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BETWEEN TWO EMPIRES:

THE TORONTO MAGNETIC OBSERVATORY

AND AMERICAN SCIENCE BEFORE CONFEDERATION*

Gregory Good**

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PERSPECTIVES ON THE TORONTO MAGNETIC OBSERVATORY

The Magnetic Observatory was founded at Toronto in 1839 as part of the worldwide magnetic crusade of the British Association for the Advancement of Science and the Royal Society of London.[1] Although it was a focus of scientific research and of institutional development in Canada for decades, little attention has been given to it. One reason for the neglect of the history of the Magnetic Observatory in the pre-Confederation period is the view that science developed later in Canada than it did in the United States or Britain.[2] Scholarly attention hence has focused on post-Confederation, as in the work of DeVecchi on the institutional development of Canadian science in the 1880s and 1890s.[3]

There are, however, some exceptions to this assumption: and some examinations of pre-Confederation science do exist. Several scientific societies have published commemorative volumes of their early years.[4] Bowler has explored the roles of nationalism and professionalism in these pre-Confederation societies,[5] while Zaslow has examined the history of governmental institutionalization of science.[6] Lastly, a few articles have been published on the Toronto Magnetic Observatory, laying out its chronology, or averting to its place in the colonial system of magnetic observatories.[7] A.D. Thiessen has provided a detailed chronology of the Toronto Magnetic Observatory from its founding to 1850, told largely through extensive quotation of the primary sources.[8] But little has been done to place its evolution in the context of the development of scientific institutions in Canada. Likewise, there is little analysis of its relation to kindred institutions in the United States. Nor has anyone yet studied the activities of the Observatory staff in the context of professionalization or nationalism. These are

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regrettable gaps, especially since the period of the interaction of the people in these institutions was such a critical early stage in the development of scientific institutions generally, in both countries.

This article examines the interactions of scientists at the Observatory with their American counterparts. My purpose is to suggest how the attitudes of these people toward nationality and the requirements of their peculiar science shaped the institutional development of the Observatory. This story is of particular interest because the Observatory began as an Imperial institution, and its managers were forced from 1853 on to redefine its role as a Provincial one. Moreover, because its duties were oriented to pure science as opposed to practical science while the Observatory was Imperial, the transition to Provincial control posed a dilemma. The nascent Provincial government was confronted with funding an esoteric research project, and the Observatory managers had to consider the utility of appearing to be useful.

It is the contention of this article that attitudes of the scientists at the Magnetic Observatory toward America, England, Canada and the scientists of those places directly affected the Observatory's institutional shape. There are three perspectives in which Toronto of the 1840s and 50s can be viewed that reflect different sides of these relationships. First, Toronto was a small town on the edge of the wilderness, with access to a vast territory, but it was a barely civilized place. From this perspective the English scientists stationed there saw America as an attractive place for scientific fellowship. For the Toronto scientists, the American Association for the Advancement of Science was a potent symbol of a more advanced American culture. Americans, on the other hand, saw the Toronto Observatory as providing access to an important area for field research in terrestrial physics.

Second, Toronto was a colonial outpost of England, with links back across the ocean stronger in some ways than those possessed by Americans.[9] This meant that American scientists dealt with those in Toronto differently than they did with each other. Moreover, the Observatory staff thought of themselves as representatives of the interests of both England and English science, especially before 1853.

Lastly, although small and colonial, Toronto was growing quickly and was seen also as a North American city, with many of the same potentials and aspirations as, say, Cincinnati or Albany. Citizens of Toronto sensitive to its relative cultural development saw the Magnetic Observatory as evidence of their city's status. The withdrawal of Imperial backing of the Observatory after 1853 also forced the directors of the Magnetic Observatory henceforth to look to local bodies for the Observatory's support. Each of these perspectives affected relations between the Observatory and its American counterparts, as well as the character of the institution.

AN INHOSPITABLE PLACE FOR SCIENCE

The first directors of the Toronto Observatory were all members of the Royal Artillery, sent to Canada to staff a colonial outpost. When Lt C.B. Riddell arrived in 1839, the population of the town was less than 14,000.[10] The isolation of the Observatory struck Riddell forcibly the first winter, when he received no news from England for more than sixty days. He tried to find scientific colleagues among the faculty at King's College, but with no success.[11] As he then saw it, his only hope for scientific collegiality would be a second scientific officer assigned to the observatory. He found that colleague in Lt C.W. Younghusband, but he too called Toronto 'wilderness' and admired the better transportation available between American cities.[12]

Given Toronto's original lack of scientists, Riddell's and Younghusband's best chance for community with other scientists lay south of the border. Personal contacts were established early in the assignments of each of the officers and first impressions made. These personal evaluations later were important counter-balances to more generalized nationalistic judgments. Both Riddell and his replacement, Lt J.H. Lefroy, toured among American magnetic investigators on their way from England to Canada, establishing links of lasting importance.[13]

