1868–1912) the following month, 18 January 1912, are naturally the subject of much attention these days of centennial recollection and remembrance. Much has been written about the differences in the two men's personalities, their rivalry, different approaches to polar travel and their respective relationships to science. Regarding science Scott's role as a facilitator of research is generally seen as positive, while Amundsen's relationship to science is more tenuous (for recent appreciations of Scott's role see MacPhee 2010; Larsen 2011; on Amundsen see Huntford 1987; Hestmark 2004; Barr & Ekeberg 2005; Lüdecke 2011).

In the present paper the focus is on Amundsen the individual (for recent biographies see Jensen 2011; Wisting 2011; as well as one on Amundsen's faithful companion and skipper Oscar Wisting, by Hansen 2011). The approach is conventional with no attempt to sociologize or place the man in a broad context that might include early twentieth century movements of amateur observers to be found in astronomy and botany. Much more might also be said to situate him in the history of polar technology for terrestrial or aerial transport, but this will not be done here. The purpose is simply to look more closely at some of the science that came out of Amundsen's expeditions even if he himself was not the one who actually did the research. The question is if he nevertheless to some degree might be regarded as a facilitator for doing science, a role he apparently claimed for himself. The first part of the paper (sections 2–5) covers what is already familiar for some readers, but the story line is given a novel twist by introducing the category "reflective practitioner" to characterize the explorer; the second part (sections 6–9) situates him in relation to contemporary scientific developments and in addition does something new—it *systematically* reviews the outcome of his expeditions and the uneven reception of the results.

When the Swedish geologist J. Gunnar Andersson (1945), a veteran of Antarctic research and exploration, writes about Roald Amundsen in the book *Männen kring Sydpolen* ['The Men around the South Pole'], he finds himself puzzled by the distinction the great explorer made between "research" and "science"—in Swedish a distinction between *forskning* and *vetenskap*. Andersson refers to a passage in Amundsen's controversial autobiography of 1927, *Mitt liv som polarforsker* ['My Life as a Polar Researcher'], translated into English the same year as *My Life as an Explorer* (compare the difference between the key terms in the Norwegian and English titles). The passage at issue is one where Amundsen writes about the geomagnetic studies undertaken at Gjoa Haven 1905–1906. Andersson makes the comment:

> After a visit with Nansen, who offered him his support, he [Amundsen] decided to study geomagnetic science and familiarize himself with methods of geomagnetic observations. In this connection he states in his autobiography something that, however mysterious in my eyes, maybe provides a key to interpreting the strange use he makes of the word *forskare* ['researcher'], an epithet he often particularly likes to use to describe himself. He writes about the geomagnetic studies: 'My

> [*Gjøa*] expedition would also have a scientific goal apart from research [Swedish *forskning*] itself.' In the Swedish language *forskning* ['research'] and *vetenskap* ['science'] are certainly identical. Is it different in Norwegian, or is it something that is unclear in his way of expressing himself? (Andersson 1945: 142–143.)

In the same vein Andersson notes that Amundsen visited the geophysicist Georg von Neumayer in Hamburg and there received a crash course in the act of handling geomagnetic instruments. "Thanks to this exemplary training Amundsen became a very skilled earth magnetic observer," Andersson concludes, still puzzled however by the purported difference between *vetenskap* ['science'] and *forskning* ['research']. Fridtjof Nansen had also sent Amundsen to Bjørn Helland-Hansen (1877–1957), who was a Norwegian pioneer in the field of modern oceanography and in 1915 became professor in this field at the University of Bergen, and two years later director of the university's renowned Geophysical Institute. It was Helland-Hansen who gave Amundsen some training in methods of oceanographic measurement and observation and later was instrumental in recruiting both Harald U. Sverdrup (1888–1957) and Finn Malmgren (1895–1928) to Amundsen's *Maud* expedition, which thanks to the efforts of these men led to significant scientific contributions despite the fact that the expedition's intended objective—to repeat Fridtjof Nansen's ice-locked polar drift experiment across the Arctic Ocean—was never achieved.

Sverdrup was the scientific mainstay of the *Maud* expedition (Dahl & Lunde 1976; Barr & Ekeberg 2005: 192, 196; Friedman 2004: 145–157). He saw to it that its various results got published as quickly as possible. His was the approach of a professional scientist, contrasting sharply with Amundsen's as an amateur and data-collector. The difference in the two men's respective interests and competence immediately becomes clear when we compare the scientific legacy of the *Maud* with that of the *Gjøa* expedition. In the latter case data collected in 1903–1904 were entirely left to others to work on and mostly did not see publication until 1932; because of the big time lag the impact was rather incidental even if researchers nowadays—retrospectively—find some relevance in the *Gjøa*-data series when tackling current research problems.

2. Navigating between Scientism and Ideologically Tinted Perspectives

What Andersson did not realize in his retrospective reflections on men around the South Pole was that Amundsen never purported himself to be a scientist; rather he was concerned with his own role as polar explorer, one that included both geographic discovery and setting records. No wonder then that J. Gunnar Andersson in his book homed in on Amundsen's shortcoming, remarking that the latter and his four men raced back and forth to the South Pole "over the unique ice barrier and especially when crossing the mountain range Amundsen named after his country's queen." Had they taken a moment to pause for the sake of science they would not have missed, as they did:

> the richest opportunities for observations concerning topography, geomorphology and geology [...] a couple of days in the mountains would have given the richest results had they only had amongst them one single modern schooled geographer. (Andersson 1945: 154.)

But then again, he adds, perhaps

> it is only petty and stingy scientific disciplinarity that speaks [...] if I add the regret that none of these polar heroes represented any sort of scientific competence outside simple observational service with respect to meteorological and earth-magnetic phenomena. (Andersson 1945: 153.)

On his way back from the South Pole he did collect a small sample (20 items) of various kinds of rock on the polar route, and Kristian Prestrud's side-expedition collected a second sample (30 items) at *Scott's Nunatak* in the Alexandra Mountains, which was the only mountain they came across that was bare of snow.[1] Two reports on these findings were written by the Norwegian mineralogist J. Schetelig (1912; 1915). But of course, it did not amount to much.

To be fair to the Swedish geologist he did recognize the expedition's significant geographic contribution to filling in some important features on a previously empty map of the interior of Antarctica. Positive too was the surveying and cartographic effort of the "Eastern-group" consisting of Johansen, Prestrud and Stubbered when it came to clarifying the contours and features of King Edward VII Land (which Richard Byrd later proved to be a peninsula) (Andersson 1945: 159; Stewart 1990: 294). In addition Andersson gave the men on the *Fram* credit for their extensive oceanographic investigations before the ship's return to the Ross Ice Barrier (now called *Ice Shelf*) to fetch the winter party for the journey back to civilization, reaching Hobart, Tasmania, in March 1912 to tell the world about a South Pole mission successfully completed. Andersson of course also expressed great respect and admiration for Amundsen's planning and logistic abilities as well as his cunning reason and technical knowledge that included elements derived from earlier exposure with Inuit cultures, knowledge that proved useful for effective transport and survival in polar regions.

In many accounts of Amundsen's achievements the tendency has been to focus on his personality, record setting, the shift of plans after Fredrick Cook and Robert Peary's announcements in 1909 of the capture of the North Pole, and the subsequent competition with Robert Scott to reach the other pole.[2]

Peary was one of the best known of American Arctic explorers. He set a tone not uncommon in geographical societies just after the turn of the century when he expressed a then partly prevailing attitude in his presidential address at the opening of the Eighth International Geographical Congress, held in the United States during the summer of 1904:

> There is no higher, purer field of international rivalry than the struggle for the North Pole. Uninfluenced by prospects of gain, by dreams of colonization, by land lust, or politics, the centuries long struggle of the best and bravest sons of England, Germany, Norway, Sweden, Holland, France, Russia, Italy, and the United States, whose able delegates are here today, has made this field of effort classic, almost sacred (cited in Hiscott 1992: 22).

This view has intermittently continued to spice narratives of the race to the South Pole. Fascination with personalities and the drama of conflict has made it all too easy to dismiss Amundsen's significance for science, since he was not a scientist but an explorer. His adventurous and sportive side still makes for a good story line to stir the reader (cf. Huntford 1979). Time and again similar perspectives also get played up in accounts of the exploits of Ernest Shackleton, another strong personality whose life similarly continues to capture the popular imagination in a time like ours, when strong leadership and entrepreneurship are promoted as virtues in our neoliberal world under the banner of privatized globalisation (see for example Morrell & Capparell 2001).

My purpose in the present paper is to step away from such portrayals in order to nuance and problematise the picture of Amundsen's relationship to science.

3. Taking a Leaf from H. U. Sverdrup

In a lengthy biographic review of Amundsen's life and work prepared for the fifteenth volume of Vilhjalmur Stefansson's twenty-volume *Encyclopedia Arctica*, H. U. Sverdrup has given what in my estimation is a fair and forthright appraisal of the explorer's intentions and approach. Although somewhat idealized the review also provides an answer to J. Gunnar Andersson's ruminations. Therefore I quote it at length. It is a snapshot informed by Sverdrup's personal experience, not least during the course of the lengthy and oftentimes frustrating time in connection with the *Maud* expedition.

> Amundsen said of himself that he never became an arctic explorer, because since he was fifteen years old all his thoughts and his energy had been directed toward one goal—the expansion of our knowledge of the Polar Regions. Circumstances made it necessary for him to change plans and make detours, but after he had sailed through the Northwest Passage, his one all-absorbing idea from 1908 to 1926 was to cross the Arctic Ocean and reach the North Pole. The attainment of the South Pole was incidental. Amundsen was not a scientist and he never claimed to be one. He was interested in securing exact information wherever he travelled and in giving specialists opportunities to carry out observations on his expeditions, but he cared little for their conclusions and even less for their theories. When he talked about men of science he had met, he would stress their personal characteristics and not their scientific achievements.
>
> Thoroughness in planning, meticulous attention to details, and nearly fussy orderliness combined with bold initiative laid the foundations of Amundsen's success. To this should be added his ability to select suitable companions and to gain their unqualified confidence in his leadership. In selecting his men he apparently looked for one particular characteristic: resourcefulness. When preparations were still in progress, he might ask a question about a difficult task or give a man an impossible assignment. If he got the answer "it can't be done," he was through with the man then and there, but if the man later returned to the matter and explained how he had tried to tackle the problem, Amundsen was satisfied even if the result was entirely negative.
>
> On his expeditions Amundsen demanded of his men punctuality and orderliness corresponding to his own. During the *Maud* Expedition he himself worked as cook for two years with members of the party alternating as mess boys. Never was the galley more shining and orderly, with every pot as well as other utensils in its proper place. He established a strict daily routine broken only by festive occasions during which he more than anyone else knew how to create a congenial atmosphere. His men loved him.

And then Sverdrup somewhat laconically adds, "Amundsen's financial troubles stood in sharp contrast to his meticulous orderliness in other matters;" it was a trait ascribable to an attitude that "regarded money as a necessary evil of no value of its own," a means to attain higher goals (Sverdrup 1959: 234–235; compare Sverdrup 1928).

The foregoing reflection was written more than forty years after Sverdrup signed up for the *Maud* expedition. To balance it out one should remember that Amundsen was also opinionated, easily slighted and unable to tolerate anyone questioning his judgement as a leader even if he was in error. These traits are evident when one considers his behaviour on a number of occasions.

One time was when as a senior ranking officer on the *Belgica* he was outraged by being passed over when the expedition leader Adrien de Gerlache selected someone else to take over command of the ship in the event that Georges Lecointe was incapacitated, the reason being that Amundsen was not a Belgian citizen. The decision was dictated by the Belgian Geographical Society before the ship left Antwerp (Decleir (ed.) 1998: 166–171). In Amundsen's diary the ship's doctor Fredrick A. Cook is approvingly cited as saying "that the Geographical Society had drawn a line between the honest Belgians and the dishonest foreigners."

A second telling incident is the well-known story when Hjalmer Johansen, an expert dog driver and polar veteran with experience from Fridtjof Nansen's famous Arctic expedition, spoke his mind regarding Amundsen's impatience (to be sure to beat Robert Scott) that led to the mistaken decision to make a premature start for the South Pole under extreme conditions that almost cost Kristian Prestrud his life had it not been for Johansen. Enraged, Amundsen took both Johansen and Prestrud off the south-pole team, consciously degrading and humiliating Johansen for having bluntly spoken the truth and in so doing threatened the expedition leader's authority (cf. Bomann-Larsen 1995: 164, 491–492; Barr & Ekeberg 2005: 155).

After the flight across the North Pole with the airship *Norge* Amundsen was frustrated and angry that the "mere skipper" Umberto Nobile was much more in the limelight than he himself. This led to acrimonious attacks on Nobile by Amundsen in his autobiography; for the background and Amundsen's schisms with several other persons including his own brother Leon, see Bomann-Larsen 1995: 477 ff.

And then of course there is Sverdrup's view that "the attainment of the South Pole was incidental." Considering how pride, personal ambition and what we today call "image" were also important driving factors in Amundsen's life one can just as well say that sometimes the reverse was the case—science, and not the Pole, became incidental.

4. A Reflective Practitioner in a Field of Tension between Exploration and Science

4.1 The Concepts of Reflective Practitioner and Facilitator

The notion of "reflective practitioner" comes from Donald Schon (1983), who has analysed the role of tacit knowledge and skills as well as continual learning in various practices. The concept emphasizes the personal dimension in the acquisition of skills and technical knowledge. It has been used to refer to the knowledge of engineers, inventors, surveyors, foresters, cattle breeders and others involved in practical pursuits with for the most part only an incidental bearing on science.[3] The concept is also used in relationship to science in order to foreground the context of discovery and with it all the informed guesses, hunches and imaginings that are part of exploratory acts motivated by what Michael Polanyi (1958; 1967) describes as "passions." Thence the question of the boundary between exploration and research does not assume hard and fast lines of demarcation but calls for attention to the overall purpose of a practice, be it research or exploration.

