

## Doctorate Degrees Earned by Early Canadian Geologists

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Volume 30, Number 2, June 2003

URI: [https://id.erudit.org/iderudit/geocan30\\_2art01](https://id.erudit.org/iderudit/geocan30_2art01)

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### Publisher(s)

The Geological Association of Canada

### ISSN

0315-0941 (print)

1911-4850 (digital)

[Explore this journal](#)

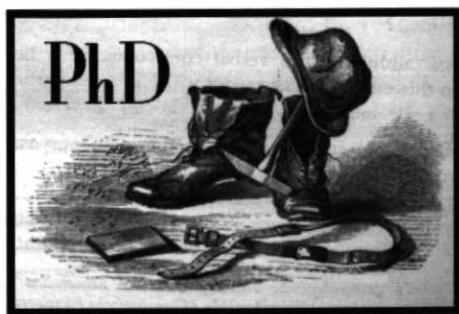
### Article abstract

The first doctorate degrees in the geological sciences earned by Canadians were: Ph.D., Yale, 1871 by Bernard J. Harrington; Ph.D., Göttingen, 1877 by Joseph William Winthrop Spencer; Ph.D., Breslau, 1882 by Arthur P. Coleman; Ph.D., Johns Hopkins, 1888 by Andrew C. Lawson; Ph.D., Heidelberg, 1892 by Frank Dawson Adams; and Ph.D., Toronto, 1900 by William A. Parks. McGill and the Geological Survey of Canada were the two institutions that most encouraged Canadians to seek graduate-level qualifications. Yale had an important influence on McGill: its Sheffield Scientific School influenced William Dawson to set up the McGill Department of Practical Science, and he appointed Harrington to be its head. In the 1860s and 1870s, the Yale school was the preeminent school in the United States for advanced study in geology and mineralogy, and the professors there encouraged many of their students to continue their studies in Germany; this advice was then taken up by McGill graduates, notably Spencer and Adams. By the 1890s graduate studies in geology had been developed to the doctorate level in many other American universities, so that travel to Germany was no longer necessary.

### Cite this article

Middleton, G. V. (2003). Doctorate Degrees Earned by Early Canadian Geologists. *Geoscience Canada*, 30(2), 37–42.

# ARTICLE



## Doctorate Degrees Earned by Early Canadian Geologists

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### SUMMARY

The first doctorate degrees in the geological sciences earned by Canadians were: Ph.D., Yale, 1871 by Bernard J. Harrington; Ph.D., Göttingen, 1877 by Joseph William Winthrop Spencer; Ph.D., Breslau, 1882 by Arthur P. Coleman; Ph.D., Johns Hopkins, 1888 by Andrew C. Lawson; Ph.D., Heidelberg, 1892 by Frank Dawson Adams; and Ph.D., Toronto, 1900 by William A. Parks. McGill and the Geological Survey of Canada were the two institutions that most encouraged Canadians to seek graduate-level qualifications. Yale had an important influence on McGill: its Sheffield Scientific School influenced William Dawson to set up the McGill Department of Practical Science, and he appointed Harrington to be its head. In the 1860s and 1870s, the Yale school

was the preeminent school in the United States for advanced study in geology and mineralogy, and the professors there encouraged many of their students to continue their studies in Germany: this advice was then taken up by McGill graduates, notably Spencer and Adams. By the 1890s graduate studies in geology had been developed to the doctorate level in many other American universities, so that travel to Germany was no longer necessary.

### SOMMAIRE

Les premiers diplômes de doctorat en sciences de la Terre décernés à des Canadiens sont les suivants : Ph.D., Yale, 1871 à Bernard J. Harrington; Ph.D., Göttingen, 1877 à Joseph William Winthrop Spencer; Ph.D., Breslau, 1882 à Arthur P. Coleman; Ph.D., Johns Hopkins, 1888 à Andrew C. Lawson; Ph.D., Heidelberg, 1892 à Frank Dawson Adams; et Ph.D., Toronto, 1900 à William A. Parks. L'université McGill ainsi que la Commission géologique du Canada sont les deux institutions qui ont le plus encouragé les Canadiens à acquérir des qualifications universitaires de deuxième cycle. L'université Yale a eu une grande influence sur l'université McGill – c'est l'École scientifique de Sheffield (Sheffield Scientific School) qui a poussé William Dawson à créer le département de sciences appliquées (Practical Science) de l'université McGill, et c'est Harrington qui en a été le premier directeur. De 1860 à 1870, l'école de Yale était la plus importante école d'études avancées en géologie et en minéralogie aux États-Unis, et ses professeurs encourageaient plusieurs de leurs étudiants à poursuivre leurs études en Allemagne. Ainsi, plusieurs étudiants diplômés de McGill ont suivi ce conseil, notamment Spencer et Adams. Et, vers

les années 1890, des programmes d'études graduées de doctorat avaient été créés dans nombres d'universités étasuniennes, de sorte qu'il n'était plus nécessaire de s'expatrier vers l'Allemagne.