Indeed, the extent of travel of magnetic scientists between Toronto and America in the early years of the Observatory is surprising. It was Riddell who explained the British colonial system of magnetic observations to A.D. Bache who was to be American's most important geomagneticist. On Lefroy's inaugural journey he demonstrated new magnetic instruments and made magnetic measurements with James Renwick in New York, William Bartlett at West Point, Bache in Philadelphia, Joseph Henry at Princeton and William Cranch Bond at Cambridge, Massachusetts.[14] The purpose of the tour was to obtain cooperation for projects seen by Captain Edward Sabine, in Woolwich, as essential to the goals of the colonial observatories, but it also introduced Lefroy to people soon to become important as organizers of American science. Other trips soon followed. Younghusband travelled to Detroit and Chicago on another magnetic survey.[15] He was also to meet with Elias Loomis, a prominent American astronomer and proponent of magnetic mapping. Lefroy made another trip to Boston in 1843, mainly to transport instruments from dockside to Toronto, but also to meet again with Bond.[16] When in transit from Toronto to London via American ports, he always detoured to visit American magneticists.[17]

The reactions of the Toronto staff to the Americans ranged from respect and expectation to bemusement. Riddell was impressed by Bache in particular and anticipated correctly that he would prove to be a valuable colleague.[18] Lefroy, three years later, judged the American magneticists generally to be gentlemen: earnest, kind and hospitable. He was especially impressed by Joseph Henry who united

simplicity, *bonhomie* and high talents with a clear head and enthusiasm for his subject.[19] On the other hand, when a representative of the Harvard Observatory visited Toronto in 1840, Younghusband judged him amusing, and Riddell called him a 'most thorough out and out Yankee.'[20]

Overall, first impressions were complimentary. They were also lasting impressions, as Lefroy recalled in the 1880s that Bache had a 'charm of manner . . . which won all who knew him.' However, Lefroy was not merely speaking kindly of a friend, as he also had this to say about Americans generally:

> ... there is a great charm in the frank simplicity of cultivated American society. It is less conventional than our own, conversation is more cultivated. Hospitality, if limited in form by their very different domestic arrangements, is more genial perhaps. I always got on extremely well with my American friends.[21]

'Cultivated' American society had welcomed the English soldier-scientist warmly, and Lefroy approved.

These favourable evaluations of the American scientists were reinforced by continuing dissatisfaction with the state of science in Toronto. From the foundation of the Observatory it had been intended that the university in Toronto would some day assume its management.[22] Throughout the 1840s Lefroy despaired of the ability of the Kings' College faculty to do this. As late as 1850 he lamented:

> As for the University I have no hope of its doing anything on an efficient scale without assistance, but it will no doubt be very happy to accept of as many instruments as the Government will bestow, and for form's sake undertake some kind of observation.[23]

Reform at the university in the early 1850s gave Lefroy hope on this score, as several new professors were hired.

The reformation of the Canadian Institute also seemed to point to brighter days for science in Toronto. But as Lefroy noted to his friend Bache, both the Institute and its *Journal* were experiments:

> ...their services to the cause of science are, I fear, to be limited to the humble office of paving the way for something of a higher order . . . .[24]

Lefroy, as Vice-President of the Institute, was one of the few research scientists among its organizers. Knowing that his days in Canada were limited, he did everything he could to build the institutional basis of support for science generally and for the Observatory in particular.

The Institute was potentially an effective way of mobilizing political opinion in favour of Provincial support of the Observatory, since as Bowler notes, the reorganization of the Institute in 1851 and 1852 was dominated largely by political individuals.[25] Yet Lefroy suffered no illusion about the level of scientific attainment of the reformed Institute:

> The state of physical science in this country is so low that it would be impossible to produce, or gain support for, any thing less popular and miscellaneous in its nature, at present.[26]

With the Canadian Institute such a provincial and amateur body, it is no surprise that Lefroy looked mainly to the Americans for professional identity.

Lefroy was the first director of the Toronto Observatory to join the American Association for the Advancement of Science at the Albany meeting in 1852. J.B. Cherriman and G.T. Kingston, the first two directors during Provincial control after 1853, also joined: Cherriman at Providence, Rhode Island, in 1855 and Kingston -- along with 132 other Canadians -- at Montreal in 1857. Lefroy began cooperating with the AAAS auroral studies and petitioned them for help in gaining continuance for the Toronto Observatory in 1850. Cherriman considered the AAAS an appropriate forum for a report on progress at the Observatory in 1856. With no comparable scientific society in Canada, the scientists at the Observatory reinforced their growing sense of professional status with membership and participation in the AAAS.[27]

It was noted by DeVecchi that in the last quarter of the 19th century Canadian scientists, at least at the highest levels, seemed to prefer close association with the British, rather than the American, Association for the Advancement of Science. He also argued that there was a degree of anti-American sentiment among these scientists at that period.[28] For the 1840s and 50s, however, the situation seems to have been otherwise. The AAAS and Lefroy in particular worked closely together. If any anti-American feeling extended to the American scientists and the AAAS, it remained well hidden. Indeed, scientists in Canada during the 1840s and 50s identified easily with the level of American society represented by the American geomagneticists.

Strong ties were built between Toronto Observatory and the American scientific community in the 1840s and 50s. America was relatively better developed, it had a genteel class and scientific activity was better organized and more extensive there than in Canada. For scientists such as Lefroy who had no special tie to the colony, it is not surprising that they sought professional ties in America.