Amundsen never claimed to be a scientist but he thought that what he did also served a broader context wherein the advance of scientific knowledge was important and that meticulous observations and generation of earth-magnetic, meteorological and oceanographic data was a contribution to that end, to science. The term *polarforskere* did not, as Andersson possibly thought, refer to science as such but had a broader connotation associated with 'inquiry,' 'investigation' or (in Swedish) 'utforskning,' where the latter term in connection with Polar Regions translates into exploration of the same. Thus there were professional explorers, enrolled by Fridtjof Nansen to carry out physical observations and measurements, data that would feed into the Nansen's program and vision at the University of Kristiania/Oslo for advancing Norwegian geoscience and therethrough also the prowess of Norway as a newly independent nation and a polar nation to be reckoned with.

The key issue here was the need Nansen saw to develop and consolidate his own work in the Arctic at a time when a new centre for geophysical research was emerging in Bergen that historically has come to be associated with the mathematisation and professionalisation of the field. Several studies by Norwegian historians of science based on archival material have enriched our picture of polar research and the development of modern geoscience (Friedman 1989; Friedman 1994; Friedman 1995; Drivenes, Jølle & Zachriassen (eds.) 2004; Drivenes & Jølle (eds.) 2006). Harald Dag Jølle's recent Nansen biography has shed new light on the role Amundsen was meant to play as a potential disciple at a critical juncture with a new North Pole expedition in the Nansen tradition that was meant to start in 1910 (Jølle 2011; also Jølle 2009). Friedman has recently in a play dramatised Nansen's fury and frustration in a fictional showdown with Amundsen for turning his back on polar science for the sake of polar sport.

> Nansen publicly defended Amundsen [...] Privately he was furious. Adding to Nansen's frustration, political intrigue kept Helland-Hansen in Bergen and lack of physical infrastructure and support prompted Bjerknes to accept a call to Leipzig. Nansen's vision for an internationally-leading centre for geophysical science in Oslo was crushed. (Friedman 2011: 6; see further below, footnote 7.)

The phrase "facilitator of science" requires some explanation. There is both a narrow and a broader sense of the term *facilitator*. In the narrow sense the criterion of facilitating is a strong one. It requires an explorer to be directly involved and seeking to actively promote research, not only by participating in measuring physical parameters and enforcing a plan of data collection, but also in following up in the next phase, data reduction, analysis, interpretation and publication in scientific journals or monographs. Examples that come to mind are William Bruce Spiers and Otto Nordenskjöld, whose expeditions also belonged to the heroic age of Antarctic exploration.

The broader sense of facilitating research is weaker. In that case it is sufficient if the explorer is engaged in data collection or failing this his contribution lies in initiating and equipping an expedition for scientific purposes and recruiting persons with adequate scientific training, thereby facilitating the scientific career of others and therewith more indirectly also science.

Amundsen role as a facilitator of science—in as far as he was one—obviously falls into the second category. In the absence of any real enthusiasm for science his engagement in Nansen's program for physical oceanography with a new Arctic drift experiment ultimately ended up as a mere fulfilment of a moral obligation to his mentor. Early in his career as explorer Amundsen carried out some measurements of physical parameters and enforced plans for data collection. However, he did not directly involve himself in data reduction, analysis and interpretation. Neither did he exert much energy in efforts to find funding to support such time-consuming endeavours. This was left to the home institutions and devices of the researchers that worked with the data and published eventual findings. He had his own agenda.

Amundsen's own concern when it came to funding was mostly devoted to initiating and financing new and daring expeditions. In Friedman's rendering of a heated exchange with Nansen, Amundsen says "private donors don't give a damn about volumes of data, they want records won," and he asserts that "some records can never be broken—a fame that cannot be washed out with time—the conquest of the poles" (Friedman 2011: 6). Nansen campaigned to create a professorship for Amundsen, in part to provide him with a stable income but also to "keep him in the camp of serious polar research," but Amundsen refused, declaring that he was not a scientist.

Amundsen's quest for immortal fame however took time and energy, travelling and lecturing to raise money, lobbying, over and over again, and constantly trying to sustain a media image of his person as one of the great explorers. These activities also at times got him embroiled in conflicts with institutions and nerve-racking personal antagonisms with a variety of supporters and rivals. As Jan Ove Ekeberg has put it, in his later years his greatest goal was no longer to discover the world but to see to it that the world discovered Roald Amundsen; "the bigger he became the more he was concerned with that" (in Barr & Ekeberg 2005: 12). This is probably one of the reasons why after the completion of the expedition through the Northwest Passage it took over twentyfive years before its scientific results were published, and then only thanks to funding from a memorial fund set up after Amundsen's death in order to honour him as a Norwegian national hero—thus ultimately a kind of symbolic action. Even if he was posthumously listed in part as editor and co-author, in reality he had not contributed to the analysis. His competence did not suffice for that (Hestmark 2004: 101–103).

In the twentyfive years that had passed the gap between the professional scientist and the amateur had also widened with the advent of an entirely new mathematically inclined generation of geophysicists. They were at the same time less glamorous individuals. With Amundsen's South Pole expedition the time of global geographic discoveries had essentially ended. Since the purpose of the present paper is to situate Amundsen in relationship to scientific networks, part of the story that follows must also note the changing style of geoscientific work and networks.

4.2 Geography's Janus Face

When Amundsen pursued his polar passion and formulated his own goals and plans it was also in the wake of the late nineteenth century debate on what was the proper task of geography. Was it exploration and the discovery and naming of new land? Or was it scientific inquiry into the geographic, geomagnetic, meteorological, hydrographical features of the Earth, auroral phenomena, or geological, geomorphologic and other aspects of lands and seas in the polar and other regions?

In geographical societies in different countries an essential tension between the double faces of geographic exploration sometimes manifested itself in a polarisation between popular geography and academic or scientific geography. The same tension was evident in the controversy surrounding Sir Clements Markham's emphasis on exploration for imperialist reasons to the detriment of scientific research in the mandate he wanted to give Robert Scott's *Discovery* Expedition 1901–1904. In a different form it could be found at universities in conflicts and debates around 1900 regarding the definition of academic chairs in geography. Furthermore, one finds it in the division amongst those involved in the establishment of the International Polar Commission (IPC), a forgotten body that emerged in 1908 from several meetings and debates concerning priorities and agendas for polar research and exploration.

Otto Nordenskjöld, William Spiers Bruce, Henryk Arctowski, Georges Lecointe and Jean-Baptise Charcot belonged to a little group that insisted on the primacy of scientific work and the need for international collaboration, thus opposing the views of others who were more closely tied to rather traditional approaches in which nationalism and geographic discovery might dominate (International Polar Commission 1908; Lüdecke 2001; Elzinga 2004). When the IPC finally—after much delay—was formally established at the International Geographical Congress in Rome 1913, the effort to institutionalize polar research in an international cooperative mode had lost momentum. The First World War did the rest to drive the new organization into oblivion. After the war other actors and other institutional arrangements came to the fore without linking back to its agenda—nevertheless several personalities who had participated in the IPC surfaced again later in the preparatory phase of the Second International Polar Year (IPY-2) 1932/33, among other places in the Aeroarctic, an organization to promote Arctic aviation chaired by Fridtjof Nansen (Aeroarctic 1924; Lüdecke 2008).

Rival stakeholder interests and cultures of inquiry that existed in the geographical societies of many countries considerably influenced epistemic boundary management within geography in the late nineteenth and early twentieth centuries. Thus an appreciation of the way boundaries were drawn between geographical exploration and academic or scientific geography has to take into account the historical and political contexts in which conflicting views were played out (cf. Hiscott 1992).

4.3 Convergence of Old and New Scientific Epistemologies

The other question at issue has to do with the ideal of science that dominated in field sciences during the latter part of the nineteenth century. In this respect it is important to realize that the dominant ideal of science was inductivist and not the hypothesis-driven view of science that with Nansen and even more with Bjerknes gained a stronger position in the early twentieth century. This is evident if one considers the epistemology reflected in the efforts of the First International Polar Year 1882–1883, an epistemology that continued to influence the conception of science in polar endeavours in important respects during the first couple of decades of the twentieth century (Elzinga 2009).

In circles concerned with geophysical investigations in the Arctic a plan emerged to incorporate Amundsen's proposed repeat of Nansen's north polar drift experiment into a broader exercise that if it had been carried out would have been a precursor (mini-)second polar year. Some of the inspiration appears to have come from Nansen himself, who in a paper entitled "On North Polar Problems" read before the Royal Geographical Society in London in 1907 identified a number of questions: the possibility or not of land near the North Pole hypothesized by R.A. Harris at the Eight International Geographic Congress, Washington, 1904; the character of the continental shelf of the North Polar Basin and its extensions north of Siberia and Alaska respectively; the directions of north polar currents and the drift of the ice; the nature of the ice in the different parts of the north polar sea, and some other issues (Nansen 1907). Nansen was coming to the end of his term in London as emissary representing the New Norwegian state, formed when the union with Sweden was dissolved. Members of the Society were impressed by his scientific acumen. His famous bathymetric map of the Arctic Sea basin was included in the paper. Significantly, Amundsen's announcement to organize a new Arctic polar drift experiment came in the year after Nansen's famous speech before the Royal Geographical Society in London and fit into Nansen's scientific ambitions in Oslo.

Meteorologists were interested in developing synoptic observations of weather patterns across the Arctic and geomagneticians were concerned with fluxes in earth magnetism and atmospheric electricity, questions that had been at the heart of the First IPY. Observations of aurora also continued to preoccupy geophysicists in Nordic countries, particularly Norway and Finland. At the same time a new generation of mathematically-minded researchers were coming forward, interested in the dynamics of atmospheric and ocean systems. Thus in several parts of the scientific community there was an interest in Roald Amundsen's attempt to repeat Nansen's polar drift experiment on a vessel that could serve as a research platform (Amundsen 1908).

5. Learning by Doing

Throughout his life Roald Amundsen seems to have been more fascinated by the techniques, new instruments and logistic problems of polar exploration than the actual science that was produced. That does not mean he shunned science, on the contrary in his younger years he became quite well versed in some areas of geosciences, particularly magnetism. Yet, the main challenge for him did not seem to lie there; it lay in the setting of well-defined practical goals and devising efficient means to achieve them. Sometimes it meant taking a calculated risk. In public lecture halls and through books he also learned to popularize and spellbind audiences with his narratives about polar exploits, even if he did not like the fickleness of public opinion upon which he was often dependent when it came to raising funds for new projects. The complete texts of Amundsen's lectures about his expeditions through the Northwest Passage and to the South Pole illustrated with the original hand-coloured lantern slides he used may be consulted in the Fram Museum Exhibition book *Cold Recall. Reflections of a Polar Explorer* (Kløver (ed.) 2009).

5. 1 Early Experience

On the Belgian Antarctic Expedition 1897–1899 Amundsen was second mate on the *Belgica*. Here he got his first taste of overwintering and being locked in the sea ice during the long polar night. His diary (Decleir (ed.) 1998) bears ample witness to his resourcefulness. He gained a wide range of practical knowledge of ice navigation, while Cook showed him survival techniques on the basis of penguin and seal diet, tested polar clothing, tents and sledges. Amundsen also learned for example that "man hauling," sledges pulled by men, was a very exhaustive and inefficient mode of travel. Tutored by the ship's captain Georges Lecointe he also learned astronomical position fixing in the field and took part in some magnetic measurements (Decleir (ed.) 1998: 151).

In addition there were the physical and medical problems of men in isolation. Much attention in the diary is devoted to logistic techniques and attempts to free the ship from the pack ice as the austral spring came along. The young Amundsen paid some attention to the behaviour of marine animals, but otherwise he displayed little interest in scientific topics. The drift of the *Belgica* in the ice confirmed, however, the importance of the kind of oceanographic studies Nansen had made just a few years before during the *Fram* expedition in the Arctic 1893–1896. Amundsen, Lecointe and the expedition doctor, Frederick A. Cook, were the ones who adapted best to the strain and difficulties and the three of them developed the ambition to reach the Magnetic South Pole once the *Belgica* was freed from the ice, but that plan never materialized.

The techniques of exact measurement and observation performed by Lecointe were a starting point for Amundsen's sorties to study the Earth's magnetic field near the North Pole. Once back home again he was introduced to George von Neumayer at the Deutsche Seewarte in Hamburg where he gained a deeper working knowledge of the theory and practice of magnetic observation. Following his studies at Hamburg he also developed invaluable contacts with the Wilhelmshafen maritime observatory and the Potsdam magnetic observatory. During a number of visits to these observatories in the years 1900 to 1903 he acquired, together with his assistant Gustav Juel Wiik, several magnetic instruments and received more detailed training in their use when preparing for the *Gjøa* Expedition (1903–1906).

The pursuit of magnetic studies became the rationale for seeking to navigate the Northwest Passage on an expedition that would include finding the exact location of the North Magnetic Pole. For this purpose in 1900, Amundsen purchased and outfitted a small ship, the *Gjøa*, for a northern expedition. Before that, however, he spent one summer to make oceanographic observations in the Arctic, among others, carrying out a vertical series of temperature and salinity measurements taken in the sea between Jan Mayen, Greenland and Spitsbergen for Fridtjof Nansen, who worked up the results and published them in book form (Nansen 1906). A frontal page has Nansen's dedication: "to Roald Amundsen the careful planner and happy leader of Arctic enterprise."

The *Gjøa* expedition into the Arctic Ocean and the Northwest Passage followed in the summer of 1903. Preparations included perusal of accounts of the tragic events of the Franklin expedition and later expeditions sent in search of survivors or remnants. The newly returned Second Norwegian Polar Expedition with the *Fram* led by Otto Sverdrup 1898–1902 had among other things explored and claimed three newly discovered islands in the archipelago north of Barrow Sound (a western continuation of Lancaster Sound).[4] Geographic details were presented on a famous map drawn by Gunnar Isachsen and appended to the second volume of Sverdrup's popular account, *Nytt Land* ([1903] 1904). On the basis of his historical and cartographic studies Amundsen developed a hunch where he might find the most suitable route to prevent meandering in archipelagic "blind alleys." From 1903 to 1905, the men wintered on King William Island in the small protected harbour of Uqsuqtuug; at a place they called *Gjøahavn*,[5] where study of the magnetic field soon proceeded. Observations offered the first empirical demonstration that the North Magnetic Pole had no exact location but constantly varied its position over a wide area. With the data the elliptical course that it followed could be calculated. During this time, Amundsen met the Inuit of Northern Canada and learned the technique of using snowshoes, and learning by doing he extended his earlier rudimentary experience with dogs and dog sledges.