### BACKGROUND

Pioneer geologists of the early to mid-nineteenth centuries rarely bothered to obtain advanced degrees. Indeed, many of the leading British, French, Canadian and American geologists had either no academic training in geology at all, or only a single course as part of medical or classical training. This was the case, for example, for William Dawson (Sheets-Pyenson, 1996), and William Logan (Torrens, 1999). In the last third of the nineteenth century, geologists raised in Canada began to seek more advanced professional training than was then available in Canada. Unfortunately, it was also difficult to find in Britain or France.

British universities were slow in establishing Chairs in geology. William Buckland was appointed reader in mineralogy at Oxford in 1813, and reader in geology in 1818. He taught geology regularly from 1814 to 1849: Charles Lyell was one of his students (Rupke, 1983, p. 7). Adam Sedgwick was appointed to the Woodwardian Chair at Cambridge in 1818, even though he is quoted as saying that at that time "...I knew absolutely nothing of geology.." (Speakman, 1982, p. 55; Speakman points out that this disclaimer should not be taken too seriously – Sedgwick had been admitted to the Geological Society of London in 1816). Some earth science had been taught in both these universities earlier, but Buckland and Sedgwick were the first professors to attract large numbers of students. Mineralogy and geology were

also taught at Edinburgh by Robert Jameson, a student of Werner, who was Professor of Natural History and Keeper of the University Museum from 1804 to 1854 (Challinor, 1971, p. 193). His most famous pupil was perhaps Charles Darwin whose reaction to Jameson's lectures was entirely negative. He learned his geology later in the field with Sedgwick, and by reading Lyell's *Principles* (Roberts, 1996). The absence of a rigorous degree program in geology was a major factor in the establishment of the Royal School of Mines by de la Beche, in order to supply trained geologists for the British Geological Survey. The first Canadian to attend was probably William Dawson's son George Mercer Dawson, from 1869 to 1872 (Sheets-Pyenson, 1996, p. 92–93), but at that time no doctorate program was available.

In France, the “grandes écoles” (elite universities, mainly for technical training) were reorganized by Napoleon in 1808 (though most had earlier origins, e.g., Ecole Supérieure des Mines, 1793) and trained many of the leading French geologists. Much geological research, however, was carried on outside of the universities (e.g., at the Jardin des Plantes, founded in 1626, and reorganized after the Revolution as the Museum of Natural History), and graduate degrees were not a major feature in the nineteenth century.

By the 1870s, some degree of professional training was available in the United States, but for reasons explored in the next two sections, Germany proved to be a more attractive option.

### TRAINING IN THE UNITED STATES

The history of geological education in the United States during the first half of the nineteenth century has been described by Johnson (1977) and Faul and Faul (1983, Chapters 10 and 11). As Johnson pointed out “Many of the early American geologists were largely self-taught because the colleges of their time were primarily devoted to classical education.” (1977, p. 1192). Faul and Faul (1983) added that “There was no ready supply of diligent well-to-do physician-naturalists and subsidized clergymen-naturalists to do the fieldwork and gather the background

data just for fun as in Britain.” (1983, p. 157). Most American physicians were too busy with the practice of medicine, and the clergy's predominantly evangelical beliefs did not encourage serious interest in geology. Early geological studies were supported by employment in universities or State Surveys.