TORONTO OBSERVATORY AS IMPERIAL REPRESENTATIVE

In 1851, Lefroy wrote a report for the Governor General of Canada, the Earl of Elgin, explaining to him the current and potential roles of the Toronto Observatory in Canadian life. In this report he stated that the

> Scientific men of the United States ... look upon [Toronto] as the Colonial Centre for enquiries into the peculiarities of American climatology--the laws of Storms, and other subjects long in contemplation...[29]

He could well have added that till then, he too had treated the Observatory as a 'Colonial Centre,' as an appendage of various Imperial plans, and that while he had friends with Americans, and while he had even joined an American professional organization, he remained an English soldier. He was, more importantly, the ambassador of English science in North America.

American science was inferior to English science in many ways in the mid-19th century. This was certainly true of geomagnetics, as is indicated by the dependence of American scientists on the Toronto staff for information on the newest instruments and techniques for magnetic measurement. During the period of Imperial control, many Americans made the trip north seeking out the representatives of English science. There was the 1840 visit of the Harvard representative. Also in 1840, Williams College professor Albert Hopkins made an unproductive journey to Montreal to look over the magnetometers.[30] Hopkins knew little of terrestrial magnetism and wanted to investigate the basic requirements of an observatory. In 1849, when the Smithsonian Institution was considering sponsorship of magnetic research, Joseph Henry visited Lefroy in Toronto 'principally to examine our Photographic apparatus...,' i.e. the self-registering magnetic instruments.[31] Arnold Guyot, also for Harvard Observatory, soon visited Lefroy for the same purpose and to confer on cooperative meteorological observations.[32] Lastly, and most importantly, Bache's US Coast Survey sent J.E. Hilgard in 1851 to train under Lefroy 'to obtain the instruction in regard to photographic processes & the instrument employed in registering the magnetic elements & meteorological changes....' Familiar with ocular observational systems, and one of America's most experienced geomagneticists, Hilgard went to learn the advanced techniques in which Lefroy excelled.[33] Hilgard entered a formal report later, but also transferred the mysteries of this new craft to the American domain by training other Coast Survey observers. Americans consistently looked to the Toronto scientists as their connection to the latest European developments in the technology of science.

The Imperial-Colonial context clearly affected the views of American science held by the Observatory scientists just as it affected Americans' views of Toronto. For example, Riddell and Lefroy both realized quickly that the

American geomagneticists were not well organized. They did not communicate or cooperate with each other effectively. In Riddell's efforts to organize a joint project in 1840, he was thwarted by this. Bache, Bond and Gilliss, of the Naval Depot of Charts and Instruments in Washington, communicated more fully with him than they did with each other.[34] Lefroy was surprised in 1846 to find that James Renwick and Charles Wilkes, whom he visted in New York City, knew less of Bache's progress than he and Sabine did.[35]

This small degree of cooperation was perhaps to be expected, as each of the American magnetic observers was dependent on local support, sometimes requiring appeals to the generosity of local gentlemen. Without a uniform national system of support, each observatory had different periods of feast and famine. This effectively kept them more separated from each other than they were from Toronto since the support of Toronto by the Home government, though several times in doubt, continued uninterrupted from 1839 to 1853. Hence, when any American observatory experienced a peak in support, it could count on observers in Toronto being active and ready to cooperate. It could not similarly count on the other American observatories.

If one may judge by the direction of correspondence, the American magneticists decidedly thought of the Toronto Observatory as a subordinate extension of English science. Especially in the early 1840s, most communication was directed to Humphry Lloyd in Ireland and Sabine in England; very little went directly to Toronto. In 1840, for example, Bache and Sabine exchanged at least seven letters, while only two letters are known to have passed between Bache and Riddell.[36] Bache also pleaded through Lloyd for the help of the Royal Society in winning the support of the American government for a string of observatories.[37]

It was not unusual that Americans thought of the Toronto Observatory as subordinate to English science, since they thought of their own science that way. During the 'Magnetic Crusade,' Edward Sabine was the very symbol of the centre of empire. Bache, in particular, looked to him as the origin and authority on magnetic questions. This was a persona carefully cultivated by Sabine. He granted simple favours such as free copies of his publications and invited various Americans to join in the system of 'fixed magnetic observatories.'[38] He even suggested to Bache that if he sent the Royal Society of London a report on work done at his observatory in Philadelphia, it would strengthen his chance to become a foreign member of the Society.[39] This paternalistic relationship was only strengthened by the failure of Bache to win the solid support of either the US or Pennsylvania governments. Sabine's attentions were, he said, 'necessary to cheer on even one of your "ardent magneticians" -- happy that the Great Man brings me in such close communion...'[40]

In the late 1840s, Lefroy began to treat the USA more and more as a market for new magnetic instruments and for

Sabine's schemes. Even on his first visit in 1842 he had tried to convince observers to purchase Fox's new dipping circle and a transportable magnetometer.[41] He played this role again with Brooke's self-recording instruments from 1846 and especially at times when the future of the Toronto Observatory was in doubt.[42] In this Lefroy was an agent of London policy.