When observations regarding climatic conditions and earth magnetism near the North Magnetic Pole were completed, Amundsen continued his navigation of the Northwest Passage. Pushing on through dangerous waters and ice, he eventually accomplished his goal: the first to successfully navigate the entire Northwest Passage in a single vessel.

5.2 Pulled between Science and "Storming the Pole"

A few years later he resolved to spend seven years in the Arctic on a transpolar drift to carry out oceanographic investigations with new instruments that had come on line since Nansen's transpolar drift.[6] Such an experiment would advance knowledge of the dynamics of currents and tides as well as of the bottom profile of the Arctic sea basin. The new initiative was presented as a strictly scientific endeavour and scientists at the time were very interested and supportive. When outlining the project before the Royal Geographical Society in London at its meeting on 25 January, 1909—where he was introduced as a "scientific explorer"—Amundsen emphasized:

> It is the exploration of this basin, the nucleus of the polar regions, to which we must turn all our attention. Many people think that a polar expedition is only an unnecessary waste of money and life. The idea of a polar expedition is connected with that of a record, of reaching the pole or farther north than any of its predecessors; and if this is the case I agree with them. But I must most emphatically assert that the storming of the pole will not be the object of this expedition. Its aim will be a scientific study of the polar sea itself, or rather an investigation of the bottom and oceanographic conditions of this great basin. (Amundsen 1909:454.)

There was no indication of a hidden agenda to "capture" the North Pole. Scientific credibility of the proposed expedition was underlined by a message from Fridtjof Nansen to the RGS that was read out at the meeting; in it he strongly endorsed and vouched for Amundsen's project. In Nansen's eyes Amundsen was still his potential scientific disciple enrolled in a grand program of Norwegian geoscience based in Oslo.

For his seven-year Arctic drift project Amundsen borrowed Nansen's famous state-owned ship, the *Fram*, allegedly to sail round the Cape of Good Hope in order to reach the Bering Strait as planned. But after Cook "took the North Pole" the plan was secretly changed; now instead came the important prize winning detour to the South Pole that re-secured Amundsen his public image and prestige as a leading explorer.

Since science was the official excuse and justification for using the *Fram*, and the vessel was equipped with many instruments, not least oceanographic ones for use en route southward in the Atlantic, it seemed natural that Amundsen came on board the vessel in Oslo rather than in San Francisco (as originally intended just to meet up when the time came to head into the Bering Sea). The scientific instruments now served as part of a useful smokescreen to guard the secret of the new goal; too immediate a release of information regarding the radical change of plans, it was feared, would seriously erode support from the scientific community and other sponsors.

The "incidental" goal was reached on 14 December, 1911. This was 33 days before Scott's team. In the case of Amundsen's team it had taken roughly eight weeks of travel across hidden crevasses and rifts. Another five and a half weeks and the group were back at base camp. Practical knowledge gained earlier of managing men, logistics and the use of sledge dogs to haul supplies now came to good stead. In his equation he even calculated the flesh of the dogs that carried the provisions as part of the food for animal and human consumption on the return trip from the pole to the base station *Framheim*. The selection of the starting point on the Bay of Whales at the edge of the Ross Barrier hinged on thorough acquaintance with and comparison of observations reported by earlier explorers who had been in the region. A close study indicated that there had been little or no change in the barrier's contour at this spot. Thus Amundsen deduced that here was a stable site for a base that was one degree of latitude closer to the pole than the starting points British explorers were wont to use. As it turned out the place was also less stormy than Robert Scott's base station *Terra Nova Hut* at Cape Evans on Ross Island at the entry to McMurdo Sound.

After his return from Antarctica Amundsen was morally obliged to take up the original Nansean plan, to pursue oceanographic studies in the Arctic for a period of seven or eight years. When it turned out that woodrot had got into the *Fram*'s hull and therefore an extensive costly overhaul was needed, it was decided to build a new ship. He also took flying lessons (getting his license in 1912) and acquainted himself with aviation and aviators. These new skills and knowledge later turned out to be useful when the next expedition, the *Maud* expedition (1918–1925), once it finally did get going, also failed to fulfil the original intention of drifting by the North Pole. Since it repeatedly ended up in the icepack in the wrong place, he developed an alternative strategy for his private goal (reaching the pole), and in the course of this helped facilitate pioneering efforts in polar aviation.

6. Significant Context. The Old Inductivist Ideal in Science and the New Generation of Hypothesis-Minded Geoscientists

The general idea behind the First International Polar Year was to obtain an overview of geophysical phenomena in poorly known parts of the world in the hope of gaining for the first time detailed meteorological and earth magnetic pictures of the world. Epistemologically the plan rested on an inductivist ideal of science, giving primacy to systematic observation and hoping that some patterns transcending the local might emerge from the data. This would give clues to relationships and trends that might be found by generalising from discrete time series of observations obtained at many sites. The chief architect and initial source of inspiration behind IPY-1, Karl Weyprecht, expressed the ideal in 1878 as

> proceeding through comparison to deduce from observations collected at different points, independent of the particularities that characterize the different years of observation, the general laws governing the phenomena under study (cited in Summerhayes 2008: 323.)

The same kind of approach, albeit linked to one or another hypothesis as in Nansen's case concerning currents in the Arctic Ocean, was important in oceanography as witnessed by the scientific results coming out of the drift of the *Fram*. In another field, Kristian Birkeland in 1908 noted that during his aurora expedition 1902–1903 he had had the good fortune of being able to compare magnetic data from 25 observatories and argued for a doubling of this number in future. He also recommended a chain of ten small expeditions with about ten stations suitably situated about each of the magnetic poles while correlating data from all observatories in the world (Birkeland 1908).

Meteorologists too were interested in setting up a network of Arctic observatories. In 1911 Hugo Hergesell, a leading German meteorologist, introduced a permanent meteorological station on Spitsbergen, which with the start of aerological ascents in the following year produced annual series of measurements, helpful for gaining a better understanding of variations in weather conditions for further projects to introduce airships in the Arctic (Aeroarctic 1924: Table 9). Integrating single outlier observation points, however, was a problem, motivating further Arctic stations, both on land and vessels not only for systematic series of surface-bound observations but also to launch kites or balloons.

To spur further efforts in this direction the International Meteorological Organisation created a special Commission for Polar Meteorology in 1913 (Lüdecke & Lajus 2010: 137). This coincided with the announcement by Roald Amundsen that he now finally was ready to undertake his postponed drift across the North Pole. The Commission, at its meeting in Copenhagen 28 February–1 March, 1914, on the assumption that Amundsen would at least set out in the summer of 1915, submitted a map with a plan for aerological observations at a chain of stations extending around the north polar basin (see below Fig. 1).

The inductivist ideal of science was in principle a democratic one, since it did not make a distinction between potential observers as long as they were sufficiently trained. In practice however the hierarchy of the world of scientific academies and central meteorological institutes in the different countries engendered differences when it came to whose voices counted for more than others, particularly since scientific training and specialist analysis were required in the various branches of institutionalized research in order to work up raw data from observations in the field into advanced knowledge. Here a dividing line existed between the explorer as initial observer and the scientist who made the data analysis and had the final say in matters of interpretation. This turned out to be significant in Norway where a younger generation of academically professionalised geoscientists schooled in advanced mathematical methods gained prominence. They also launched an internationally oriented journal that became influential (see below). It was a different kind of science to the one with which Amundsen was familiar (Hestmark 2004: 147); as time went on and, it seems, as he felt more and more out of place in Sverdrup's scientific context, his own passion for initiating and testing novel modes of polar exploration extended into the use of airplanes and dirigibles.

By 1927, Isaiah Bowman, director of the American Geographical Society from 1915 to 1935, in connection with a stock-taking symposium on polar research problems was able to say this about the new times:

> The whole assembly of contributions makes it clear that science, not adventure, will be the motive for future polar work. This represents a great gain for science because it forces attention on principles rather than personalities. (In Joerg (ed.) 1928: v.)

He may have had in mind Peary's words of 1904, or equally the image of Amundsen's on-going experimentation with airships to find or exclude the possibility of new polar lands from observations aloft. Bowman was from the very start a staunch advocate of academic geography as opposed to popular geography, science as distinct from only geographic exploration.

7. Framing the *Maud* Expedition in an International Context. 1914

When Amundsen had asked Nansen to help him obtain the right of use of the state-owned ship *Fram* for an extended Arctic expedition, the latter was at first reluctant since he (Nansen) had hopes of undertaking an expedition to Antarctica as the crowning event in his own life as a polar researcher. Since Amundsen used the ship to race south Nansen must have had mixed feelings and suppressed his disappointment that his own dream would never be realised—the younger prodigy had become a rival (Bomann-Larsen 1995: 226–227; Barr & Ekeberg 2005: 114). Worse still the intended potential disciple had aborted the crucially important Arctic research plan. Amundsen's own justification afterwards for the sudden change of plans was that he wanted to be in a better position to raise funds for the Arctic drift project, given the decline of public interest in the North Pole once that prize had already been reaped by Peary and Cook—by enhancing his own reputation as explorer and adding a fresh dramatic topic for lecture tours, he hoped it would be easier to raise more money.

In the foreword to Amundsen's book about the South Pole expedition Nansen stated that he hoped the author would now be able to continue his original plan for an oceanographic expedition in the Arctic. Amundsen was publicly obliged to make good his earlier promise to do just that (Hestmark 2004: 147). It was this project and not the South Pole one that fitted in with the professional interests of so many Norwegian scientists who had already invested much effort and expertise into the design of its scientific program and equipment. They had also worked on trying to integrate it into a broad international framework with a parallel campaign for sustained simultaneous data collection at several other Arctic sites. So there was more at stake than just a broken promise to Nansen.

Apart from Nansen's oceanographic program, Amundsen's projected expedition to repeat an extended drift experiment in the Arctic Ocean fit into a broader scientific framework of international meteorological interests. In 1912, at a meeting of the Aerological Commission in Vienna chaired by Hergesell, the wish was expressed that Amundsen on his planned drift across the Arctic Ocean should adopt the guidelines for atmospheric measurements developed by the International Meteorological Organization (IMO). At the IMO congress in Rome the following year Hergesell again emphasised the importance of systematic collection of atmospheric data in the Arctic involving several nations to be synchronised with Amundsen's projected expedition. Amundsen himself was asked to become a member of the board of the newly created Commission for Polar Meteorology. During a visit to meet Hergesell at his institute in Strasbourg Amundsen was briefed on the broader picture and from his side he indicated that he might be able to obtain funding from the Carnegie Institute in the USA to set up an atmospheric observatory in the American North-West (Lüdecke 2011: 112–113). Thus he became directly involved in the network planning that culminated in the map of projected stations produced for the commission meeting in Copenhagen in 1914 (for the map, see Fig. 1).

Apart from lobbying for financial assistance, on his lecturing tours he was also on the lookout for suitable persons to recruit. One such person turned out to be Wilhelm Filchner, the leader of the Second German Polar Expedition (on the Norwegian ship *Bjørn*, renamed *Deutschland* 1911–1912). While in Berlin in February 1914 Amundsen met Filchner, outlined his new expedition plan, and invited him to participate in reconnaissance and aerial surveys using an airplane (off the ship), an idea that had been entertained earlier and was once again actualised. Amundsen, remember, had a pilot's licence and Filchner also learned to fly and obtained one. In addition Filchner learned to operate a movie camera. For the final preparations for the expedition Amundsen asked his new companion to move to Kristiania (Oslo) and it appears the latter might have done so had it not been for the outbreak of the First World War (Lüdecke 2011: 113–114). Filchner himself, writing in 1922, recalls that he intended

> to proceed to neutral Norway, where I was to receive training as an oceanographer, since in the meantime I had been recruited by Roald Amundsen for his extended arctic voyage. (Filchner [1922] 1994: vii.)

During part of the war he later found himself stationed in Norway doing military intelligence work for the Germans, which put him in a rather delicate situation since he formally still regarded himself as a member of Amundsen's projected expedition. Eventually he was asked to leave the country.

For the scientific communities that were supportive of the expedition the expectation appears to have been one of linking the old inductivist ideal of the first polar year (IPY-1) to mathematically more sophisticated and hypothesis-oriented approaches in the geosciences. Here the Norwegian geophysicist Vilhelm Bjerknes was a pivotal figure whose approach in principle spanned over several disciplines (Friedman 2008). The dynamic research networks he created simultaneously bridged empirical and theoretical dimensions of investigation.

Early on Bjerknes realized that one could formulate a complete set of hydro- and thermodynamic equations that govern the processes in the atmosphere. Consequently he tackled the problem of weather prediction as an initial value problem of mathematical physics, where the initial state was to be determined from observations, and the future change from integration of the governing equations. In 1905 he got the opportunity to lecture about this bold program in Washington D.C. This resulted in a yearly grant from the Carnegie Institution, which he retained for about 35 years, until the Second World War. Over the years these funds enabled Bjerknes to employ a considerable number of research assistants all of whom later became well-known geophysicists (Eliasson 1982: 3). A common denominator lay in Bjerknes' unified approach to the study of the dynamics of the motions of the atmosphere and water circulation in the oceans, friction, turbulence and energy balance (Hestmark 2004: 147). He spearheaded the establishment of an exact science of atmospheric and ocean circulation.

In 1907 Vilhelm Bjerknes was called to a chair at the University of Kristiania/Oslo. Since he was also affiliated with the Carnegie Institute in Washington D.C. he soon employed two young Norwegian science students as his Carnegie assistants: Theodor Hesselberg and Olaf Devik. Harald Ulrik Sverdrup succeeded the latter in 1911 (Friedman 2002). These three rose to prominence in different fields: Hesselberg in meteorology, Sverdrup in oceanography, and Devik in hydrology. Hesselberg eventually became the president of the IMO (1935–1946). At the end of the nineteenth century Scandinavia was the centre of marine science (Fogg 1992: 195), and this tradition was further developed and modernized, particularly in Bergen, where Bjerknes (after five years in Leipzig) moved in 1917 to join Helland-Hansen, who had become professor of oceanography there two years earlier. Undergraduate students had for some time already come from several countries to receive training in new geophysical methods in Bergen. One of these was Alexander Kuchin from Russia, who Helland-Hansen sent along on the *Fram* expedition to the South Pole to do oceanography.