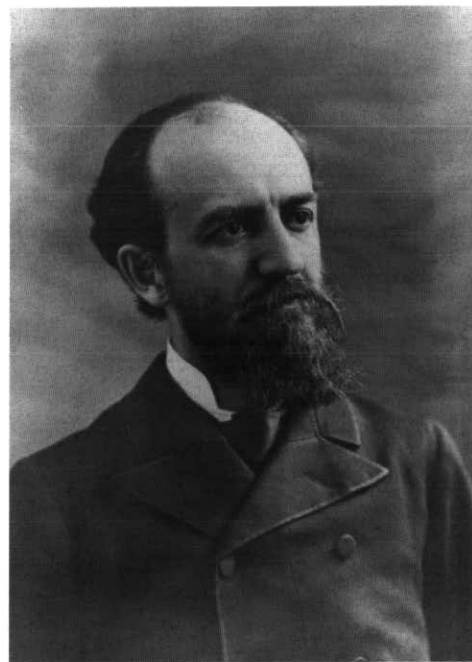
Many early American geologists were trained at Rensselaer School, or New Harmony (Johnson, 1977), but the first American university to offer graduate training in the geological sciences was probably Yale, best known for the pioneer work of Benjamin Silliman, who established America's first journal devoted mainly to geological sciences, the *American Journal of Science*, in 1818. Silliman was appointed Chair of Chemistry, Mineralogy and Geology in 1802. The first graduate courses were taught in 1846, and the Yale Scientific School (later renamed the Sheffield Scientific School) was set up in 1854 (data from Encyclopedia Britannica; see also Wilson, 1979). The first doctorates were awarded in 1861. Longwell (1929) stated that the first doctorate in geology at Yale was awarded to William North Rice in 1867. After this Rice spent a year in Berlin, before taking up an appointment at Wesleyan University in Middletown, Connecticut. According to Adams (1908) the first two doctorates in the Sheffield Scientific School were awarded in 1871 to Bernard J. Harrington and Henry Shaler Williams. Harrington (Fig. 1) can lay claim to being the first native-born Canadian to receive a doctorate in the earth sciences (see below) and Williams became a well known stratigrapher/paleontologist, who taught at Cornell and Yale.

Harvard's Lawrence Scientific School was set up in 1847, but the graduate school of arts and sciences was established only in 1872, after Charles W. Elliot was appointed President (in 1869). Johns Hopkins was the first American university specifically set up to develop graduate work on the German model, but this did not take place until 1876, and although a doctoral program soon developed, it was not the immediate goal (Versey, 1965, p. 313–314).

### THE GERMAN DOCTORATE

As undergraduate instruction in science was established in the mid-nineteenth century in American and Canadian universities, students began to feel the need for more advanced instruction than was generally available in North America. Graduate instruction was not available in Britain, and access to the leading French “Haute Ecoles” was generally denied to foreigners by competitive entrance examinations (cf. Caullery, 1922): Lardner Vanuxem (1792–1848; Merrill, 1924, p. 122), John Strong Newberry (1822–1892; Stevenson, 1893) and Samuel Emmons (see below) were rare exceptions. After completing his M.D. in 1848 Newberry went to Paris intending to study medicine: instead he worked on fossil plants with Brongniart.

By contrast, German universities had a high reputation for their research in science (and in other fields, such as philosophy, philology, history, psychology, and social sciences), and there were very few barriers to study by foreign visitors. The German educational philosophy of *Lehrfreiheit* allowed both German and foreign students to pursue their interests by



**Figure 1** Bernard James Harrington. Photo taken in 1885, when he was 37 years old (McGill University Archives).

moving from one university to another, attending lectures or seminars (themselves practically a German invention) in a variety of schools, until they were ready to attempt a comprehensive qualifying examination, and submit a thesis in order to obtain a doctorate degree. The result was that many Americans spent months or years in advanced studies in Germany, before returning to obtain academic appointments in the United States. Examples include George Ferdinand Becker (1847–1919; doctorates from Heidelberg, 1868, and the Royal School of Mines in Berlin, 1871; Day, 1919); Joseph Silas Diller (1850–1928; doctorate from Heidelberg, ca. 1882); George W. Hawes (1848–1882; doctorate from Heidelberg, 1880; Anonymous 1882); and George H. Williams (1856–1894; doctorate from Heidelberg, 1882; Clarke, 1895). Several others, for example, Samuel Franklin Emmons (1841–1911; Pirsson, 1911); Arnold Hague (1840–1917; Diller, 1917; Iddings, 1918); Joseph Paxton Iddings (1857–1920; Mathews, 1933); Othniel Charles Marsh (1831–1899; Beecher, 1899); and Charles E. Wright (1843–1888; Lawton, 1888) studied in Germany, apparently without taking a doctorate degree.

Several of those who had studied in Germany were recruited by Clarence King for his Fortieth Parallel Survey, and Louis Pirsson (1911) remarked:

“With the formation of this organization . . . a new epoch in American geology began; the former pioneer period, in which geology was carried on . . . by men largely self-trained, was henceforth to be succeeded by one in which such work was to be supplemented, and largely replaced, by national organizations of men who, like Emmons, had been specially trained and fitted as professional geologists.”