But the United States was not a British colony and this was evident both in national jealousies and in genuine political difficulties. Much vaunted internationalism had its limitations, even in science. As early as 1839 it was evident that Bache had a nationalistic side when he critiziced J.W. Draper for his 'kink' of publishing his articles 'abroad.'[43] While he cooperated with Sabine, Bache was intent to get some credit for American science too. He encouraged Bond to help him analyze the date of a magnetic storm since

> ... in a national point of view it would be better that this should be done between us than to reserve it for deductions on the other side of the Atlantic.[44]

Likewise, his local pride was offended 'that Sir J. Herschel should not take the pains to learn by whom the co-operation here is effected.' It was as though, he said, someone gave King's College credit for something done by London's University College.[45]

This urge to lay claim for national accomplishment was not solely American. Lefroy watched ruefully as the Americans developed an extensive telegraphic network to which Toronto Observatory was not connected. American telegraph lines, stretching from Nova Scotia to the Gulf of Mexico, made possible the least expensive and fastest, precise method of determining longitude for secondary observation points. The system was quickly dubbed the 'American system.' Of equal pain to Lefroy, the telegraph allowed the passive study of induced line currents whether due to the atmosphere or the ground, and the fast communication needed for the study of aurorae and storms. Lefroy urged Sabine to obtain a special grant to connect the Toronto Observatory to a projected telegraph line, saying:

> I . . . should regret much to have to stand aside while the Americans were enjoying it. [i.e., their monopoly on using the telegraph for science.][46]

This national jealousy in science was of course based in strongly-rooted tensions between England and the United States. Just when the Webster-Ashburton Treaty of 1842 had eased the tensions between the United States and Canada remaining from the Rebellion of 1837, American expansionism entered a new phase: the war against Mexico, the annexation of Texas and California and the enunciation of the principle of Manifest Destiny.[47] In 1845 the

focus of conflict between America and Britain shifted to Oregon Territory but threatened to engulf Canada as well.

According to Careless, most Canadians expected English troops to defend them against the United States, as their own militia was inadequate. Orders came for strengthening the fortifications at Kingston and for the building of ships for possible conflict on the Great Lakes.[48] A measure of the perceived seriousness of this threat is Lefroy's reaction to it. Despite his American friendships and professional ties, Lefroy was also a British soldier and he would defend British land against American governmental aggression. Although in the past Lefroy had tried to maintain the independence of the artillerymen at the Observatory from provincial military command, this time he promised his cooperation:

> We are here in rather confident expectation of a War with the U. States.... I do not think it would be inconsistent with our duties here [at the Observatory], that we should be considered part of the Garrison of Toronto, exemption being granted from mere Parades.[49]

Hence, the colonial context of the Toronto Magnetic Observatory affected the mutual attitudes and interactions of its scientists and their American colleagues in several ways. It meant that Americans looked at the Observatory as subordinate to English scientific interests. Secondly, both the Americans and Lefroy were keenly aware that, beyond any question of the inter-nationalism of science, they were competing for the scientific honour of their respective nations. Lastly, while the Toronto scientists forged friendly and professional links with Americans, they continued to act as representatives of both British science and the British nation; some nationalistic principles superseded scientific fellowship.

TRANSFORMATION TO A LOCAL INSTITUTION

As Bowler points out, the first learned societies in Canada were 'local organizations' satisfying the demands of local intellectuals. We have come to expect this of scientific societies in this period, but we have not so fully admitted that this could be true of other forms of scientific institutions such as observatories. The Toronto Magnetic Observatory had its national and international supporters, certainly, but strong support also came from Toronto. It was, like the Insane Asylum or the Orphanage, a local institution, much like a public charity. And it was one in which Torontonians could feel a more unqualified pride. Toronto was at this time vying with Kingston, Montreal and Quebec City for cultural status, and for this the Observatory could have great social utility.

Until 1850 the interest or ability of locals to manage the Observatory was not a concern because Sabine was able

to secure funding from British sources. However, opposition to further funding of the Observatory was increasing at home. The Astronomer Royal, G.B. Airy, thought the time had come to stop gathering data and to begin its analysis. In fact, he wanted to 'wind up his own magnetical labours...' and he did not feel he could do so while the Toronto Observatory still enjoyed British financial aid.[50] Airy's opposition, combined with the Imperial government's stringent fiscal policies, put the pressure on the Canadians to assume responsibility.

Because Canada was emerging slowly from the economic depression of the late 1840s, the Provincial Government was in embarassed circumstances. Some politicians were calling for fiscal restraint and the leadership, though sympathetic to the plight of the Observatory, could not accept the expense.[51] The outcome was that the British government agreed to maintain the Observatory only until 1853 when the Province would have no choice but to take over. Lefroy used these last three years to convince the local people and the Provincial government that the Observatory was indeed in their interest. As he said in 1850, the Observatory needed to be 'nursed' into a permanent condition, or 'fall to the ground.'[52]

Lefroy was aware that to win this support he needed to cultivate the ground in which the Observatory would grow. He began a preemptive campaign to demonstrate to the Provincial officials that the Observatory's research was considered valuable by American scientists. He obtained resolutions from the American Academy of Arts and Sciences, the Smithsonian Institution and the AAAS.[53] He also became actively involved in the reorganization of the Canadian Institute in 1851. It is certainly no accident that the new Institute broadened beyond being an engineers' and surveyors' organization and included the physical sciences in its compass.[54] Lefroy was also in contact with the new professors at the renovated University College, formerly Kings' College, one of whom was J.B. Cherriman, who became director of the Observatory in 1853. The Institute was not much, he said, but perhaps it would 'rub up' these new scientists.[55]

But Lefroy's most important efforts were in direct lobbying of the Canadian government. He began this campaign in 1851 with a detailed appeal to the Governor General, Lord Elgin.[56] Lefroy intended to convince Elgin to ask the Imperial authorities to maintain the Observatory until the Province could take the responsibility. However, Lefroy also was preparing him to make the case to the Canadian officials for that transfer.