7.1 The First Arctic Drift Plan as Published in 1914

After Amundsen returned from the Antarctic and revived his scheme, the little network of polar meteorologists developed the plan for co-operation to anchor it more firmly in the institutional framework of the IMO. It called for a network of up to 20 geophysical stations in the Arctic, to operate for at least one year or even two years in parallel with Amundsen's intended lengthy north polar drift in the *Maud*, which was meant to enter the ice on a trajectory north of Pt. Barrow Alaska (Fig. 1).

Observations were to be made simultaneously (ensured through radio contact) on a daily basis during the year September 1915–September 1916 with similar observations to be made by Amundsen during his intended

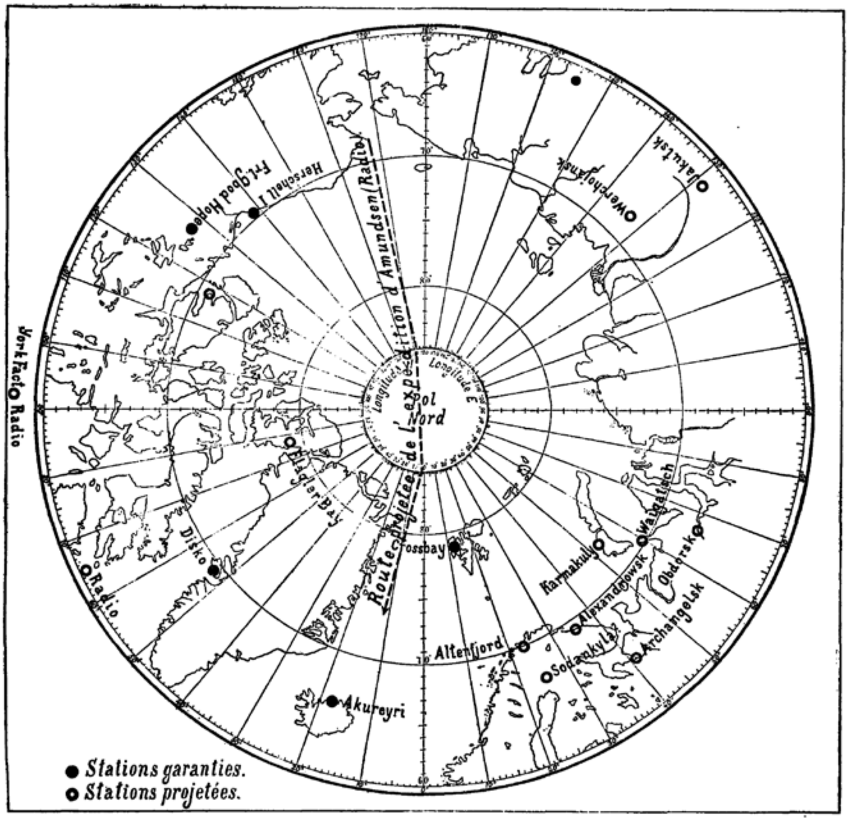


FIG. 1.—Proposed route of Capt. Amundsen's arctic expedition, and location of stations that are to collaborate in aerological observations. (From Bulletin Imp. Acad Sci., St. Petersburg, April 1, 1914. For English spelling of names see text.)

Fig. 1. Proposed route of Amundsen's Arctic expedition, and location of stations that were meant to collaborate in aerological observations (Talman 1914).

north polar drift. Membership of the Commission for Polar Meteorology reflected the nations to be involved (Talman 1914): A.I. Rykachev (president; he had once been an assistant to H. Wild and succeeded him as director of the Physical Observatory in St. Petersburg), R. Amundsen (Norway), H. Hergesell (Germany), C. Ryder (Denmark), R. F. Stupart (Canada), B. Birkeland (Norway), Prince Boris Golitsyn (Director of the Russian Meteorological Service), A. de Quervain (Switzerland), and A. Wegener (secretary, Germany).

It is noteworthy that the Russians were apparently geared up to play an important role, with three fully equipped primary stations, one on Novaya Zemlya and four secondary ones across its vast Arctic territories. Canada intended to equip four stations, the Danes were to take part on the west coast of Greenland and at Akureyri in Iceland, the Germans would use their observatory at Cross Bay, Spitsbergen, and it was hoped that the Scandinavians would participate with two Arctic observatories (Altenfjord and Sodankylä), while an American expedition in Greenland would also take part.

7.2 The Second, Updated and Extended Plan for Co-Operation with Amundsen for 1920–1922

Five months after the IMO's Commission for Polar Meteorology at its meeting on 28 February–1 March 1914 in Copenhagen formally decided upon the co-operative plan, it had to be postponed because of the First World War. When Amundsen finally did manage to start it was in June 1918; the *Maud* was provided with the latest meteorological and oceanographic equipment as well as instruments for measuring terrestrial magnetism. H. U. Sverdrup was to supervise the scientific program, and in the meantime the plan for external international cooperation had been updated and extended for the years 1920–1922 (Norwegian Geophysical Commission 1921). The new co-operative plan was duly endorsed at the meeting of the International Meteorological Committee (IMC) in London in July 1919 and in October the same year at the important meeting in Paris when committees within the IMO were reconstituted, an International Polar Commission was established to lead the projected co-operation with Amundsen's expedition. The days when aerological balloon ascents from the *Maud* would be launched were now fixed as the international days for launching similar atmospheric probes all over the world (Hesselberg 1921: 4).

The resolution that the IMC passed at its London meeting states:

> It is agreed that the members present will do their best to secure favourable consideration of the co-operation of their representative Institutes on the lines of the proposal passed by the Norwegian Government. (Cited in Hesselberg 1921.)

Thus it is clear that the Norwegian Geophysical Commission and with it the new generation of professional mathematically minded geophysicists in Norway had a leading role in the efforts to integrate the experiments on Amundsen's expedition into an internationally coordinated observational network.

Further, when the IMO's Commission for Scientific Aeronautics was reconstituted in Paris in 1919 as the Commission for the Investigation of the Upper Atmosphere, it was Vilhelm Bjerknes who was appointed as its president. The International Polar Commission subsequently joined forces with the Commission for the Réseau Mondiale. The latter was responsible for coordinating observations at a worldwide network of meteorological stations and synthesizing the results in annual catalogues published in London. The joint Commission for the Réseau Mondiale and Polar Meteorology later was the one within the IMO that decided on the feasibility of a Second International Polar Year, IPY-2 (Elzinga 2009; Elzinga 2010; for the history of the polar years, see Barr & Lüdecke (eds.) 2010).

7.3 A New Multilingual Norwegian Journal Enters on the Scene

Norwegian networking through existing international organizations had a good base in a consolidation of a domestic network that began when Nansen and Helland-Hansen were able to find funding for a chair for Vilhelm Bjerknes in Bergen,[7] starting in 1917. The very same year Bjerknes and

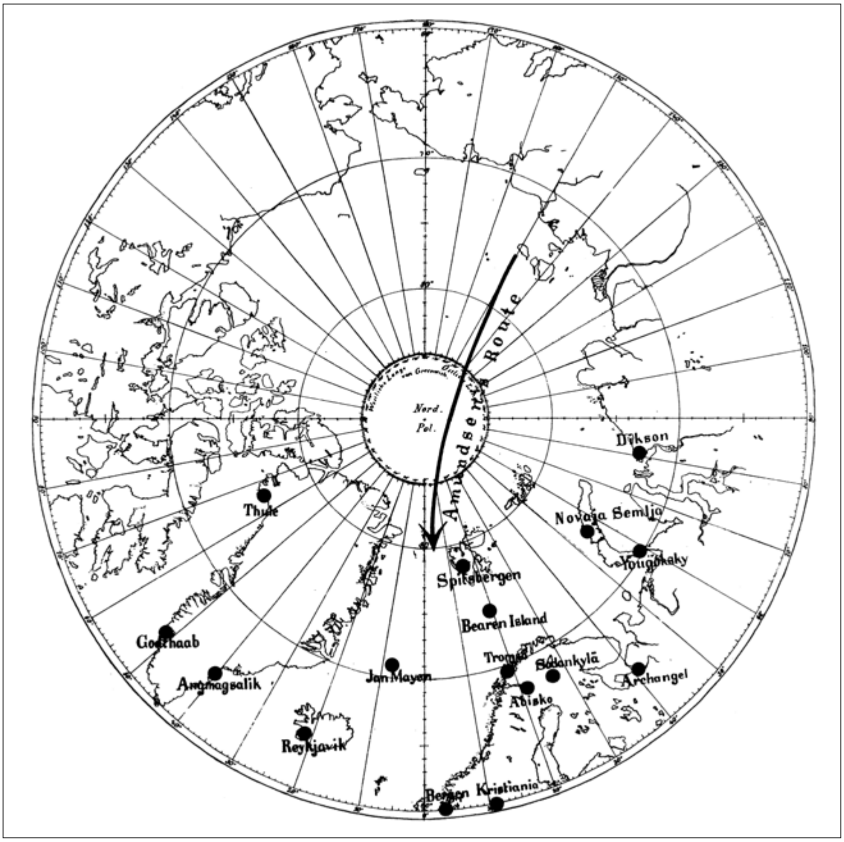


Fig. 2. The updated map 1919/1920 for the projected co-operation with Amundsen's *Maud* expedition showing the intended modified route (Hesselberg 1921).

Helland-Hansen together with their younger colleagues, O. Devik, T. Hesselberg, O.A. Krogness, H. U. Sverdrup and S. Sæland founded the Norwegian Geophysical Society and decided to create a journal, *Geofysiske Publikasjoner.* This journal started up in 1921 with private capital and an idea of linking scientific and practical concerns, while at the same it helped profile the Norwegian geophysical research community. It also put Norwegian geosciences squarely on the world scientific map, since it served as an independent periodical outlet for publications in English, French and German.

The decision to make the journal multilingual was propitious. In the cold war in science that followed upon the heals of the First World War when the international institutional landscape of science was reconstituted under the auspices of the International Research Council (IRC), it excluded researchers from the losing side, that is, researchers from the Central Powers (this situation that was not rectified until the advent of ICSU in 1931). Like Holland, Switzerland and Sweden, a neutral country like Norway played an important role in seeking to reconciliate scientific communities in the spirit of a truer internationalism; in this conjuncture the new journal filled an important gap that in turn helped it flourish.

Consciously or not the move also resonated with Nansen's newfound role as an international ambassador of peace. At the same time a more conscious international promotion of Norwegian geosciences might also have helped win goodwill during the later growth of *ishavsimperialisme* ['Polar-sea imperialism'] (Barr 2003; Drivenes 2004) that was even played up on Greenland during IPY-2.

The first issue of *Geofysiske Publikasjoner* featured several papers by the enthusiastic core group of Norwegian geoscientists reiterating the importance of arranging for the earlier idea of international co-operation with the *Maud* expedition. Theodor Hesselberg (1921), Ole Andreas Krogness (1921) and Carl Størmer (1921), respectively, outlined detailed guidelines for scheduling the synchronous study of several geophysical parameters over a sufficiently long period of time. Hesselberg's paper features a map of proposed co-operative stations, updating the earlier map of 1914 (see Fig. 2). Bjerknes meanwhile had been arguing for a network of polar observations stations patterned on the model of field weather services, the *Réseau Mondiale*, but smaller and not just for terrestrial observations. The trick was to get a sufficient number of stations for meaningful comparison of simultaneous polar upper air observations with pilot balloons (Friedman 1989: 120).

In later years the *Geofysiske Publikasjoner* featured papers in which the analysis of the results of Amundsen's *Gjøa* expedition were finally disseminated (Geelmuyden 1932; Graarud 1932; Steen *et al*. 1930; Steen *et al.* 1933). The journal was also important as an organ for disseminating some scientific outcomes of the *Maud* expedition, for example, Finn Malmgren's study of humidity and hoarfrost (Malmgren 1927) and Sverdrup's analysis relating to observations of tidal motions and other oceanographic parameters off the Siberian coast (Sverdrup 1927a), both of which will be taken up below.

8. Scientific Outcomes of Amundsen's Various Expeditions and Projects

The previous sections have established the fact that Amundsen did not operate independently of the scientific community. The legitimacy of his expeditions, the design of their scientific plans and also the possibility of incorporating empirical results into the body of existing scientific knowledge all hinged on a positive attitude on the part of working scientists.

In order to highlight the outcomes of the various expeditions I have chosen not to follow them in chronological order but rather to use the disciplinary headings that were relevant at the time. This does imply an occasional repetition of events, but on the other hand that is necessary in order to do justice to the richness of the story line and reflect the internal coherence of the overall plot in which *several* actors appear. A helpful entry is a retrospective stocktaking perspective afforded by a symposium held towards the end of 1927 at the invitation of the American Geographical Society (AGS). The proceedings were published in a volume entitled *Problems of Polar Research. A Series of Papers by Thirty-One Authors* (Joerg (ed.) 1928); a companion volume contains an encyclopaedic overview of what was known about the climate, physical characteristics and regional geography of polar regions (Nordenskjöld & Mecking 1928).

The symposium was on problems of polar research. Thirty papers were presented by leading scientific authorities from different parts of the world covering a diverse number of topics. Fridtjof Nansen addressed the topic of oceanographic problems in still unknown Arctic regions (Nansen 1928). Knud Rasmussen spoke about tasks for future research in Eskimo culture, and Vilhjalmur Stefansson about the resources of the Arctic and the problem of their utilization. Louis Agricola Bauer, the longstanding head of the Department for Terrestrial Magnetism at the well-known Carnegie Institute of Washington D.C.—a world centre in the field—reviewed unresolved problems in terrestrial magnetism in Polar Regions. Longstanding enthusiasts employed by this department in those days used to be called "the magnetics."

Sir Douglas Mawson spoke on unresolved problems of Antarctic exploration and research, and Erich von Drygalski on the oceanographic problems of the Antarctic, complementing Nansen's paper. Griffith Taylor, geologist on Scott's *Terra Nova* expedition, dealt with climatic relations between Antarctica and Australia, while R. E. Priestley, another former member of that expedition, took up geological problems of Antarctica. R. E. Priestley and C. S. Wright, also once members of Scott's expedition, took up problems of ice in Antarctica. A further topic was the use of aircraft in polar-regions, dealt with in papers by Richard Byrd (Antarctic), Lincoln Ellsworth (airplanes and airships in the Arctic) and Umberto Nobile (dirigibles and polar exploration).

