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First International Polar Year, 1882-83

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ABSTRACT. During 1882-83 eleven countries cooperated in a project to study the geophysics and geodesy of the polar regions by establishing 14 research stations. Three of these were located in Canada's Arctic: one each by the United States, Germany and Britain. They accumulated data on terrestial magnetism and boreal phenomena and brought back valuable information on arctic living.

This year will mark the 100th anniversary of the first International Polar Year, probably the most ambitious of 19th-century international scientific projects and the forerunner of more recent cooperative ventures such as International Geophysical Year. Eleven countries launched 14 expeditions — 12 in the Arctic and two in the southern hemisphere — and the accumulated data furthered the world's knowledge of meteorology, geomagnetism and boreal phenomena. Of the ten arctic research stations that were ultimately established during IPY, three were in Canada: Fort Rae (British), Lady Franklin Bay, Ellesmere Island (U.S.) and Clearwater Fiord, Baffin Island (German). Auxiliary observatories were established by the German polar year committee at six Moravian missions in Labrador and the Toronto Observatory took the same observations as the arctic research stations. Although Canada did not participate directly (except from Toronto) in the IPY, it partially funded the British expedition and two other important arctic stations were established on what is now Canadian territory.

Scientific curiosity in the north was associated with an interest in the earth's magnetism. By the end of the 17th century it was known that the earth possessed magnetic fields organized around north and south magnetic poles. Besides being of obvious interest to navigators, it was also believed that terrestrial magnetism was connected with weather patterns and other phenomena such as the aurora borealis. By the early 19th century scientists were interested in explaining terrestrial magnetism and determining how, if at all, it was connected with other phenomena (Cawood, 1979:497). Scientists had been trying to solve such universal problems since the time of the Greeks and since the Renaissance had had a measure of success using mathematics to determine the unknown. But in the 19th century, for a variety of reasons including a belief in inductive reasoning, there arose a passion for collecting facts on a large scale. So, although mathematicians continued to search for answers in formulae, others began to collect hard data. One of the first to attempt this approach to understand terrestial magnetism appears to have been the German Alexander von Humboldt, who began making magnetic observations while touring South America in the 1820s and subsequently established a network of trans-European observatories. He was followed by his countryman, mathematician Carl Freidrich Gauss, who wanted a broadly-spaced series of observatories to supplement his mathematical work. With his colleague Wilhelm Weber he established in 1836 the Gottingen Magnetic Union (Magnetische Verein) which united a world-wide network of observatories. Gauss delineated the three categories of geomagnetic observations — declination, inclination, and intensity — and invented instruments for the accurate measurement of these phenomena. He also devised a schedule of observations so that data would be collected in the same way at identical times around the globe (Dictionary of Scientific Biography, 1972).

Meanwhile the British scientific establishment was also affected by positivist notions of fact gathering, and geomagnetic surveys became among the most ambitious of its schemes. The most active British promoter of a global study of magnetism was Edward Sabine, an officer in the Royal Artillery who was also closely connected with the Royal Society of London. Sabine reactivated the old Royal Observatory at Kew as a magnetic station and began a campaign to establish similar magnetic observatories across the Empire. He was an associate and keen supporter of James Clark Ross, the naval captain who by 1839 had located both the north and the south magnetic poles. The two collaborated on a magnetic survey of Great Britain. In 1838, the British government, influenced by German endeavours and pushed by Sabine, agreed to support the establishment of a network of magnetic observatories across the empire. Soon after, an observatory was built in Toronto, the ancestor of the present structure near Hart House on the university campus. These observatories were administered by the Royal Society and directly supervised by Sabine. The original personnel were also appointed by him and the first head of the Toronto Observatory was therefore a British Army officer, Captain J.H. Lefroy. In 1843-44 Lefroy travelled to Hudson Bay and the Mackenzie River valley to observe the earth's magnetic field in its northern latitudes. This enthusiasm for making magnetic observations linked with Gauss and Sabine has been termed the "magnetic fever" or the "magnetic crusade" by scientific historians (Cawood, 1979). Although it had become unfashionable by the second half of the century, it provided many precedents for subsequent global scientific endeavours.