The list given above makes no claim to completeness (for other American pioneers, see Merrill, 1924; Faul and Faul, 1983), but two common features stand out: 1) many of those who left the United States to study in Germany had previously studied at Yale, and most were interested in petrology and geochemistry (rather than stratigraphy or paleontology); and

2) most of the studies in Germany were carried out from the late 1860s to the 1880s. King himself did not study in Germany, but he was a pioneer in recruiting those who had received foreign graduate training for work in geological surveys. Americans studied other disciplines in Germany before the 1870s, but geology seems to have been rare. After the work of Vogelsang (1867) and Zirkel (1873), which established microscopic petrography (for references see Merrill, 1924; Yoder, 1993) most American geologists went to Germany to learn this technique until the first generation of American-born petrographers started to teach it at Yale, Wisconsin (Irving in 1879), Johns Hopkins (George Williams in 1883) and elsewhere. This was also the period of German dominance in chemical research, and the links between the studies of Van't Hoff, and the beginnings of experimental geochemistry in America, particularly at the Carnegie Institute, have been explored by Eugster (1973).

## DOCTORATES EARNED BY CANADIANS

Canadians began seeking higher degrees somewhat later than Americans, but followed much the same pattern. The three earliest doctorates awarded to native-born Canadians were earned by Bernard J. Harrington (1871) at Yale, and by Joseph William Winthrop Spencer (1877), and Arthur Philemon Coleman (1852–1939) in Germany. Andrew Lawson was the first full-time employee of the Geological Survey of Canada to earn a doctorate (1888; Zaslow, 1975, p. 132). Frank Dawson Adams was also supported by the GSC while he worked on his doctorate with Rosenbusch in Germany in 1881 (Zaslow, 1975, p. 187; the doctorate was awarded in 1892). The first doctorate in geology conferred by a Canadian university (University of Toronto) was awarded to William A. Parks in 1900.

Bernard J. Harrington (1848–1907) was born in St. Andrews, Lower Canada (Quebec) and graduated from McGill University. He obtained a first

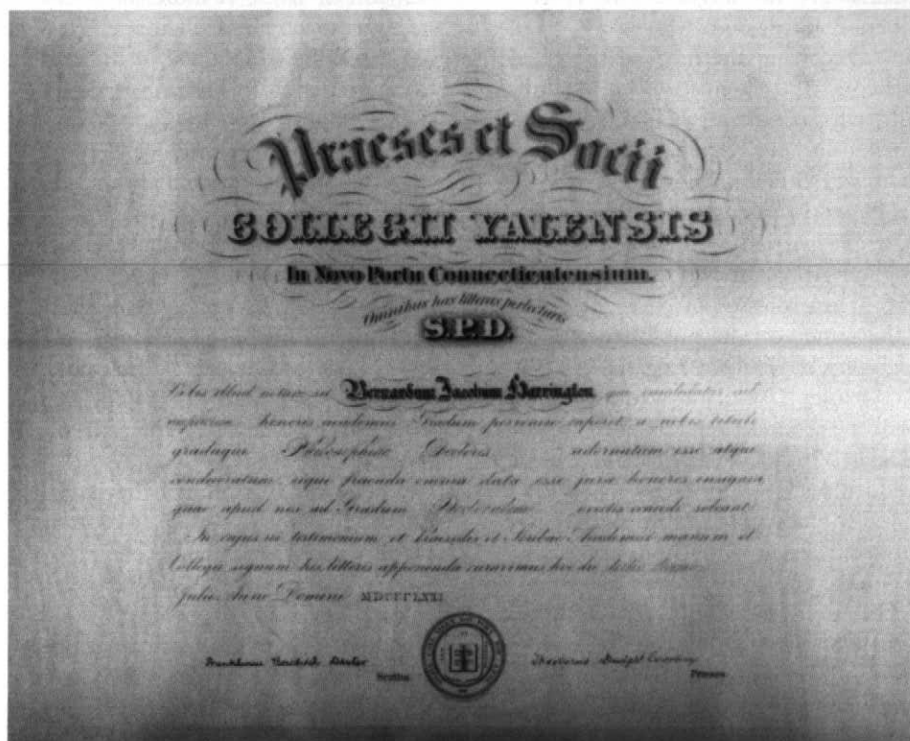


Figure 2 Harrington's doctoral diploma from Yale University. His thesis was entitled "The Siemens-Martin Process for the Production of Steel" (McGill University Archives).