Several other speakers covered questions mostly related to data from the Arctic and problems concerning tides, geology, meteorology, classification of sea ice and zoogeography.

The symposium volume provides an informative window onto the state of the art of polar research and its agendas at the time. Here and there one also finds evidence of a positive reception of the outcome of at least two of Amundsen's expeditions, the one with the *Gjøa* and the other with the *Maud*. Notable at the 1927 symposium is a scarcity of references to Amundsen's south polar expedition 1910–1912, while coverage of scientific results that emanated from Scott's ill-fated parallel expedition is richly represented. Ellsworth and Nobile took up Amundsen's later interest in facilitating airplanes and dirigibles as new modes of polar transport as well as logistical tools and platforms for performing airborne research.

Curiously, Amundsen himself did not attend the symposium. He had been in the US on a contract with several institutions, including the AGS, for a five month lecturing tour starting in the autumn of 1927, but broke it off abruptly after only three weeks. A visit with (and positive words for) his old mentor Cook of the *Belgica* expedition, who happened to be in jail for fraud, was picked up by newspaper reporters who featured Amundsen as now siding with Cook in the latter's controversy with Peary over who had reached the North Pole first. Since the AGS backed Admiral Peary, critical comments followed indicating that Amundsen was a meddler, which Amundsen in turn took as an affront and slander thrown in his face (Bomann-Larsen 1995: 486–487). He abruptly broke off his lecturing program and immediately left for Norway, where he isolated himself in his house nursing bitterness over this latest turn of events and how, earlier, Nobile had stolen the limelight and dampened public interest in Amundsen's story about the success of the transpolar flight with the dirigible *Norge*.

In the meantime he had also landed himself in trouble with the Royal Geographic Society in London. In his autobiography that had just appeared in print he not only attacked his rival Nobile but also referred to an episode at a formal dinner after a lecture he had given at the RGS after his return from the South Pole. Allegedly there had been three cheers, not for Amundsen but for his sledge dogs, a clever bit of sarcasm he had not forgotten. In his autobiography he commented on it, saying that the British were "bad losers," alluding to British national chauvinist opinion after Scott's loss of the race to the pole. The statement led to furore in Britain and a warning that if he Amundsen did not apologize, his status as honorary member of the society would be revoked. This in turn prompted Amundsen to immediately reply with a letter wherein he formally renounced his title.

Late in December 1927 Nansen, at the request of the Norwegian ambassador in London to dampen diplomatic turmoil that might be damaging for Norway, wrote a letter to the vice president of the Royal Geographical Society to explain that Amundsen had become mentally unbalanced and could no longer be held accountable for his behaviour. The legend had become a tragic isolated figure.

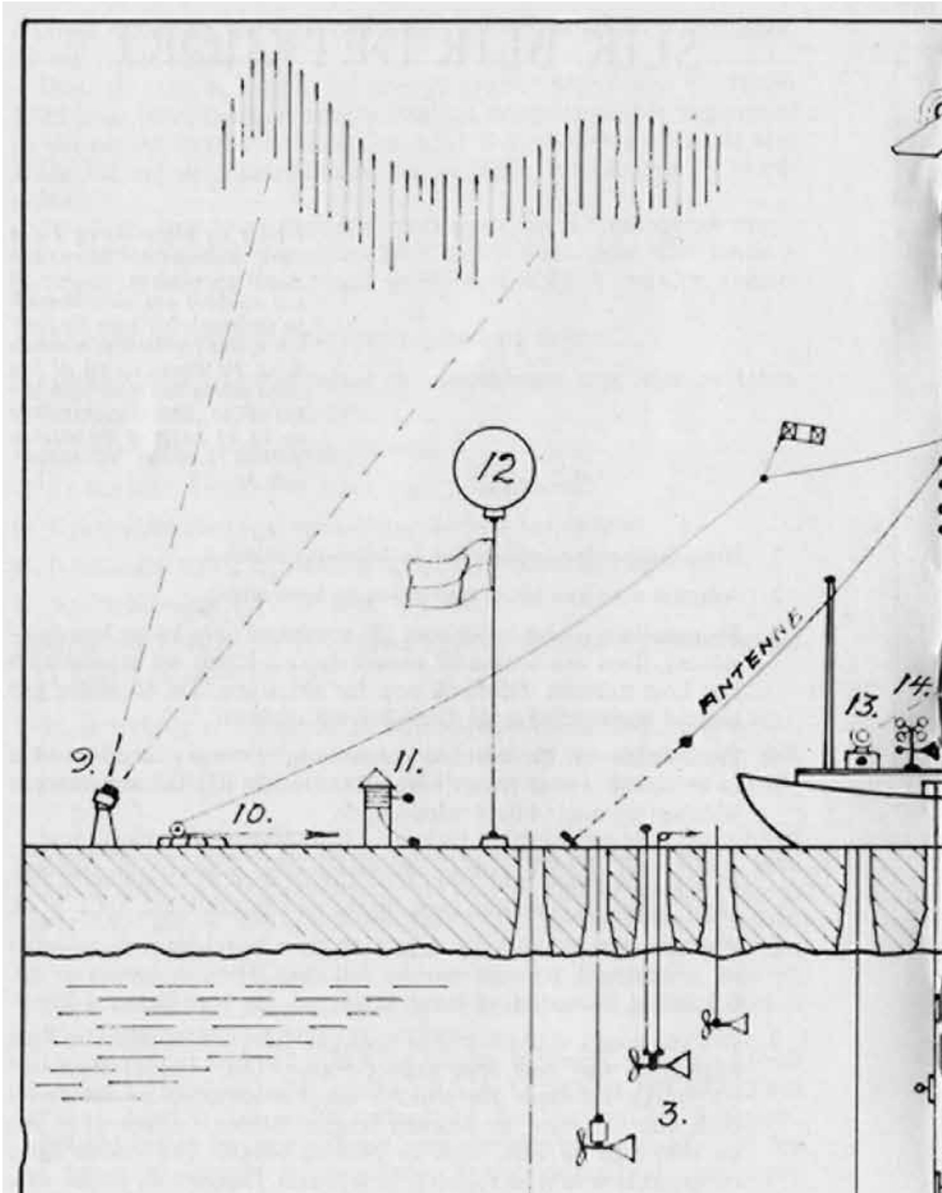
In what follows the 1927 AGS symposium report is used to help focus and summarize, and complemented with information from other sources, to thematize scientific results from the various expeditions and projects associated with Roald Amundsen over a period covering the first three decades of the nineteenth century.

8.1 Polar Oceanography and Arctic Tides

From April to September 1901, Amundsen made his first cruise in the *Gjøa*, in the Barents Sea and the Arctic regions of the Norwegian Sea. The results of his oceanographic observations were soon afterwards described and discussed by Nansen (1906). In a later report one reads that Amundsen's oceanographic observations are of great importance, and are much more trustworthy than those of any previous expedition to the Arctic Seas. His vertical series of temperatures and salinities taken in the sea between Jan Mayen, Greenland and Spitsbergen, are of special value, as they clearly prove the manner in which the bottom-water of the Norwegian Sea is formed (Helland-Hansen & Nansen 1909).

The empirical data collected at Gjoa Haven (just north of the mainland coastal rim of present-day Nunavut) was largely focused on earth magnetism and meteorology while oceanographic work was absent. The success of finding a way through the Northwest Passage rightly belongs to the art of navigation and mapping, as do the surveys of the land and coastal area near Gjoa Haven.

The plan of the oceanographic work during the Norwegian South Polar Expedition was designed together with Helland-Hansen. While Amundsen and his companions were passing the winter down south, Captain Thorvald Nilsen in the *Fram* had his second mate Hjalmar Fredrik Gjertsen together with the young Russian oceanographic researcher, Alexander Kuchin,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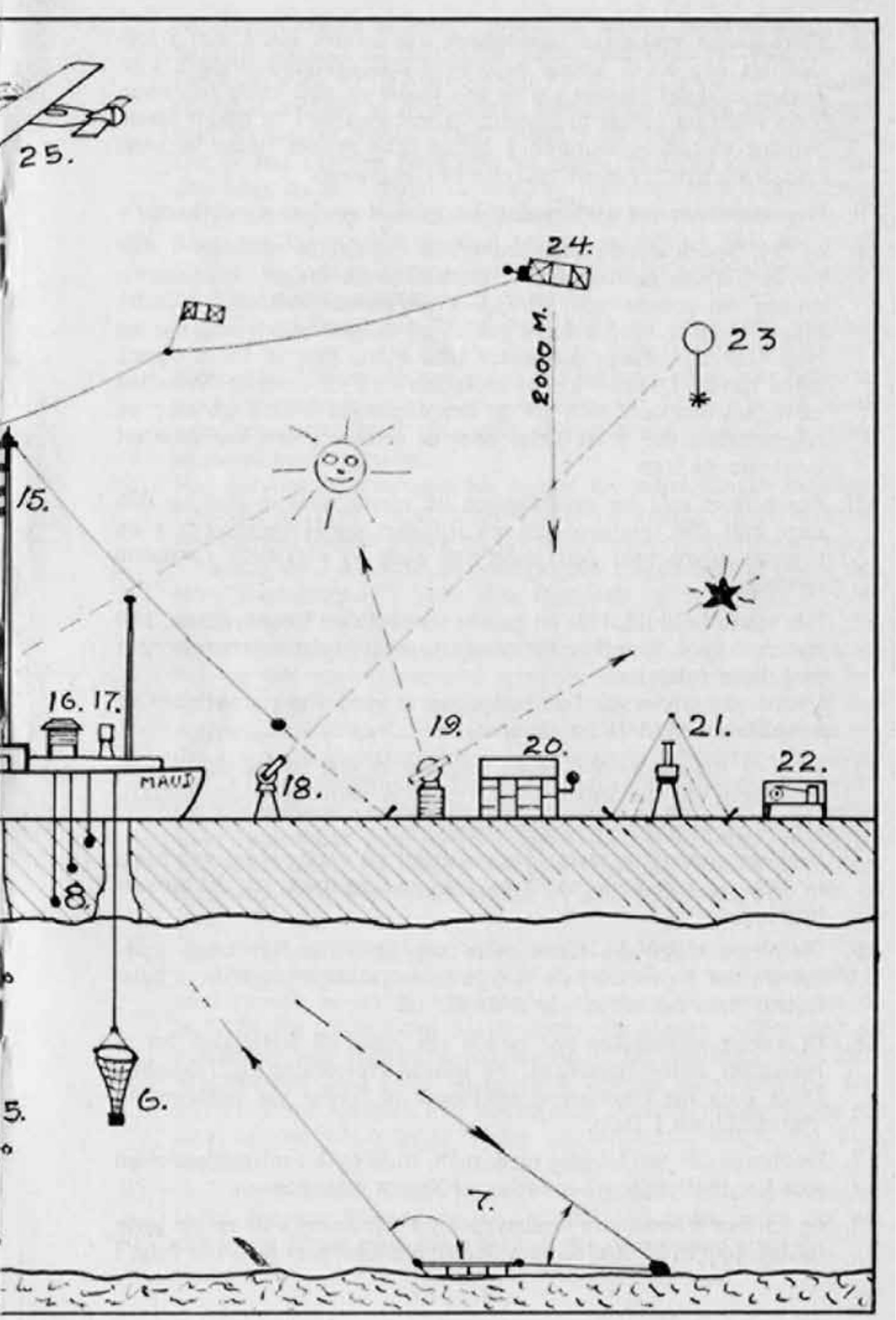

Fig. 3. Odd Dahl's drawing of the *Maud* as a polar laboratory (from Dahl & Lunde 1976: 24–25; courtesy of the Norwegian Polar Institute, Tromsø).

collect a series of data on the ocean on a double traverse back and forth between South America and Africa. Kuchin had been trained for the profession in Helland-Hansen's laboratory and Gjertsen had also received instruction there. In sixty locations they recorded temperatures, took water samples and specimens of plankton in this little-known region down to a depth of 2,000 fathoms or more.

When the *Fram* got back to Buenos Aires before heading south to pick up Amundsen and his men, Kuchin disembarked with all the samples and data, taking these with him by steamer back to Bergen and the laboratory where he made a preliminary analysis which was then taken over by Helland-Hansen. Analysis of the *Fram*'s overall oceanographic work appears in a report jointly authored by Helland-Hansen and Nansen; in it they highlight a number of interesting features in parts of the north and south Atlantic regions (Appendix V in Amundsen 1912). It was noted that at the time, the two sections covered in the Southern Atlantic were the first such ever so investigated in that region, thus adding new knowledge about previously unknown ocean depths; indeed for a while they were the longest and most complete sections known in any part of the ocean (Barr 1985: 408). These results were later compared and built on in a more detailed investigation by the German Atlantic Expedition of the *Meteor* 1925–1927 (Lüdecke 2011: 109); using a new device, the radio echo sounder, it was able to reach much deeper. Also noteworthy was the fact that the *Fram* on her voyage also reached the latitude of 78° 41' S, the furthest south a ship had ever penetrated.

As for Kuchin, after finishing in Bergen he returned to Russia. On the strength of his research training and having been chosen as Amundsen's oceanographer on the *Fram*, he was engaged in a Russian survey expedition on Svalbard and soon advanced to lead an oceanographic mission in the Arctic. His vessel was shipwrecked and he is presumed to have died in or near the Kara Sea late in 1912, thus clipping short a promising scientific career (Barr 1985: 409–412).

The *Maud* expedition that followed represented the latest state-of-the art seagoing laboratory (see Fig. 3). Since the time of Nansen's transpolar drift several new instruments had been developed, making it possible to obtain much more exact measurements of currents and tidal motions. It was now possible to more precisely determine water temperatures at many levels in the sea right down to the bottom;[8] bottom sediments could also be brought up from the Arctic sea basin. Although it failed to repeat Nansen's drift over the central Arctic Basin, thanks to Harald Ulrik Sverdrup, the *Maud* expedition nevertheless carried out a great amount of oceanographic work in the course of seven years in the ice north of Eastern Siberia and the

Bering Strait (cf. Friedman 1994; for highlights as well as photographs of different facets of the expedition see Barr & Ekeberg 2005: 181–222).