But geomagnetism was not the only branch of geophysics interested in global observations. The emerging science of meteorology was predicated on the synoptic approach, or the idea that a series of identical observations taken at regular intervals in space and time were essential

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to the understanding of weather patterns. An international conference was held in Brussels in 1853 to organize the coordination of meteorological observations at sea. And national organizations took shape to initiate large-scale and continuing weather studies. In 1855 the British Board of Trade established a Meteorological Department, initially supervised by the Royal Society, which numbered among its responsibilities the observation and recording of compass variations, aurorae and falling stars (Sutton, 1961:77). In other countries meteorology usually came under the aegis of a national scientific society, as in Germany, or the army, as in the United States. The Canadian Government established the Meteorology Branch of the Department of Marine and Fisheries in 1871 (Thomas, 1971:7).

Considering the early and active participation of Germany and Great Britain in studies of terrestrial magnetism, it is surprising that the first proponent of a coordinated international study of the geophysics of the polar regions was not a citizen of one of these countries but an Austrian named Carl Weyprecht. But taking into account the vicissitudes of European politics and the chauvinism of British and German scientists, a man like Weyprecht was probably ideal for initiating a project requiring international cooperation. Weyprecht was a lieutenant in the Austro-Hungarian navy. In 1875 he returned from an expedition to Franz Josef Land in the Barents Sea with the conviction that coordinated scientific investigation in the Arctic would be much more productive than solely geographic exploration. Weyprecht first presented his views at a meeting of the Academy of Sciences in Vienna early in 1875 and elaborated them at a meeting of the Association of German Naturalists and Physicists later that year (Heathcote and Armitage, 1959:6). He was delayed in bringing his ideas before an international forum by the conflict between Russia and Turkey, until 1879 when he addressed the International Meteorological Conference in Rome. Weyprecht's proposal that a network of research stations be established in the Arctic to simultaneously record meteorological and geomagnetic phenomena was endorsed by the congress which decided "that these observations will be of the highest importance in developing meteorology and in extending our knowledge of terrestial magnetism" (Greely, 1895:204). Along more practical lines it took measures to arrange another conference specifically devoted to Weyprecht's proposal.

The First International Polar Conference was held in Hamburg in October 1879, followed by a second in Berne in 1880 and a third in St. Petersburg the year after that. These conferences established the program of observations that each research station would follow. It was decided that every station would make observations relating to meteorology (temperature, barometric pressure, humidity, wind, clouds, precipitation); terrestrial magnetism (declination, inclination, intensity); the borealis and astronomy (Heathcote and Armitage, 1959:9). From the available accounts of the IPY expedition, it seems clear that the camps tended to be laid out after a preconceived standard plan. It was usual for an expedition to build a rectangular residence which in some cases had a mast with an anemometer and wind-direction vane linked to allow observations to be taken from within. A short distance away would be a small one-room cabin constructed with either copper nails or wooden pegs and containing instruments for magnetic observations. A louvred shed (called a Stevenson Screen) would be built for the meteorological instruments: wet and dry bulb thermometer, maximum-minimum thermometer, hair hygrometer, barometer and rain gauge. The schedule of International Polar Year established at the St. Petersburg Conference demanded that each station take hourly observations of these instruments during a ten-hour period every day from 1 September 1882 to 31 August 1883. It also prescribed that on the first and fifteenth day of each month a special timetable be followed: readings to be taken every fifteen minutes over a 24-hour period, and during one hour two readings to be taken every 120 seconds. This was called a term day or Gottingen Civil Day and the procedure had been devised by Carl Gauss. On these days all observations were to be noted according to Gottingen mean time. These were to be obligatory observations; in addition most stations carried out voluntary programs: observing earth and water temperatures and monitoring other astronomical, meteorological and magnetic phenomena.

By the second conference in 1880 there were only six countries actually committed to establishing arctic or Antarctic research stations: Austria-Hungary, Norway, Sweden, Denmark, Russia, and the United States. France and Holland participated in the conference but remained uncommitted. The two most experienced countries from the point of view of geomagnetic studies — Germany and Great Britain — were conspicuously absent from the planning sessions prior to International Polar Year. France and The Netherlands committed themselves at the St. Petersburg conference and by the end of 1882 the German government appointed a German Polar Year Committee to coordinate that country's efforts. Finland also decided to participate. Britain left things very late: it was only in April 1882 that the government agreed to sponsor an expedition, the actual organization to be undertaken by the Royal Society and personnel to be supplied by the army. This was to be partly Canada's effort, for also in April an order-in-council was passed in support of the expedition which was to establish a station on Canadian territory (Canada, Auditor General, 1884:365).