class B.A. in Natural Science, and was awarded the Logan Medal in geology in 1869. Later he obtained the M.A. at McGill, and, in 1871, a Ph.D. at Yale (Fig. 2), where he was awarded the prize in mineralogy. He was a classmate of Henry Shaler Williams (1847–1918) who later taught stratigraphy and paleontology at Cornell University (Schuchert, 1918). Adams (1908) credited Harrington and Williams with being awarded the first two Ph.D.s in the Sheffield School at Yale. Though Harrington's thesis topic was "The Siemens-Martin Process for the Production of Steel," (Morgan, 1898) there is no doubt that he was at least as well trained in geology as in chemistry and metallurgy. In 1871 Harrington returned to McGill to teach chemistry and metallurgy in the Department of Practical Science (Sheets-Pyenson, 1996, p. 63) and in the following year, he was appointed part time to replace Sterry Hunt as chemist and mineralogist at the Geological Survey of Canada (the appointment continued until 1879). The Department of Practical Science was soon renamed Applied Science, and raised to Faculty status. Besides Harrington, it included George F. Armstrong, who taught engineering; Gilbert P. Girdwood, who was transferred from the medical school to teach practical chemistry; and Archibald Duff, who taught mathematics. Harrington later helped design a new Chemistry Building (now called the MacDonald-Harrington Building). In 1876, he married William Dawson's daughter Anna. In 1883 he was appointed professor of chemistry, and in the same year, he published a biography of William Logan.

Joseph William Winthrop Spencer (1851–1921) was born in Dundas, Ontario (Shaw, 1924). He attended McGill University from 1871 to 1874, graduating with a Bachelor of Applied Science with "honours of the first rank" in geology (Spencer papers in McGill archives), so he was certainly a student of Bernard Harrington, though more influenced by William Dawson. After graduation he worked for a summer in Manitoba as a field assistant to Robert Bell. He became a friend of Bell, and corresponded with him

frequently in later years. Much of the information that follows comes from letters written by Spencer to Bell (in the National Archives, Ottawa) or to Dawson (in the McGill archives). Returning to Ontario, he was unable to find work as a geologist (the economy was in recession) so the following summer he travelled to find work in the copper mining district of the Upper Peninsula of Michigan. He was taken on as an assistant by Luther G. Emerson, a mining engineer, from whom he learned useful skills in surveying and mining engineering. By December he was back in Ottawa looking for work, and the following spring he was in Hamilton. Still unable to find work as a geologist, he began applying for positions teaching in high schools, and in 1876 he started to teach chemistry and other subjects at Hamilton Collegiate Institute. One of his pupils in chemistry was Andrew Lawson.

In 1875 or 1876, Spencer decided that in order to obtain a geological position he would have to improve his professional qualifications. One step was to become a Fellow of the Geological Society of London, which he achieved with help from Bell and Dawson in 1877. A more important step was to obtain a doctorate. How he did this is best explained in his own words (letter to Dawson, Oct. 1879):

"Six months before I went to Germany, the College Authorities [at Göttingen] accepted my Monograph on the Copper-Bearing Rocks as my thesis. And then, sending my application and sketches of my life in Latin, I was admitted to the examinations for the degree on the 20<sup>th</sup> of July 1877. The special subjects of the oral were Geology (particularly Paleontology) and Mineralogy, as the leading subjects, with Natural History as secondary."

Spencer wrote his thesis in English and spent perhaps two or three months in Germany at most. His "supervisor" there was probably a volcanologist, Sartorius von Waltershausen (the Michigan copper ores are closely associated with volcanic rocks). When the thesis was published in *Canadian Naturalist* (1878), however, Spencer acknowledged the assistance of Emerson and Bell, but did not mention

any of the instructors at Göttingen. Spencer probably chose Göttingen because it was recommended to him by Harrington, who learned about German doctorates while he was a student at Yale. The only other person who might have suggested Göttingen was Luther Emerson (who might just possibly be the L.P.[sic] Emerson, described by Merrill (1924, p. 442) as an assistant to Raphael Pumpelly (1837–1923), while Pumpelly was working on the Michigan copper deposits from 1869 to 1873). Neither Bell nor Dawson had (at that time) travelled to Germany. Though Spencer's thesis was on economic geology, he made no use of petrographic techniques, and his research interests lay at that time more in Paleozoic stratigraphy and paleontology. In 1880, Spencer obtained a position at King's College, in Windsor, Nova Scotia, and by 1881 his interests had switched decisively to geomorphology.