The tidal data collected during the first phase of the expedition was worked on by J. E. Fjeldstad, who predicted the existence of submarine barriers across the Arctic Ocean, such as the Lomonosov Ridge, later found by Russian scientists. He incorporated Sverdrup's preliminary tidal observations into a larger co-tidal map of the Arctic seas (Fjelstad 1923). During the second phase of the expedition Sverdrup engaged the assistance of the inventive airplane pilot Otto Dahl to construct novel current recorders (Sverdrup & Dahl 1926).

While on the *Maud*, Sverdrup also began theoretical studies applying dynamics to oceanography. He constructed a co-tidal map showing the properties of the tide between Cape Chelyuskin and Point Barrow, which differs from Harris' (1911) map. This led him "to conclude that the tidal phenomena do not indicate the existence of land within the unexplored area." He found tidal currents of the northern Siberian shelf to have a rotary, almost circular, character at considerable distances from the coast, all of them in a clockwise direction, indicating an effect of the deflecting force of the Earth's rotation. His hydrographic study of the behaviour of the tide wave on continental shelves took into account both the effect of the resistance along the bottom and the effect of the deflecting force of the Earth's rotation. The tide wave on continental shelves does not progress in accordance with the simple formula valid for deep oceanic basins. This was a novel and important finding (Marmer 1928). Sverdrup argued that the effect of the earth's rotation, a fundamental effect in the dynamics of oceans, is most simply observed in the Arctic.

The foregoing results and other findings were elaborated in *The Norwegian North Polar Expedition with the 'Maud,' 1918–1925*, a major publication in several volumes edited by Sverdrup (1928–1933; meteorology 1930, vol. 3) who was responsible for about two-thirds of the total contents.

8.2 Polar Meteorology

During eighteen months a couple of men of the *Gjøa* expedition carried out meteorological observations three times every twenty-four hours at Gjoa Haven. All the data was brought back to Oslo where it was to be reduced and interpreted. As time went on several of those scientists who had been tasked to do this died, and also the war intervened, so that coherent scientific results and discussion were not ready in manuscript form until 1922. Then post-war financial difficulties caused a further delay so that the results, after having been critically examined and revised by H. U. Sverdrup in 1931, first saw publication only in 1932. The relevant volume comprises well over two hundred pages with discussion, synoptic maps and accompanying tabulations of primary data (Graarud 1932). However, by that time the relevance of all this material was rather incidental. Paradoxically, the isolated local meteorological data, being of good quality and forming a continuous series over a considerable period of time, may be more useful today as an ingredient in climatological studies that compare past data from neighbouring sources (e.g., Hudson's Bay Company stations and logbooks of ships both further east and west) in the Canadian north.

During the Norwegian Antarctic Expedition meteorological observations of several parameters plus cloud conditions three times a day (08, 14 and 20 hrs.) were made at the base station *Framheim* for the period April 1911–January 1912. The tabulations were analysed and climatological implications drawn by B. J. Birkeland (Appendix II in Amundsen 1912). A more detailed analysis was made by Norway's grand old man of meteorology Henrik Mohn (1835–1916). It was published in a much longer report by the Science Academy in Oslo (Mohn 1915).

During 1918–1920 the *Maud* expedition recorded full meteorological observations three times a day (at 08, 14 and 20 hrs.). These and other original records for the expedition's first phase were lost when two members of the party tried to transport the records home following the coastline of the Siberian tundra 900 kilometres to Port Dikson where there was a radiotelegraphic weather station and died en route (Barr 1983).[9]

For the second phase, 1922–1925, when Sverdrup had Finn Malmgren and Odd Dahl to assist him, the meteorological records were more comprehensive with six observations per day. Records of the first one-year portion of this period have been digitized at the National Climate Data Centre (NCDC) in the USA where there is interest in expanding this, also using published records from Sverdrup's expedition report (Sverdrup 1928–1933, vol. 3).

Unlike Amundsen, Sverdrup did not leave data analysis to others. Tore Gjelsvik (director of the Norsk Polarinstitutt 1960–1983) in a review of Norwegian research in the Arctic has this to say:

> Sverdrup's work on the *Maud* expedition represents one of the most fundamental contributions to arctic meteorology. It may be mentioned that by means of recording instruments carried aloft by kites, he succeeded in giving a detailed picture of the inversion over the pack ice. Furthermore, by means of pilot-balloon soundings, he obtained valuable information about the wind conditions at different levels of the arctic troposphere. (Gjelsvik 1966: 71.)

Finn Malmgren, moreover, apart from his work on humidity and hoar-frost (Malmgren 1926a), made a thorough and groundbreaking study of the properties of sea ice (Malmgren 1927, doctoral thesis at Uppsala). Amundsen further facilitated Malmgren's career when the explorer engaged him as meteorologist on the flight of the *Norge* across the North Pole to Alaska (Malmgren 1926b).

After the return of the *Maud* expedition Malmgren spent almost four months in the winter of 1925–1926 in Bergen where he acquainted himself with Bjerknes' new methods of synoptic meteorology. Thus he was well equipped for his next task, the flight with the airship *Norge* across the North Pole in May 1926. In this connection a novel arrangement was introduced. During the period of the flight weather telegrams from different countries were collected in Oslo where they were "synthesized" and sent on through a telegraphic cable to Stavanger. From there the powerful Radio Stavanger whose voice could be heard clear across the entire Arctic Ocean, even in Alaska, periodic reports seven times a day were sent to the *Norge*. There they formed the basis of the synoptic weather maps Malmgren plotted three times a day while en route in the airship (Malmgren 1926b: 241–242). The arrangement may be counted as a technoscientific innovation that probably encouraged visionaries of Arctic aviation by airships (Aeroarctic 1924; and see below, section 8.5).

8.3 Terrestrial Magnetism and Electricity

One of Amundsen's objectives with the *Gjøa* expedition was to determine the location and the extent of the migration of the Magnetic North Pole since its discovery by James Clark Ross in June 1831. During the stay at Gjoa Haven magnetic measurements were made continuously at the base station and intermittently in a circle of auxiliary magnetic stations around the main station to consider local and daily variations. At the time the Northern Magnetic Pole (NMP) was located on Boothia Peninsula (then called *Boothia Felix*) about 120 kilometres in a southeasterly direction from Gjoa Haven; Amundsen and Peder Ristvedt reached its vicinity by sled in April 1904, making measurements on the way. The NMP site turned out to be not far from the place at which James Clark Ross had first found it 73 years earlier; during the course of the twentieth century it has migrated northwestward at an average rate of about 10 kilometres/year. Those who later made the analysis back in Oslo expressed regrets that Amundsen was unable to make intended observations at several other locations including Victoria Harbour, Ross's headquarters in 1831 (Steen *et al.* 1933: 192). Although the total material of the field observations was considerable, the number of stations on Boothia Peninsula was too small to draw reliable conclusions about local variations over time or draw relevant magnetic charts for the region neighbouring the approximate NMP in the year 1905. At most what was established were the more or less probable (not the exact) geographic coordinates of the magnetic pole at the given time. Most of the work at the Gjoa Haven fixed magnetic hut and later at King Point on the Yukon coast of the Canadian Beaufort Sea was done by Amundsen's assistant Gustav Wiik. Often left alone with this task while others were out on various side-expeditions, he sometimes felt that he was the one who was largely responsible for securing the expedition's scientific goal. Since he became sick, died and was buried by his last post at King Point in late March 1906 before the ship could travel on he has been referred to as a martyr of science (Bomann-Larsen 1995: 84–85).[10]

After his return to Europe Amundsen presented some of his findings before the Royal Geographical Society in London, whose members applauded him for putting the interests of science before geographical exploits (Amundsen 1907). The precise results however again took way too long before they entered the scientific literature.

Aksel Steen directed work on the vast amount of data and started preparing publication of the results. After he died in 1915 younger colleagues took over and it took another seven years before a publishable manuscript was finally put in order. As in the case of the meteorological report, the Norwegian government's financial difficulties then halted further progress. It was not until after Amundsen's death that the results of the expedition (after revisions made by H. U. Sverdrup in 1931) were published in two substantial volumes funded by Roald Amundsen's Memorial Fund (Editorial Committee 1932). One volume contains 191 images of photograms taken by the self-registering instruments at Gjoa Haven and King Point (Steen *et al.* 1930); the other contains lengthy tabulations, data analysis and interpretation (Steen *et al.* 1933). Together they comprise over five hundred pages. A very short report gives pertinent data and discussion regarding observations with astronomic instruments to determine exact times and geographical coordinates (Geelmuyden 1932).

Afterwards the scientific results seem to have gained some use once they were incorporated and compared with those from other sites in later studies, and today they are utilized in modern research on solar wind patterns (Svalgaard & Cliver 2002; Svalgaard & Cliver 2006). Solar research expert Leif Svalgaard in Houston Texas has emphasized the importance of such past data (Svalgaard & Cliver 2007: section 7) and says Amundsen's Gjoa Haven data is of very good quality (Svalgaard, personal communication 17 January 2011).

The report of the *Fram* expedition to Antarctica contains no record of earth magnetic measurements. The *Maud* expedition on the other hand delivered many interesting results that were soon circulated in relevant scientific communities thanks to Sverdrup's personal contact with the "magneticians" at the Carnegie Institute of Washington and his ability to get things published. Results from the first phase of the expedition appeared quickly (Sverdrup & Duvall 1922), followed by analytical papers (Sverdrup 1927a; Wait & Sverdrup 1927; see also Fisk & Fleming 1928), and a voluminous publication in the Terrestrial Magnetism series of the Carnegie Institute (Sverdrup 1929b). L. A. Bauer was quite familiar with these when he spoke at the 1927 symposium on problems of polar research (Bauer 1928). He gave a snapshot of essential findings and commended Sverdrup for having obtained valuable continuous records for the magnetic declination both at winter quarters near Cape Chelyuskin, Siberia October 1918 to August 1919 and again at the winter site 1924/25 further west near A. E. Nordenskiöld's location in 1879, making for interesting comparison of magnetic declination over time.

During the latter phase of the expedition (1922–1925, without Amundsen) observations were made at numerous stations on the ice at remote distances from the ship and isomagnetic lines were constructed. Measured values of the magnetic declination differed significantly from those on charts but matched fairly well with Nordenskiöld's forty years earlier. Bauer notes how

> [i]t would have added greatly to our knowledge of the supposed measurements of the magnetic pole if similar magnetic-observatory observations could have been obtained simultaneously at several stations surrounding the magnetic pole.

The ambitious plan of 1919/1920 for a network of co-operating magnetic and meteorological observatories as outlined by Norwegian geoscientists and endorsed by the IMO (see above) had apparently fallen through.

Bauer also noted how in 1924 the idea of simultaneous studies in the high latitudes was promoted at the Section of Terrestrial Magnetism and Electricity of the International Geodesic and Geophysical Union (IGGU) and likewise by the Commission of Solar Terrestrial Relationships of the IRC 1925. The discovery that year of the height of ionosphere layers (Breit & Tuve 1926) spurred the study of a correlation between "polar lights and radiotelegraphy" to further probe the effects of magnetic storms. Such research gained much prominence, not least with E. V. Appleton's work in Tromsø during IPY-2 (Elzinga 2009). For his investigations of the physics of the upper atmosphere with an ionosonde and his discovery of a new ionosphere layer Appleton was awarded the Nobel Prize in physics in 1947.

The study of aurora during the *Maud* expedition was qualitative. No parallactic photographic equipment had been taken along to measure their height above the Earth. However, on the basis of his studies Sverdrup confirmed that aurora displays are always accompanied by magnetic disturbance whose severity increases, in general, with the intensity of the movement of the aurora. He further found that the intensity of magnetic disturbance decreased with increasing altitude of the aurora.

A thorough treatment of relevant empirical and theoretical work on the magnetic material was published in the expedition volume (Sverdrup 1928–1933). For contemporaries it set a high standard, not only because of the continuous data sets but also for the theoretical twists Sverdrup was able to add.

With his scientific reputation established with the *Maud* (Nierenberg 1996) and partly in recognition of what he had accomplished for Norway during seven hard and sometimes frustrating years in the Arctic,[11] in 1926 Sverdrup was offered the chair of meteorology after Bjerknes, who had moved to Oslo. In Bergen Sverdrup found more time to work on the data collected and edited the scientific report of 1933. Before assuming his post, however, he spent ten months at the Carnegie Institute in Washington, among other things, to work on the expedition's electric and magnetic records and publish the report cited by Bauer. Consequently those records—data collections, computation notebooks, charts, tables, reports and 68 aurora borealis photographs—can be found in the Institute's archives, where processing and organizing them was completed by Jennifer Snyder in 2004 (Carnegie Institution 2004).

8.4 Ethnography

Amundsen was a fairly astute and respectful ethnographer of the Netsilik Inuits. The men of the *Gjøa* befriended the local Netsilik and seem to have left a favourable impression with them. This has recently been evidenced in studies of anecdotal knowledge transmitted over the years by local tribal Elders (Eber 2008). Elders still actualize oral historical memories transmitted in their society from the time of the explorers, including Amundsen. The indigenous people in their encounters 1903–1905 called him "Amusi" (pronounced Amuse-uh); several stories concerning the big-nosed "Amusi" and his men still circulate today (Eber 2008: 116).

The Norwegian party were not the first *kabloona* (Inuktitut for 'non-Inuit person') the Netsilik community had encountered, but they were certainly friendlier than some other Europeans who had sought a way through the Passage on many earlier occasions. They even set about to learn Inuit skills of various kinds, including the construction of igloos, adopting indigenous clothing and joining their native hosts on hunting parties. In addition they learnt how to hunt for seal and native methods of preparing food, as well as how to cope with extreme weather conditions that might arise, and in some cases as guests they slept in Inuit homes. By rewarding individual members of the native community with much prized items of wood and metal in exchange for exemplars of Inuit dress, tools and other artefacts like shamanistic and ritual objects, Amundsen introduced an incentive system whereby it became easier to assemble a large collection of ethnographic materials. Inuits were also encouraged to bring in various kinds of birds for the expedition's ornithological collection. As a result, thanks to the assistance of local communities on King William Island and elsewhere, the expeditioners were able to bring a variety of unique material and photographs back to Oslo, where the ethnographic part came to form the backbone of the Ethnographic Museum's Inuit collection. The Netsilik collection, with over 900 items, is held to be the Museum's largest from a single culture (Walter & Neumann Fridman (eds.) 2004: 176). To this was later added a valuable collection of objects from the Chuckchi people of easternmost Siberia obtained during the *Maud* expedition.