By April 1882, then, less than five months before the commencement of International Polar Year, 11 countries had committed themselves to establishing 12 stations. Norway, Sweden and Finland each planned to establish one station in their arctic territory. Russia planned two along its coast and Holland planned to establish a station on the Siberian coast. The United States was to send an expedition to Point Barrow, Alaska and another to Lady

Franklin Bay on Ellesmere Island. Britain arranged to establish its station at a Hudson's Bay Company post on Great Slave Lake. Denmark was to establish a station at Godthaab, Greenland, and Austria-Hungary would put one on Jan Mayen Island northeast of Iceland. Germany planned an arctic research station on Baffin Island with auxiliary work to be carried out in Labrador, and an Antarctic station on the island of South Georgia situated about 55° South latitude. France planned an expedition to Tierra del Fuego on about the same latitude as South Georgia. As well as these expeditions, 34 permanent observatories including ones at Peking, Shanghai, Rio de Janeiro and Bombay, undertook to follow the schedule of observations established for International Polar Year (Greely, 1895:204). Among these was the Toronto Observatory which also collaborated with the British expedition (Directory of the Magnetic Observatory, 1883:181). With the exception of the Dutch venture, whose ship became stuck in the ice of the Kara Sea, all of the expeditions established stations and successfully completed the IPY. Besides bringing back quantities of valuable scientific data, these expeditions proved, with one awful exception, that man could function in an arctic climate.

The three stations established in Canada's north were an important part of the IPY programme and, as they provided valuable information on the Canadian Arctic, are significant to the northern history of this country as well. To date, however, these stations have not received much attention. The best known of these, largely because of its tragic end, was the American expedition to Lady Franklin Bay, Ellesmere Island, which was led by Lieutenant Adolphus Greely. It also comprised the largest party (24 men) and had the most ambitious project of all the IPY expeditions. Its plan was to spend two years on what is even today a very isolated spot of the world. Only six men survived the third unplanned season.

The Lady Franklin Bay Expedition

It is obvious from the history and scope of the American project that it was intended to accomplish more than the compilation of data for International Polar Year. It was linked to an earlier unrealized project of a Captain Howgate of the U.S. Army to establish a colony there in the 1870s. Lady Franklin Bay had been charted by a Royal Navy ship of the Nares expedition which had wintered there in 1875-76, but for a short time the Americans came to consider this their territory. These designs were not official but a result of pressure from strong lobbyists, of whom Howgate was one. According to Greely, "failing in his direct plan for a polar colony, Captain Howgate succeeded in having Lady Franklin Bay designated as the point in the Archipelago of North America which was to be occupied by the United States Signal Service as a polar station" (Greely, 1886:22). Congress approved this proposal in 1880 and an expedition would have been launched that year but for bureaucratic wrangling between the armed services. Instead, that year a small party was sent to carry out biological studies in western Greenland. The following year Congress approved the establishment of arctic research stations at Point Barrow and Lady Franklin Bay to be under the jurisdiction of the Army Signal Corps. The immediate purpose of these stations was to conduct observations for International Polar Year but it was hoped that they would continue as permanent observatories (Greely, 1886:xi). The American expeditions were the most ambitious of the IPY exercises in that they were planned to last two years. Both parties planned on carrying out extensive geographical studies besides the regular IPY program. It is probable that they were interested in exploring as far north as they could, possibly to the Pole, and discovering new land for the United States. The leader of the Point Barrow expedition implied in a report that one of his objectives was also to determine the possible existence of an ice-free polar sea, a chimera from the ancient myth of the Northwest Passage (Rae, 1884:677).