Lefroy argued that while public opinion in Canada was hardly capable of appreciating the importance of science, this was an understandable and temporary situation. It arose in the necessary preoccupation of Canadians with commerce and material life. This was, he said, an unavoidable stage in social development. Hence, the universities had not sufficient resources to support

research in physical science, and other than the Geological Survey, the Observatory was 'the only public Establishment in British America devoted to any branch of physical research....'

Because the current stage of Canadian society could not support 'higher intellectual pursuits,' Lefroy continued, it was necessary for the government to intervene. The intellect generally, he said, could be encouraged by 'cultivation of the higher branches of Science....' While support of a magnetic observatory would lead toward this general goal, the establishment of a broadly conceived astronomical and physical observatory would be even more effective:

> Nothing less than this, I conceive, will satisfy what science may reasonably claim from a Country of the growing wealth and importance of Canada, nothing less will please the native Canadians seeking education at the Colonial universities, upon a footing of equal advantage with the Youth of the Neighboring States.

Lefroy later suggested, in a more detailed plan, that the new facility be termed either the Colonial Physical Observatory or the Physical Observatory of Toronto.[57]

As he had suggested before, there were local advantages to maintenance of this facility. It could train surveyors and engineers in the use of instruments, support local and Provincial surveys by standardization of instruments, provide practical experience in science for students at the university, continue its internationally-acknolwedged physical research and extend the function of the Observatory to include astronomy. Lefroy suggested that in supporting such a plan, Canada would obtain a facility nearly comparable to those in Cincinnati and Washington, DC, which were among the best in the world. He was especially sensitive to the need to build local and national support for this project and he suggested the establishment of a Board of Visitors with representatives from many constituencies. This Board was to include the President of the University, the Commissioner of Public Works, the Commissioner of Crown Lands, a Judge, the Province's Chief Engineer, a professor from each college, the President of the Canadian Institute, an alumnus of the University and 'one or more ... gentlemen of known scientific attainments, to be appointed annually by his Excellency.' Lefroy did his best to build political bridges and appeal to local feeling.

An assessment of the changing attitudes of Canadians and Torontonians towards the Observatory is provided by reactions to Lefroy's suggestions. The winter of 1852-53 was a crisis period for the Observatory. British aid was certain to be cut off by 1 April 1853, and the Canadian authorities had done nothing to fill the void. Action was required immediately, and Lefroy readily mobilized

for it. Letters and memorials soon reached the Provincial government from the university and from three learned societies in the Province: the Natural History Society of Montreal, the Literary and Historical Society of Quebec and the Canadian Institute at Toronto. The university was appalled at the possible 'removal of the Royal Magnetical Observatory from this city' and pledged to cooperate with the government within the limits of its funds.[58] The Montreal society, having learned that the Canadian Institute was to memorialize the Government, implored the Governor General to forestall the discontinuance. Perhaps the Provincial Legislature would, in its liberality, allow a small annual grant for its maintenance, since the Observatory was 'highly creditable to this country, whether regarded in a Provincial or National point of view.'[59] The memorial from the Canadian Institute included the signatures of sixty-one local business people, politicians and professors.[60] Moreover, as it was Thomas Ridout who brought the memorial forward in the Legislative Assembly, it appears that the 'High Tory' element, so important in the reorganization of the Canadian Institute, had adopted the Observatory as a special cause.[61]

It may have been Ridout's purpose to embarass the government into action, but the Provincial Secretary, A.N. Morin, was already acting. As a scholar, Morin appreciated the potential importance of science; as a politician, he occasionally worked effectively with the Upper Canadian moderate Tories.[62] Before formally bringing the matter of the Observatory before his colleagues, he corresponded unofficially with Lefroy. Morin admitted his own partiality toward the Observatory and asked Lefroy his advice on how best to secure the goal of continuance. To move further he also needed a series of technical questions answered:

> I have no one else to whom I could refer for such information and I know your zeal in the cause of science is such that you would cheerfully do anything in your power that might lead to the continuation of the valuable series of observations which have been made....[63]

The Observatory, thus, had support at the highest level of the Canadian government. Morin was strongly inclined to continue the Observatory as a Provincial establishment. When he brought this issue before the Executive Council, he discussed its decision in stark terms: if action were not taken quickly, it would be equivalent to having decided to 'abandon the idea of having an observatory at Toronto....'[64] He did not, however, endorse Lefroy's idea of extending the scope of the Observatory to include astronomy and physics generally. The Provincial Observatory, as he saw it, would be more modest. Lefroy's grand scheme was not required to meet the local need.