In a recent historical review of Amundsen's achievements the *Gjøa*-collection brought back from the Northwest Passage is referred to as that expedition's perhaps most interesting scientific result (Barr & Ekeberg 2005: 83); at the time it was given to the Museum it constituted the biggest single collection of Inuit objects anywhere (Jølle 2004: 299). However, it was never used for research purposes to the extent hoped for; by 1918 it was eclipsed by a much stronger (politically motivated) interest in the life and culture of Norway's own Arctic minority or "polar people," the Sami. Thus the Ethnographic Museum in Oslo never became a centre for studies of Inuit culture. In Copenhagen, Denmark, on the other hand, Knud Rasmussen's collections from his Thule expeditions became the basis for a world centre of Inuit research, politically motivated by the Danish claim to Greenland.

At the 1927 symposium on polar research problems Rasmussen noted that "in Oslo there is the rich collection brought home by the *Gjøa* expedition from the neighbourhood of the north magnetic pole," but said nothing about Amundsen's ethnographic observations (in Joerg (ed.) 1928: 186).

The popular account of the *Gjøa* expedition (Amundsen 1908), translated into many languages, is laced with observations of the amateur ethnographer. It recounts encounters with the Netsilik, has observations on their customs, modes of transport over land and water, interpersonal relations, generational differences, women, and shows respect for and an appreciation of indigenous knowledge. Some of the photographs taken during the expedition are also featured (cf. Barr & Ekeberg 2005: 92, 95–96). In his book Amundsen says he warned his men against giving in to the temptation of getting too intimate with young Eskimo women. The collective memory of the Netsilik suggests that this advice was not always followed.

In her book *Encounters on the Passage. Inuit Meet the Explorers* (2008), one of anthropologist Dorothy Eber's Inuit informants says: "there was a lot of sexual activity;" another tells her that

> in Gjoa Haven a number of persons lay claim to Norwegian heritage [...]. I never heard it directly from my father himself, but when I was a child close relatives would sometimes say, 'your father is a half white person—mixed with white.' (Eber 2008: 124.)

In the wake of centennial celebration marking the visit of the men of the *Gjøa* some of these memories of the past kept alive in the local lore of a multifaceted oral tradition are probably surfacing again. Today Gjoa Haven has a population of about 1,000; in 2010 community leaders in cooperation with the Fram Museum in Oslo had an Amundsen celebration that featured an exhibition of some of the unique historical photos taken over a century ago.

During the course of the first phase of the *Maud* expedition, which was essentially a transit of the Northeast Passage (1918–1920), Amundsen kept a diary. In it his own observations regarding the Chuckhi are limited to practical matters like their ability to handle sledge dogs or their clothing and personalities plus his general view that they had a morally high stature, but because they were so isolated they culturally stood far below the level of the Alaskan Inuit who had adopted much more from the surrounding white society.

Sverdrup was the one who, on Amundsen's suggestion, spent eight months living and travelling with the Chuckchi and carried out extensive ethnographic work among them. Although less pronounced, his approach also reflected a Darwinist cultural evolutionary perspective that was prevalent in the 1910s and 1920s. The *leitmotif* of the study as he expressed it, was the duty of his generation to use every opportunity

> to save whatever can be saved; collect information about life and thought forms, especially among those people who still find themselves at the edge of civilization; because in a few decades their way of life may also have changed, their uniqueness disappeared. We must learn to know these people, but it must occur soon. (Stated in Sverdrup's chapter in Amundsen 1921.)

Sverdrup's study is more concentrated and professional than Amundsen's earlier one of the Netsilik Inuits and presents a systematic review of similar aspects like tools and dress forms. He also discusses questions of social structure and genealogy (who may marry whom), accepted forms of homosexuality, norms more generally, traditional forms of trade, justice, manifestations of intra-tribal and family solidarity as well as marriage customs and funeral rites. A substantial part of the study takes up belief in supernatural causes of earthly events which might influence a person's (mis)fortune, well-being or not, and various healing practices in cases of sickness. Names of powerful and capricious spirits abound, while on the other hand curiously because there is no word or name for it, toothache does not exist. Shamanistic practices are also discussed.

Sverdrup's account was first incorporated as a long chapter (*Blandt rentsjuktsjere og lamuter* ['Among the reindeer Chukchi and the Lamut']) in Amundsen's expedition report (Amundsen 1921); subsequently he published a paper in English, "Customs of the Chukchi natives of north-eastern Siberia" (Sverdrup 1922). Thereafter came popular books in Norwegian, *Tre Ar i isen med "Maud"* ['Three years in the ice with the "Maud"'] (Sverdrup 1926) and *Hos Tundra-Folket* ['Among the tundra people'] (Sverdrup 1938). Although he lectured on the subject in English while in the USA, broad dissemination in print to an Anglophone readership had to wait forty years while a manuscript based on *Tundra-Folket* lay at the Scripps Institution of Oceanography, La Jolla, California, where Sverdrup served as director 1936–1948. When finally it had been translated, edited and published (Sverdrup 1978) there existed more authoritative studies of the Chuckchi reindeer herders so the volume had a limited impact.

8.5 Arctic Exploration by Airplane and Airship

The last phase of Amundsen's life was spent in new feats of polar exploration involving air travel, with some sensationally novel projects. In late 1922 when it became clear that the *Maud* would not reach the North Pole, he hit upon an alternative strategy—long distance flight. The idea emerged already when he was momentarily in Norway. Arnesen (1929: 121) dates it to March 1922.

After the *Maud* headed north again and got stuck in the ice and overwintered once more off the coast of Siberia it headed for Seattle with a damaged propeller. A year later after repairs the ship set out again in June 1922 to continue the second phase of the expedition (1922–1925). This time it had two small planes on board, one of which, a German-made Junkers-Larsen JL-6 called *Elisabeth*[12] was transferred to a schooner and deposited at Wainwright (near Port Barrow) together with Amundsen, who stayed behind there in northern Alaska from where, with his pilot Oskar Omdal of the Royal Norwegian Navy, he planned to fly over the Arctic Ocean to Spitsbergen. Take-off proved impossible that summer and autumn because of strong winds and storms, so the pair ended up building a house and Omdal stayed the winter in Wainwright with the plane stored in boxes. Amundsen found the place boring and travelled by dog sled to the gold-digger town of Nome where he spent the winter (becoming a well-known figure in local social life) before returning to Wainwright where bad luck continued in the spring of 1923 (Jensen 2011: 244–248). The *Elisabeth* crashed during its test flight, and after attempts to repair the undercarriage failed, Amundsen got fed up, and so by midsummer the entire plan was abandoned. Amundsen then stayed behind in the USA to raise money for further aviation projects. Meanwhile Oscar Wisting, now in command of the *Maud*, was once more in the pack ice for the intended transpolar drift that also failed.

The second plane was an American Curtis plane named the *Kristina*. Together with the pilot Odd Dahl it stayed on the *Maud* and was able to carry out two short reconnaissance flights; during a third flight it crashed on the ice (Wisting 2011: 405–406). Nevertheless it was a pioneering effort that added knowledge about off-ship flights in Polar Regions.

Dahl was employed by Amundsen in 1922 as pilot, mechanic, radio telegrapher and film-photographer on board the *Maud*. Together with the newly recruited Finn Malmgren he also assisted Sverdrup. Dahl maintained and constructed scientific instruments and proved to be a good illustrator and draftsman. In later life he declared: "the 'Maud' was my university and H. U. Sverdrup my professor."[13] In 1927 Sverdrup helped him get a position to assist geophysicists at the Carnegie Institute in Washington, the start of a scientific career that led on to Dahl's later prominence in Norwegian and European atomic and space research.

In 1925 Amundsen had the good fortune of being called upon by Lincoln Ellsworth (the son of an American millionaire). He wanted to become a member of Amundsen's new expedition to reach the North Pole; Amundsen agreed since it meant much needed financial support (Jensen 2011: 258–259). This time the starting point was Spitsbergen using two Dornier Wal flying boats. They landed in a water lead in the pack ice (a polynya) at 87° 44' N. When the lead closed up it took twenty-five days of hard work before one plane was freed and now with six persons on board flew back to Spitsbergen. In his presentation at the 1927 symposium on polar research problems, Ellsworth says:

> [t]he scientific results, from the expedition that cost 150,000 dollars, consisted in viewing 120 square miles of hitherto unknown territory and taking two soundings with a Behm echo sounding machine which showed a depth of the polar basin at that point to be 3,750 metres (12,300 feet), thus precluding the likelihood of any land in the sector between the north pole and Greenland-Spitsbergen. In addition the flight had

> shown that meteorological conditions prevailing over the Arctic Basin offered no hindrance to its successful exploration by the proper kind of aircraft. (In Joerg (ed.) 1928: 410–411.)

The following year Amundsen and Ellsworth contracted the Italian airship pioneer, Umberto Nobile, to buy his dirigible that they christened the *Norge*.[14] In May 1926 the airship successfully flew from Spitsbergen, over the North Pole, and landed at Teller Alaska 72 hours after take-off. This was another first in the history of polar aviation. Photographs made during the flight further confirmed the absence of an unknown land.

It was a dramatic moment. Take-off was just two days after Richard Byrd had flown towards the pole with a plane and came back to Spitsbergen claiming he had reached it. In retrospect, since recent analysis of Byrd's technical records and meteorological conditions indicate that he could not possible have got beyond 89°, and recent perusals of Peary's and Cook's records indicate that they also fell short, the Amundsen team now after all appears to have been the first to cross the pole. Hence Roald Amundsen and Oscar Wisting (who in 1911 helped plant the Norwegian flagpole at the South Pole) were actually the first men to reach both poles.

Finn Malmgren, the meteorologist on the *Norge*, on the basis of his findings concluded that future traffic over the polar sea, if it was to materialize, would not be with dirigibles but with airplanes (Malmgren 1926b: 250). This was because of the problem with strong winds and icing that created dangerously risky situations for dirigibles. It was an insight that was tragically confirmed two years later with the crash of Nobile's *Italia* in the aftermath of which Malmgren lost his life out on the sea-ice, and Amundsen died during a search-and-rescue flight out of Tromsø. An extract from Malmgren's diary while on the *Italia* has recently been published as an appendix in Nencioni (2010: 128–131).[15]

Despite the tragedy of the *Italia*, the vision of airships as research platforms developed further within the network of enthusiasts organized by the Aeroarctic (1924), a society for promoting Arctic aviation (Nansen was its president and Sverdrup was also on its Board).[16] The idea got a momentary boost with the partial success of the flight, July 1931, of the society's airship, the LZ-127 Graf Zeppelin in a five day polar flight with a team of German, Swedish, Soviet and US scientists on an exploration of the Arctic (Sverdrup 1929a). Arthur Koestler (1952) was on board as one of the journalists for the press agency Ullstein that had a monopoly on reports to the media.[17]

Apart from meteorological observations, scientists measured variations in the earth's magnetic field in the latitudes near the North Pole, and made a photographic survey of unmapped regions using a panoramic camera that automatically took several pictures per minute. A massive aerial survey and mapping of the Russian Arctic was achieved, but the Zeppelin never became the research platform that was envisaged by some.

Speaking at the symposium in December 1927, Nobile covered several problems attending the use of dirigibles in Polar Regions. He recognized the dangers of fog and ice encrustation of the airships and spoke of the need to protect against falling chunks of ice from hitting and tearing the gasbag. Further he discussed the need to protect motors and gas valves against low temperatures. Still, he held that all such problems could be solved and then went on to try and refute those who dismissed the use of dirigibles as platforms for scientific research; against them he argued why

> the dirigible is the best means of transportation for the exploration of the Arctic zone. The airplanes and hydroplane can be used, but mainly as an auxiliary means of transportation. (In Joerg (ed.) 1928: 424.)

In an overly optimistic tone he outlined a futuristic scenario where larger dirigibles might be used to transport entire laboratories for use in Polar Regions. History proved him wrong; in 1952 Arthur Koestler summarized: "Just as the dinosaur represented the end product of withered branch of development, it was too clumpy, vulnerable and slow" (Koestler 1952). The vision nevertheless was an important part of an episode wherein Amundsen had an important role as a man of action and facilitator.

One final aspect to be mentioned here is Amundsen's role in the development of a solar compass for aviators. In 1923 he commissioned the engineer and inventor Johann Boykow to construct a solar compass as a navigational aid for flying near the North Pole where magnetic compasses become unreliable (Aeroarctic 1924: 47; Lüdecke 2011: 144). The small instrument was designed to follow the daily rotation of the sun, and in the case of a constant course project the image of the sun at a fixed place on a frosted glass in front of the pilot. The instrument was manufactured by the C. P. Goerz Co. in Germany. In the hands of the Norwegian aviation pioneer Hjalmer Riiser-Larsen, who served as Amundsen's pilot during the N 25 Dornier Wal flight and navigator on the *Norge* flight, it was used to calculate aerial routes fairly accurately in cloudless skies (Riiser-Larsen 1926). It was Riiser-Larsen's careful monitoring of the compass and factoring in wind drift that decided when they were actually over the Earth's mathematical North Pole.

Nobile used a new version of this solar compass on the flight of the *Italia* and thereafter the *Graf Zeppelin* also navigated by it while over the Arctic Ocean. Even the two Dornier-Wal hydroplanes used during the German Swabenland Expedition to Antarctica 1938–1939 used the Goerz solar compass.

On the basis of archival findings historian of polar science Cornelia Lüdecke says Amundsen deserves credit for the initiative behind this technical innovation and that it could have become a lasting contribution to polar navigation had it not been for the fact that the mainstream technical development in this area took another path (Lüdecke 2011: 200–201).

9. Photography

In September 2006 Christies in London at their auction sold a consignment of several boxes containing photographs taken during three of Amundsen's expeditions, the *Gjøa*, the South Pole Expedition and the one with the *Maud*. They were clubbed at £78,000. They were the "direct positive glass lantern slides" which are the subject of Roland Huntford's book, *The Amundsen Photographs* (1987).