The Lady Franklin Bay expedition left St. John's in July 1881 in the Newfoundland steamer the *Proteus*. Its party consisted of Greely, a first lieutenant in the fifth cavalry, two second lieutenants named Kislingbury and Lockwood, and 18 enlisted men. Two of these men, sergeants Israel and Rice, were civilians who had signed up especially for the expedition. Israel, a graduate of the University of Ann Arbor, was an astronomer; and Rice, a Washington lawyer, assumed the role of photographer (Greely, 1886:39). Two regular army sergeants were experienced meteorological observers. En route to northwestern Ellesmere Island the *Proteus* stopped at Godthaab, Greenland where the expedition was joined by Dr. Pavy, a physician who had been studying the botany of that region for the United States, and two Inuit hunters named Jens and Christiansen. In August the party landed at the mouth of Lady Franklin Bay and began construction of a camp which Greely named Fort Conger, after a senator who had supported the idea of an arctic station.

The site was chosen because Greely wanted to be able to compare his data with some of the observations made by the captain of HMCS *Discovery* which had wintered here six years before. There was also supposed to be an available seam of coal nearby. Upon disembarking the party commenced building a main house which measured 60 x 70 feet and had double-thick lumber walls (Fig. 1). This was divided into three rooms: a smaller one for the officers, an entrance *cum* galley in the centre and a large living area combined with sleeping quarters for the men. A magnetic observatory was built about 183 m northeast of the main building. This structure measured approximately 8 x 14 feet and was put together with wooden pegs instead of nails. Its roof was covered with earth and in the winter was insulated with snow and ice. It was a most uncomfortable place to be, especially on term days when an observer was there around the clock, so in the second year a small fireplace was added (Greely, 1886:39). Inside the observa-

FIG. 1. Main building, Fort Conger. From Adolphus W. Greely, *Report on the Proceedings of the United States Expedition to Lady Franklin Bay, Grinnell Land*, Vol. 1 (Washington: Government Printing Office, 1888), front.

tory was a tripod supporting a magnetometer. The thermometers, some of which had been made especially for the station, were housed in a louvred shed about 40 yards northeast of the main building. Inside, the instruments were attached to a revolving sheet iron drum which was further enclosed in a louvred shelter of galvanized iron. At Fort Conger the party spent two productive years. Today not much remains of the fort, the buildings having been looted for their valuable material. Only the brick base of the transit is immediately evident.

At the beginning of International Polar Year the expedition began its program of observations. Sergeant Israel made the magnetic observations and Sergeant Jewell was responsible for the meteorology although on the difficult term days there was more general participation. In addition to the standard polar year observations the Americans noted the high and low tides and recorded the water temperature at specific intervals. Although maintaining this research station was Greely's principal concern, he was also very keen to explore the northern limits of the globe. He led an expedition in the spring of 1882 to the interior of Ellesmere and he sent Lieutenant Lockwood and Sergeant Brainard on a journey to the northern coast of Greenland (Cape Bryant). Although they were unable because of unfavourable ice conditions to continue north over the frozen ocean, they still managed to set a record for going further north than any previous expedition. The following year Lockwood spent two months exploring the interior of Ellesmere Island.

Fort Conger was to have been resupplied in 1882 and the men relieved in 1883, but in both years ships were unable to reach that far north. By August of 1883, having received no word for two years, Greely decided to move his party to the southern part of the island where they had a better chance of encountering a ship. Until this time the United States government had been somewhat remiss in reacting to the fate of Greely and his men. A supply depot which was to have been established by a U.S. Navy ship near where Greely was headed had been only partly filled. By October the expedition was settled at Cape Sabine, near where Captain M'Clure and his men had wintered after traversing the Northwest Passage. A crude shelter was built of stone and canvas and a boat used for a roof. This they called Camp Clay (Fig. 2), and here they prepared to make their last stand knowing that without relief and with limited game most would not survive until the spring. In January the men began to die one by one from starvation. One man was shot for theft and probably cannibalism.

FIG. 2. Remains of Greely's Camp Clay, Pim Island (Photo: P. Schledermann).

Sergeant Rice perished in an heroic attempt to reach a supply cache. One of the Inuit hunters drowned while hunting from his kayak, taking with him the last rifle. Finally, toward the end of June the rescue ships arrived. Only seven men were left alive and one of these died soon after being carried on the ship. Greely and the scientific records surived. The fate of the Lady Franklin Bay expedition led the United States to postpone work in this part of the Arctic until Peary came here in 1909 and virtually negated the Point Barrow expedition leader's claim that "the work of exploration in the Arctic can be carried on at any season of the year" without undue hardship (Ray, 1885).