The importance of Lefroy in stimulating Canadian interest in the Observatory cannot be over-estimated. Sabine had

been concerned with the Observatory only as it fit his plans for the study of geomagnetism. His orders to Lefroy regarding the discontinuance were totally insensitive to possible local aspirations. Discontinuance at first meant to him only that the Royal Artillery officers and the instruments would be sent home.[65] Later, when he agreed to leave some instruments, he suggested that others could be purchased 'at Toronto or elsewhere in North America... should it appear to you... that they would be likely to render useful service to magnetical science in America....'[66] It did not matter to him if they stayed in Canada or not. His attitude seems to have been encouraged by the failure of the Province to respond earlier than it had.[67] But as Morin wrote to Lefroy on the eve of his departure from Canada, he and Lord Elgin sincerely regretted that the Province was to lose an individual of his 'high scientific attainments and of the zeal and energy which you have [exerted] in furthering anything (*sic*) local effort [and] the interest of Science in the Colony.'[68]

The process of transference of the Observatory to Provincial administration offers a fine example of an institution which, having -- temporarily -- lost its relevance to science, took on a local social utility previously absent. Once the building and instruments were saved and the arrangements made to keep on some of the observers, the sense of urgency was gone. The Provincial government casually deferred consideration of the details of how the Observatory would now be managed.[69] Indeed, this issue was not completely settled until 1855 when University College achieved a long-term solution by which the Professor of Meteorology became Director of the Observatory.

Immediately, once the transfer was effected, the Observatory ceased to be a government concern and became a matter for local Toronto authorities to resolve. Presidents of the Canadian Institute referred to the scientific accomplishments of the Observatory repeatedly and talked of 'pardonable pride' that it was the only one of the colonial observatories still in operation. In 1858, President (and Chief Justice) Draper stated:

> ...it is not too much to say that the name of a Canadian city, which will be sought for in vain on maps twenty years old, had now become, by means of its Observatory, familiar in the mouths of European savans as a "household word".[70]

Draper's bravado was tempered by the lingering image of a backwoods community and he explained that the fast-growing Toronto of 1858 was past mere material advancement. The sciences, the arts and philosophy were all gaining more attention and the Observatory proved this.[71] As if to embody this union of science with the other elements of intellectual culture, another president, Daniel Wilson of University College, enthused:

> There is something grand and ennobling in reflecting on the patient labors of the Magnetic, as of the Astronomical observer.... those little-heeded labors of our magnetic observers unite us as fellow-workers with the noble phalanx of intellectual toilers, whose far-reaching thoughts and speculation wander through unilluminated vistas of the coming centuries, and search for revelations of truths which the angels desire to look into....[72]

In the minds of these prominent Toronto figures, the Observatory was a potent illustration of cultural maturity. It is not surprising that the Director no longer applied to Britons or Americans for help. He no longer needed it. Toronto was a city with aspirations and accomplishments of its own. The Observatory symbolized this.

ACKNOWLEDGEMENTS

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NOTES

1. On the 'Magnetic Crusade,' see John Cawood, 'The Magnetic Crusade: Science and Politics in Early Victorian England,' *Isis*, 70 (1979), 493-518.

2. Peter Bowler, 'The Early Development of Scientific Societies in Canada,' in Alexandra Oleson and Sanborn C. Brown, eds., *The Pursuit of Knowledge in the Early American Republic: American Scientific and Learned Societies from Colonial Times to the Civil War* (Baltimore, 1976), 326-39. Bowler mentions the late development of science in Canada to explain the focus of his article (326).

3. Vittorio DeVecchi, 'The Dawning of a National Scientific Community in Canada, 1878-1896,' *Scientia Canadensis* (June 1984), no. 26, 32-58; 'Science and Scientists in Government, 1878-1896,' *Ibid.*, (December 1984), no. 27, 112-42. See also Suzanne Zeller, 'Inventing Canada: The Role of Victorian Inventory Science in the Growth of Nationalism in Canada' (Unpublished PhD dissertation, University of Toronto, 1986).

4. For example, W. Stewart Wallace, 'A Sketch of the History of the Royal Canadian Institute,' in *The Royal Canadian Institute Centennial Volume* (Toronto, 1949), 123-70. This society is particularly interesting because of its early association with the Toronto Observatory. The exact relationship has yet to be determined.

5. Bowler, *op. cit.*

6. Morris Zaslow, *Reading the Rocks. The Story of the Geological Survey of Canada, 1842-1975* (Ottawa, 1975).

7. John Cawood, *op. cit.*

8. A.D. Thiessen, 'The Founding of the Toronto Magnetic Observatory and the Canadian Meteorological Service,' *Journal of the Royal Astronomical Society of Canada* 34 (September 1940), 308-48; 'Her Majesty's Magnetical and Meteorological Observatory, Toronto,' *Ibid.*, 35 (April 1941), 141-50, 205-24, 36 (February 1942), 61-5, (December 1942), 457-72, 39 (July-August 1945), 221-30, (September 1945), 267-78, (October 1945), 311-19, (November 1945), 355-69, (December 1945), 394-408. These were reprinted in pamphlet form. See also: Gregory A. Good, 'Toronto Magnetic Observatory and International Science *ca.* 1850,' *Vistas in Astronomy* 28 (1985), 387-90; 'Geomagnetics and Scientific Institutions in 19th-Century America,' *Eos: Transactions of the American Geophysical Union* 66 (2 July, 1985), 521, 524-6.