Long regarded as lost the hand-coloured slides were discovered in 1986 in the attic of Amundsen's nephew's widow Anne-Christine Jacobsen in Oslo. A box marked "Horlicks Malted Milk Tablets" turned out to contain not field rations but 248 of Amundsen's original lantern slides, apparently the only more or less complete set to have survived. Compared to Robert Scott, who employed the professional photographer and cinematographer Herbert Ponting, who as "camera artist" took over one thousand pictures on the *Terra Nova* expedition, Amundsen was the happy amateur when it came to recording his exploits. He almost missed getting any pictures at all from his own South Pole expedition, since the camera he had taken along was damaged and the film did not turn out. Fortunately, Olav Bjaaland brought his personal camera along, which saved the day, especially when it came to the iconic image of four men in front of the tent at *Polheim*.[18]

On the other hand Amundsen did bring a film camera. With it various sequences in the South Polar expedition were shot, first when the *Fram* was being loaded before departure, then underway and when arriving at the Bay of Whales. Gradually Kristian Prestrud took over and he filmed the "caravan" of the five men with their four dogsleds as they disappeared into the horizon on their way to the pole. Then when the group is back and the *Fram* in March 1912 is about to leave for Hobart he filmed a sequence where one can catch a glimpse of penguins at the Ross Barrier and further away the ship *Kainan Maru* of the Japanese expedition. Amundsen used the documentary in various versions in connection with lectures after his return to Norway.[19] One such lecture is reproduced in a recent booklet produced by the Norwegian Film Institute in connection with the restoration of the film for popular distribution (Norsk Filminstitutt 2010: 155–166). Since 2005 the film, now entitled Amundsen's South Pole Expedition 1910–1912 is listed as one of the world heritage films in Unesco's Memory of the World Register.

The legacy of the *Maud* expedition includes many photographs and some filmed episodes. In this case again there were no professional photographers present, but pictures were taken here and there in amateur fashion. In a sense this is ironic because, like many other private venture explorers, Amundsen was very dependent on publicity to help raise funds to finance his enterprises, including the later ones with airplanes. As already noted, it meant he had to spend a lot of time touring the world giving lectures.

The pilot and mechanic Oskar Omdal took photographs of the tiny plane *Elisabeth* unpacked in Alaska for the initial attempt to fly to Spitsbergen from there, and we can see images of it and the result of the crash immediately upon take-off. Odd Dahl took some footage on the plane *Kristina* used on the second phase of the *Maud* expedition. These and other images were incorporated into Reidar Lund's expedition film *With Roald Amundsen's North Pole Expedition to its first Winter Camp* (1923), which also features ethnographic sequences of the life of the Chukchi people and scenes on board the *Maud*.

Later Omdal shot several film rolls on the flight of the two Dornier Wal hydroplanes that almost reached 88° North in 1925. It includes scenes of the breakdown in the ice-scape. Combined with his own footage from flight preparations on Spitsbergen and the triumphant return to Oslo showing crowds of dressed-up people waving flags in large and small boats cheering the N-25 in the harbour, Paul Berge turned this into the popular educational film *Roald Amundsen. Lincoln Ellsworth's Polar Flight 1925*. The approach of the on-site film photographer was documentary, since he rarely had the opportunity to capture dramatic situations and moreover it was held that the matter-of fact representation of ordinary events during an expedition provided a truer picture of the explorer's reality.

Later Amundsen's flight film was reworked for an American market in a totally different way with a reordering of sequences and new clippings to accentuate drama and mimic the approach of a newsreel feature. In a recent book published by the Norwegian Film Institute in Oslo Jan Anders Diesen carefully analyses the composition of the aforementioned films and discusses the shift from the documentary to the dramatic approach (Diesen 2010).

When lecturing Amundsen was most comfortable with the documentary style, which also influenced his lectures regarding the South Pole expedition. Here the hand-coloured glass slides were an important visual aid. At the same time, as Huntford notes, there was a positive side to all this:

> He was a man of action, with an almost naive faith in his deeds necessarily speaking for themselves [...]. He and his companions took pictures

> themselves as they felt the need. In this alone they were amateurs, and their work was undoubtedly that of the snapshot [rather than the carefully posed composition]. Whatever the drawbacks in presentation, this did at least register events as seen through their own eyes. The outcome is a poignant blend of immediacy, artlessness and authenticity. This happens to suit Amundsen's style. (Huntford 1987: 7–8.)

The meaning conveyed however does not emerge purely out of the pictures themselves, as Huntford seems to suggest. The lecturer and his orchestration of the invisible hand that coloured the glass slides also contributed to what a member of the public might "see."

Recent research into Amundsen's use of visual material indicates that for his lectures he preferred to use the most retouched and coloured glass diapositives, which probably allowed for greater flexibility in his popular presentations. It is also found that there are a number of different versions of the iconic image of the four men in front of the tent and that these versions differ from each other in some interesting respects. Amundsen's favourite version was the one touched up in Norway with more colour and a straighter Norwegian flag when one compares to an earlier Australian version showing "the slackness of both the flag and Amundsen's belly" (Lund 2010: 174). The latter, a rather brownish image, was produced in Hobart, Tasmania. It is also a copy of the "original" authentic print that seems to be lost. A comparison of the different versions of the iconic photograph opens for some interesting interpretative flexibility that shows how the construction of meaning is not independent of socio-political context. In his analysis Lund writes:

> The South Pole picture with a more discreet flag shape not only shows that the wind is weaker at the South Pole [than suggested in the retouched Norwegian diapositive]. The wealth of detail and the context also appears liberating in relationship to the nationalistic overtones the picture has gained in Norwegian settings. (Lund 2010: 178.)

10. Concluding Remarks

Summing up, the purpose of the present paper has been to provide a better understanding of Roald Amundsen's problematic relationship to science. Even though he did not like to hob-knob with academics, he had a respect for science and liked Fridtjof Nansen's description of him as a scientific explorer. On the basis of a review of the expeditions and projects Amundsen was involved in during a period of three decades, it can be concluded that he was a reflective practitioner who facilitated both empirical data collection and had an impact on the life and early work of a number of persons who were or became important scientists, H. U. Sverdrup, Finn Malmgren and Odd Dahl. Dahl made a career in cosmic and nuclear physics and then space research and technology, playing an important role also at the policy level in Europe. Lincoln Ellsworth's successful expeditions with aircraft in Antarctica may also be mentioned.

Secondly, whereas Amundsen himself at first was intimately involved in empirical data collection, especially when it came to geomagnetic observations he left it to others to do the data reduction and interpretation of the results. In his life as a reflective practitioner there was always the double agenda—namely, setting records based on first hand geographical exploration, while service to science became a kind of spinoff. It was polar adventure that created headlines and turned him into an icon, particularly after the successful South Pole mission.

Thirdly, in Sverdrup's perspective in the context of a much broader picture the race to the South Pole was incidental to the older plan to follow in Nansen's footsteps in the Arctic. The subsequent expedition with the *Maud* remained the first objective, the one of repeating Nansen's trans-Arctic drift close by the North Pole.

A fourth conclusion is that then as now, science can simultaneously serve as a means both in itself and for promoting other goals, political or personal. The dual purpose of facilitating science and leaving footprints in the snow at the North Pole or crossing it by air were both part of the complex passions that drove Amundsen.

Although neither the objective of drifting across the Arctic Ocean for seven or eight years from the Bering Strait to Greenland nor the one of planting a flag at the North Pole succeeded, the scientific results that came out of that expedition were nevertheless impressive. This was thanks to Sverdrup's resourcefulness as a scientific leader. Amundsen himself was not a scientist and never pretended to be one. He was the seasoned leader and planner—oftentimes stubborn, vain and opinionated—the reflective practitioner, a genial master of logistics, enrolled by Nansen to help facilitate science. On the *Maud* he at first took his turn equally at the instruments and in the ship's galley. After two years, however, he hopped off from his own expedition and became part of the movement to promote multiple purpose polar aviation that for a while tied in with a vision of using dirigibles as research platforms.

A close historical study of results to be found in several classical disciplines reveals that Amundsen's expeditions, especially the one with the *Maud* where he himself was only present on the first leg, but also the two expeditions with the *Gjøa*, contributed more than is commonly recognized. Magnetic data for 1 November 1903 through May 1905 from the Gjoa Haven, although they did not have much relevance when they were finally published, are now still being used in modern day Earth and Planetary Systems Science.

A final point central to the paper's line of argument is that the plan of the expedition with the *Maud* fitted into a broader landscape of scientific institutions and contemporary interests of leading scientists. First of all there was Nansen's struggle to establish Oslo as a centre for physical oceanography that failed as Bergen (where Sverdrup became affiliated) surged ahead; secondly there was the plan of interaction with the meteorologists within the IMO. In the Amundsen story Norwegian historians of science have been instrumental in throwing new light on the Nansen-Amundsen nexus and the role of polar research and exploration in Norway's identity as a nation. Archival research has also provided a more complete picture of the context(s) and networks, and convergence of a variety of relevant stakeholder interests at play before, during and immediately after the First World War, and how in the immediate post-war period institutions in neutral countries like Norway played a special role in fostering reconciliation and promoting scientific internationalism. The present paper has not been able to do justice to the richness of the most recent scholarship pertaining to this broader context of geopolitical and cultural dimensions. The aim has been the more limited one of problematising Amundsen's ambiguous self-description as "scientific explorer" and to look more closely at knowledge and know-how that came out of his expeditions.

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NOTES

1 Prestrud's group left a cairn there that is today considered to be an historic site—77° 11' S, 154° 32' W.
2 Cook's announcement was published a week before Peary's; being a good friend since the *Belgica* expedition Cook actually suggested that Amundsen might now want to go to the South Pole instead.
3 From Charles Darwin's diaries however we know that animal husbandry was a source of practical knowledge that played into his development of the theory of evolution.
4 The group of Sverdrup Islands were claimed on behalf of Norway. A conflict with Canada over this Norwegian claim was not settled until 1930.
5 On Canadian maps nowadays it is called *Gjoa Haven*, which is also the name I will use in the present text.

6 As it turned out he only spent the first two winters on the *Maud* whereafter he left for his first trials in flying in the Arctic in 1922 and 1923.

7 Bjerknes became a professor at Stockholm University College 1895. In 1906 he became affiliated with the Carnegie Institute in Washington D.C. as a Research Associate. In 1907 he got a professorship at the University of Oslo but after five years moved to Germany to become the founding director of the Geophysical Institute in Leipzig, Germany, where he stayed from 1913 to 1917 whereafter he returned to Norway to found the Geohysical Institute at the University in Bergen. He did not return to Oslo until 1926.

8 Already in 1910 Nansen developed a special water sampling bottle that Amundsen was able to use during the South Pole expedition.

9 Remnants of the private postbag were found by a Russian geologist in 1922, only to be lost again, but in the mid-1970s a covering telegram dated 15 August 1919 from Roald Amundsen to his brother Leon in Oslo mysteriously surfaced in the Moscow Central Archives, in a section containing the private archives of a former Soviet administrator, Georgy D. Krazinsky. It is not known what happened to another item, an impregnated water-tight package with a book manuscript and many photographs destined for Oslo, nor if a further similarly water-proofed package containing scientific material ever reached its destination, the Carnegie Institute of Washington in the USA (Sjparo & Sjumilov 1986; Sandholm & Reinfjord 2008).

10 At King Point the crew of the *Gjøa* built two small houses of driftwood plus a magnetic observation hut. The marker by Wiik's grave was located at King Point where the magnetic instrument stand once stood, but since 1906 it has been moved several times because of continuous erosion of the permafrost on the Yukon coastline in the area. Five kilometres off the coast lies Herschel Island where whaling ships from 1890 onward used to overwinter. There one can find 100 wind-worn grave markers, silent witnesses to a late nineteenth century bustling Beaufort Sea whaling industry. There used to be a settlement of 1,500 people with many buildings and an Anglican Mission Church to evangelize the Inuit—in 1907 the whaling market collapsed and in the following year the island was deserted; today the few remaining houses and Herschel Island with it are top-listed in Canada as a potential Unesco heritage site.

11 Recall that Amundsen participated only during the first two years, later on he was absent while he was planning to fly to the North Pole with an airplane, as discussed in the next section.

12 Named after his sweatheart Kristine Elisabeth Bennett.

13 See www.polarhistorie.no/personer/Dahl,%20Odd; access date 16 May 2012.

14 Nobile's airship had been used by the Italian military and Amundsen was able to purchase it fairly cheaply with Ellsworth once again affording financial support (Jensen 2011: 288–289; Wisting 2011: 444–446).

15 For a picture of the *Italia* as it flies over the royal castle in Stockholm on the way to Svalbard see Jensen (2011: 311).

16 At the outset in 1924 the society had about one hundred persons with illustrious titles, most of them professors but also industrialists, high ranking civil servants or ministers of German governments, military men and directors of meteorological institutes and earth magnetic observatories. Some of these have been mentioned in the foregoing text (Louis A. Bauer, Bjørn Helland-Hansen, Th. Hesselberg, Otto Nordenkjöld, Knud Rasmussen and Alfred Wegener), others are ones that figured centrally in the network behind the idea and subsequent plan for the Second International Polar Year (Leonid Breitfuss, Dan Barfod Lacour, Evert van Everdingen and Johannes Georgi). In addition

one finds Sven Hedin, the Swedish explorer of desert landscapes and ruins along the fabled Silk Road; interestingly the polar explorer Roald Amundsen is missing. Nansen urged him to come to the 1924 meeting in Berlin but Amundsen refused saying that—considering Germans having caused the death of innocent Norwegian fishermen whose ships they sank during the war—he no longer wanted to have anything to do with the "German nation;" possibly he now also saw Nansen as a potential competitor in the polar skies and feared his own glory would diminish in the older man's shadow (Bomann-Larsen 1995: 413, 479). At first Germans and Scandinavians heavily dominated the Aeroarctic; by 1925/1927 an internationalization had taken place. Breitfuss edited the society's journal *Arktis* (1928–1931) with articles by several prominent scientists of the time. In 1930 Nansen's death and economic crisis led to the society's demise. For the historical and political context see De Syon (2002).

[17] Arthur Koestler's autobiography, *Arrow in the Blue* (1952) contains two chapters about the expedition; its achievements and behind the scenes personal and political conflicts are told with much humour.

[18] On the printed label within the glass are written the credits, e.g., "Prepared by J. W. Beattie Hobart Tasmania and coloured by TW Cameron, Carlton, Victoria."

[19] The longest Norwegian version is the socalled Cinema-version—it is 16 minutes.

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