The Cumberland Sound Expedition

By comparison with the Lady Franklin Bay expedition, the German project to send two parties to northern Canada was carried out with great efficiency and little hardship. Although large, it was focused on carrying out the program for International Polar Year and had only peripheral interest in exploration. The principal German station at 66°N latitude was considerably to the south of the American camp, at 81°N, and operated for only one season. There were actually two German expeditions to Canada which, although independent of one another, were designed to provide complementary data. The main party under the direction of Dr. W. Giese arrived by ship at Clearwater Fiord on Baffin Island's Cumberland Sound in August 1882, and departed with all of its men the following year. Meanwhile supplementary observations were carried out at six Moravian missions in Labrador under the direction of Dr. K.P. Koch (Heathcote and Armitage, 1959:53). Koch compiled auroral observations from Nain simultaneously with those from Cumberland Sound. Giese's team also conducted some geographical exploration in May 1883.

There is an illustration of the Cumberland Sound station (Fig. 3) which shows the buildings of the camp. The main building in the centre contained living quarters, work space and kitchen. The mast on the right side supported a weather vane and anemometer which were connected to a self-

FIG. 3. General view of the German International Polar Year station at Cumberland Sound, Baffin Island. From *Annals of the International Geophysical Year*, Vol. 1.

recording apparatus within. The barometers were also located in this building. The building to the right was probably for differential magnetic observations, and just to its left is the transit instrument supported on a stone and concrete foundation. This base also served the altazimuth. Immediately to the left of the main building was a shed for the meteorological thermometers, and the large building to the left of that was the building for absolute magnetic observations. Today, not much remains of this camp except for a couple of concrete pillars and the base for the transit (information supplied by Dr. E.F. Roots, Science Advisor to the Department of the Environment, March 1981).

When the schooner *Germania* arrived at Cumberland Sound in August 1883 to remove the scientific party, she was prevented by ice from reaching the station and instead anchored at a nearby Scottish whaling station near present-day Pangnirtung. She carried as a passenger a young scientist named Franz Boas who had intended to use the German station the following year as a base for a planned geographical study of the area. Boas set out from the ship accompanied by Inuit guides to try to reach the German expedition and arrange for its evacuation to the whaling station (Boas, 1964:v). Having accomplished this he decided to stay at the whaling station, and Boas's stay is an interesting footnote to the German expedition because his work proved to be the beginning of a long and important career in ethnology. His year at Cumberland Sound culminated in *The Central Eskimo*, one of the first scientific monographs on the Inuit. Boas soon after moved to the United States where he became a pioneer in North American anthropology. Although Boas would have probably become a noted anthropologist regardless, his first work on Cumberland Sound was a direct result of the German IPY station there.

The Fort Rae Expedition

The British expedition to Fort Rae on Great Slave Lake (sometimes called the British-Canadian expedition, although there were no Canadians on the team) was, by comparison with the American and German projects, a fairly modest effort. As noted above, it was not until the beginning of 1882 that the governments of Britain and Canada agreed to subsidize the expedition which was then organized by the Royal Society of London. In the tradition of British magnetic surveys established by Sabine, the commander of the expedition, Henry P. Dawson, was an officer in the Royal Artillery. The three soldiers who accompanied him were likewise artillerymen. Dawson had little time to collect his equipment and organize his journey and he had to rely on gifts for both instruments and transportation. Consequently, some of his equipment was unsuitable and the journey to Fort Rae was long and arduous. Fort Rae was chosen ostensibly because of its proximity to the North Magnetic Pole, but it is reasonable to assume that as a Hudson's Bay Company post the site was convenient for an expedition travelling tourist class. Dawson and his men left Liverpool on the 11th of May and did not reach their destination until August, stopping off along the way to pay a brief visit to the Toronto Observatory. They spent nearly two months travelling the Carlton Trail and eight days crossing Great Slave Lake. On this last leg their boat swamped and most of their gear was soaked. Once at their destination, a small point of land on the north arm of the lake, the party had to work quickly to set up their instruments in time for the commencement of the Polar Year at the beginning of September (Dawson, 1886:ix).