9. Bruce Sinclair, 'Americans Abroad: Science and Cultural Nationalism in the Early Nineteenth Century,' in Nathan Reingold, ed., *The Sciences in the American Context: New Perspectives* (Washington, DC, 1979), 35-54.

10. J.M.S. Careless, *The Union of the Canadas: The Growth of Canadian Institutions, 1841-1857* (Toronto, 1967), 27-8.

11. Letter of Riddell to Edward Sabine, 5 March 1840, Public Archives of Canada, microfilm A707, item 6. Riddell termed the one professor he had met a 'shallow and bitter wretch.' This collection will henceforth be referred to as PAC, mfA707.6. The originals of this archive are at the Public Record Office, United Kingdom.

12. Younghusband to Captain (later General) Edward Sabine, 25 March 1843, PAC, mf A707.18, 2nd series.

13. Riddell to Sabine, 23 September 1839, Washington, DC, Smithsonian Institution, Joseph Henry Papers, microfilm X-66 [JHP.X-66]. The original papers are at the Public Record Office, Kew. My thanks to Nathan Reingold for permission to examine this microfilm and other materials he has collected.

14. Lefroy to Sabine, 25 October 1842, JHP.X-66.

15. Lefroy to Loomis, 2 December 1842, Yale University, Beinecke Library, Loomis Collection; Lefroy to Loomis, 24 December, *ibid.*; and Atmospheric Environment Service Library, Toronto [AES] and Magnetic Observatory Ledger Book, 1839b, pp 103-4 and 124.

16. Younghusband to Sabine, 25 March 1843 PAC, mf A707.18.

17. Lefroy to Sabine, no date (after 9 March 1846). PAC, mf A707.111, 2nd series.

18. Riddell to Sabine, 23 September 1839. JHP X-66.

19. Lefroy to Sabine, 25 October 1842, *ibid.*

20. Riddell to Sabine, 27 August 1840, PAC, mf A707.21.

21. Lady Lefroy, ed., *Autobiography of General Sir John Henry Lefroy* (London, 1895). This was printed for private circulation only, and few copies exist.

22. The land on which the Observatory was built was leased to the Imperial authorities by King's College. Lefroy to Sabine, 21 November 1846, PAC, mf A707.131, 2nd series; Patrick Freeland to A.N. Morin, 7 February 1853, PAC, RG5.C1,385.673. Freeland was the secretary to the University College Senate and Morin was then the Provincial Secretary.

23. Lefroy to Sabine, 11 March 1850, PAC, mf A707.216, 1st series.

24. Lefroy to Bache, 12 October 1852. United States National Archives [USNA], Record Group 23, 5.1852.11.293.

25. Peter Bowler, *op. cit.*, 330. Lefroy was well connected to Tory politics, having married Chief Justice Robinson's daughter. Bowler states that the reformation of the Canadian Institute was undertaken by a High Tory faction.

26. Lefroy to Bache, 12 October 1852, USNA, RG23,5.1852.11.293.

27. American Association for the Advancement of Science, *Proceedings*, 6 (1852), 9 (1855) and 11 (1857); cf. Loomis to Lefroy, 29 August 1850, JHP X-66; AAAS, *Proceedings*, 10 (1856), 224.

28. Vittorio DeVecchi, 'The Dawning of a National Scientific Community,' 46-52. But, see also, R.A. Jarrell, 'British Scientific Institutions and Canada: The Rhetoric and the Reality,' *Transactions of the Royal Society of Canada* Series IV, XX (1982), 533-47.

29. Lefroy to Lt Col R. Bruce, 7 April 1851. PAC, mf A707.220, 1st Series.

30. Riddell to Sabine, 15 November 1840. PAC, mf A707.23, 1st Series. Hopkins had been seeking information on magnetic instruments since at least 1838, when he ordered instruments from Simms in England (Hopkins to Loomis, 14 November 1838, Loomis Collection).

31. Lefroy to Sabine, 26 September 1849. PAC, mf A707.209, 1st Series.

32. Lefroy to Sabine, 15 December 1849. PAC, mf A707.214, 1st Series.

33. Bache to Lefroy, 30 August 1851. USNA, RG23.1851.14.418.

34. See *e.g.*, Riddle to Sabine, 12 December 1840, PAC, mf A707.24, 1st Series; W.C. Bond to Sears C. Walker, 14 December 1840, Harvard Archives UAV.630.2; Riddell to Bache, 8 December 1840, Washington, DC, Smithsonian Institution Archives [SIA], RU7053.Box 3; and Bache to Bond, 31 December 1840, Harvard Archives, Bond Collection.