The expedition was fortunate to have the hospitality of the little Hudson's Bay Company post, for the four soldiers not only were novices in arctic living but had their hands full making the required observations. Since readings often were made around the clock there was usually only one observer at any one time to take both meteorological and magnetic readings. The party was also lucky in being able to make use of a partly-finished cabin which was easily converted into an observatory. Any iron used in its construction was removed and replaced with copper. Inside, instruments were mounted on wooden pillars. A second magnetic observatory was completed by the middle of October and shutters built in the roof allowed the transit to be used for astronomical readings (Dawson, 1886). The meteorological instruments were located nearby. During the winter a fence was erected around the compound to keep out the wolves. The following September the team began their arduous but uneventful trek back to England where the data were analyzed by staff of the Kew Observatory and the British Meteorological Office.

Except for the ill-fated Lady Franklin Bay expedition, all of the IPY teams were on their way home by September 1883. In 1884 a final conference was held to collect the data and co-ordinate its publication. Each expedition published a quarto-sized account of its activities during IPY. The few volumes that I have seen consist largely of tables although the account of the station at Point Barrow includes an ethnological account of the Inuit of that vicinity, and the account written by Greely describes the geography of Ellesmere Island. It would be almost impossible to measure the application that the scientific data have had since their publication. They undoubtedly increased scientists' knowledge of the earth's magnetic field and weather systems in the polar regions. Astronomical figures have been used by that branch of science (geodesy) concerned with computing mathematically the properties of the globe. Perhaps the clearest contribution of IPY, however, was information on the nature of the northern lights, which was derived from simultaneous observations being made from strategically-placed observatories. Seventy-five years later scientists involved with the International Geophysical Year noted this contribution of the First International Polar Year:

> Observations made by the various expeditions appeared to support the view that the intensity of the auroral phenomena does not increase indefinitely with the latitude, but reaches a maximum represented by a belt extending from Cape Barrow in Alaska by way of Great Bear Lake, across Hudson's Bay (on the sixtieth parallel) and thence through Nain in Labrador and Cape Farewell, between Iceland and the Faroes, past the North Cape, skirting Novaya Zemlya and Cape Chelyuski and along the coast of Siberia (Heathcote and Armitage, 1959:54).

The two southern stations operated by France and Germany were ideally situated to record the effects of the eruption of the volcano on Krakatoa in 1883.

But one of the most significant contributions of the First International Polar Year was the proof it provided that international scientific ventures were possible on a large scale. In this vein probably its most significant legacy was the Second International Polar Year, held in 1932-33 and inspired by the 50th anniversary of the first. By this time many technological inventions had greatly expanded the scope of geophysical research. Weather balloons made it possible to observe weather in the earth's upper atmosphere, and telegraph and radio allowed for instantaneous communications. In this second attempt Canadian scientiss were able to play a significant role. The Canadian Meteorological Service established arctic stations at Chesterfield Inlet and Coppermine in the Northwest Territories and at Cape Hopes Advance on Ungava Bay in Québec (Canada, Public Archives). A permanent observatory was also built at Meanook, 150 km north of Edmonton. A British expedition established a station at Rae, 26 km from the former one at old Fort Rae. The old station was reoccupied as a magnetic observatory so that the data could be compared with those obtained 50 years before, and the two posts were linked by telephone (Stagg, 1934:21). After the departure of the British expedition in 1933 the Canadian Corps of Signals established a permanent station there. Since the war, however, a major weather station and observatory have been established at Yellowknife and the Rae establishment no longer functions. Old Fort Rae was abandoned as a fur trade post in the 1920s.

The First International Polar Year was the progenitor of the International Union of Geodesy and Geophysics (IUGG) which was founded in 1919. It is a member of the International Council of Scientific Unions (ICSU) which has had strong participation from Canadian scientists and which at present has a Canadian president. IUGG has always had a sense of belonging to IPY: the Second International Polar Year marked its 50th anniversary and the date of International Geophysical Year, also sponsored by IUGG, coincided with its 75th anniversary.

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