35. Lefroy to Sabine, 21 November 1846. PAC, mf A707.131, 2nd Series.

36. Bache wrote to Sabine on 18 March. Nathan Reingold, *et al.*, *The Papers of Joseph Henry* (Washington, DC, 1981), 4:266 and 29 June 1840 (JHP.X-66); Sabine to Bache on 6 April, 22 April, 12 May, 25 May and 17 October, Huntington Library, Rhees Collection. On 25 June Riddell complained that he had not heard from Bache in a long time (letter to Sabine, PAC, mf A707.16, 1st Series). One letter of Riddell to Bache is 8 December 1840, SIA.RU7053.Box 3, and a letter of Bache to Riddell is mentioned in Riddell to Sabine, 12 December, PAC, mf A707.24, 1st Series. My thanks to Nathan Reingold for making copies of items in the Rhees Collection available to me.

37. Sabine to Bache, 6 April 1840. Rhees Collection.

38. Sabine to Loomis, 13 November 1839. Loomis Collection. For Sabine, see Nathan Reingold, 'Edward Sabine,' *Dictionary of Scientific Biography* XII, 49-53, and T.H. Levere, 'Sir Edward Sabine,' *Dictionary of Canadian Biography* XI, 798-800.

39. Sabine to Bache, 6 April 1840. Rhees Collection.

40. Bache to Sabine, 29 June 1840. JHP.X-66.

41. Lefroy to Sabine, 25 October 1842. JHP.X-66. He thought 3 or 4 of the dip circles would be ordered. On these instruments, see T.H. Levere, 'Geomagnetic Instruments in the Canadian Arctic Expeditions of Franklin, Lefroy, and Nares,' *Annals of Science* 43 (1986), 57-76.

42. Lefroy to Sabine, 21 November 1846. PAC, mf A707.131; Lefroy to Bache, 26 February 1848. SIA, RU7053, box 3, and Lefroy to Bond, 21 June 1850, Bond Collection.

43. Bache to Henry, *The Papers of Joseph Henry* 4:206-8.

44. Bache to Bond, 9 November 1840, Harvard Archives.

45. Bache to Sabine, 10 May 1842. JHP.X-66.

46. Lefroy to Sabine, 26 September 1849. PAC, mf A707.209, 1st Series.

47. J.M.S. Careless, *op.cit.*, 16-18, 60-1.

48. *Ibid.*, 102-3.

49. Lefroy to Sabine, 24 December 1845. PAC, mf A707.98, 2nd Series.

50. Lefroy to Bache, 5 June 1850. SIA, 7053.Box 3.

51. Lefroy to Sabine, 16 May 1850, Thiessen, *op.cit.*, (December 1945), 396.

52. Lefroy to Loomis, 11 June 1840, Loomis Collection.

53. Loomis to Lefroy, 29 August 1850, JHP.X-66, regarding AAAS Resolution; American Academy of Arts and Sciences Resolution, November 1850, Harvard Archives, UAV.630.3; and Henry to Sabine, 26 September 1850, Sabine Collection, Public Record Office regarding the Resolution of the Smithsonian Institution Board of Regents. My thanks to Nathan Reingold for access to a copy of the letter.

54. Bowler, *op.cit.*, 330. Lefroy's speech to the 1852 annual meeting, in which he enunciated his hopes for the Institution, was printed in *The Canadian Family Herald* (Toronto), 10 April 1852, 142-5.

55. Lefroy to Bache, 12 October 1852, NARS, RG23.5.1852.11.293.

56. Lefroy to Lt Col R. Bruce (Civil Secretary to the Governor General), 7 April 1851. PAC, mf A707.220, 1st Series.

57. Lefroy to Bruce, 20 November 1852. PAC, RG5.C1.376.54. The memorandum included with this letter was requested by Lord Elgin in a conversation with Lefroy.

58. Patrick Freeland, Secretary of the University Senate, to A.N. Morin, Provincial Secretary, 7 February 1853. PAC, RG5.C1.385.673.

59. Memorial of the Natural History Society of Montreal, 7 February 1853. PAC, RG5.C1.378.167. See also, Memorial of the Literary and Historical Society of Quebec, 18 February 1853. PAC, RG5.C1.379.204.

60. Memorial of the Canadian Institute, no date [early 1853]. PAC, RG5.C1.379.204. The list of signatories has yet to be investigated in detail.

61. E. Gibbs, ed., *Debates of the Legislative Assembly of Canada*, vol. 11, pt. 3, 1637.

62. See Careless, *op. cit.*, chapters 10 and 11, *passim*.

63. A.N. Morin to Lefroy, 19 January 1853. PAC, RG5.C1.376.54.

64. A.N. Morin, Memorandum, 7 February 1853. *Ibid.*

65. Sabine to the Deputy Adjutant General of the Royal Artillery (a copy), 11 December 1852. PAC, RG5.C1.385.673.

66. Sabine to Lefroy, 18 March 1853. PAC, RG5.C1.385.653.

67. Sabine to Henry, 4 March 1853, JHP.X-66.

68. Morin to Lefroy (draft), 1 April 1853. PAC, RG5.C1.288.673. Parts of this draft are illegible.

69. Memorandum of Morin to Executive Council, 27 April 1853. PAC, RG5.C1.385.673.

70. 'President's Address,' *Canadian Journal* new series 3 (1858), 100-1.

71. *Ibid.*, 103.

72. 'Presidential Address,' *ibid.*, 5 (1860), 112 and 114.