Arthur Philemon Coleman (1852–1939) was born at Lachute, Quebec (Adams, 1940; Sissons, 1952; Eyles, 1987). He obtained his B.A. and M.A. at Victoria University in Cobourg, Ontario, then spent two years at the University of Breslau in Germany, obtaining his Ph.D. in 1882 for his thesis "The Melaphyres of Lower Silesia." Coleman chose to study in Germany because of the influence of one of his teachers, Eugene Haanel (professor of chemistry and physics at Victoria: he had been born in Breslau, and obtained his doctorate there in 1873. He was not the first professor appointed at Victoria who had a German doctorate. Elijah P. Harris, an American with a doctorate from Göttingen taught there from 1857 to 1866). In 1910, Coleman recollected that "we were looking towards Germany as the home of science...[as] our American universities were not sufficiently equipped to give a thorough scientific training." (Eyles, 1987, p.183). He returned to Canada and was appointed professor of geology and natural history at Victoria. In 1891 he became professor of assaying and metallurgy in the School of Practical Science at the University of Toronto. He was later appointed Professor of Geology, a position he held until his retirement in 1922.

Andrew Cowper Lawson (1861–1952) was born in Scotland, but came to Canada when he was six years old (his parents had nine children, five born in Canada). He was educated in Hamilton, including four years (1876–1880) at Hamilton Collegiate Institute, where he learned chemistry from J.W. Spencer (though this is not mentioned in his biography by Francis E. Vaughan, 1970). While at school he studied classics, mathematics and chemistry. He also delivered newspapers, including the *Hamilton Spectator*, and after graduating from HCI “with great distinction” in 1879, he worked part-time as a reporter for that newspaper. He began studies as a sophomore at the University of Toronto in January 1881, and that summer was offered a job as a reporter in Montreal. He accepted, and in the fall of 1881 took courses in geology, mineralogy, and medicine (from William Osler) at McGill. He soon discovered he was too squeamish for medicine, and not inclined to pursue a career in journalism. Instead, he worked in the summer of 1882 for Robert Bell. Returning to the University of Toronto, he graduated in 1883, with a gold medal for excellence in classics, mathematics, modern languages and natural science.

He then worked for the Geological Survey until 1885, when he obtained a Masters degree from Toronto, and began graduate studies in geology at Johns Hopkins, where he learned thin-section petrography from George Williams. After obtaining his doctorate there in 1888, he travelled to the International Congress of Geology in London, and participated in field excursions in Scandinavia, France, Germany and Italy. After this he worked again for the GSC, but resigned in 1890 to become a consultant in Vancouver. In November of that year he moved to the University of California at Berkeley, and remained there for the rest of his long life.

William A. Parks (1868–1936) was born in Hamilton, Ontario (Moore, 1937; Fritz, 1971). In 1879, his family moved to Bowmanville, east of Toronto, but returned to Hamilton in 1888. In that year, Parks began his studies at the University of Toronto, where he ob-

tained a bachelor's degree in natural science in 1892. After working as a chemist at Copper Cliff, he joined the faculty at the University of Toronto in 1893, obtained his doctorate in 1900 (only three years after the degree was established by the Senate: Wallace, 1927, p. 223), and served as Head of the Department of Geology and Paleontology from 1922 to 1936. He is best known for his work on stromatoporoids, western Canadian dinosaurs, and building stones. He was instrumental in the founding of the Royal Ontario Museum in 1912 and was its first Director of Paleontology from about 1915 until his death in 1936. His interest in fossil vertebrates dated from about 1918, and he collected many specimens for the ROM (Fritz, 1971; Allman et al., 1998).

Geology doctorates in other Canadian universities came much later: the next university to award one was McGill (Frost 1984, p. 82; Stearn, 1968). Most Canadian geology students went to American graduate schools for doctoral work. Among the favoured schools were (in alphabetical order): Berkeley, Harvard, Johns Hopkins, M.I.T., Princeton, Stanford, Wisconsin and Yale. No numerical data are available for geology doctorates, but Harris (1976, p. 191–192) gives the following data for doctorates awarded to Canadians in all subjects in the 1890s: Johns Hopkins, more than 30; Cornell, more than 50; Harvard, more than 60; Chicago, more than 80. Canadian attendance at American graduate schools changed only in the late 1960s, when increased funding for research in Canadian universities, and a Centennial surge of patriotism (and the Vietnam war) led more students to remain in Canada. Further details of the early growth of graduate studies in Canada are given by Thompson (1963).

## EPILOGUE

It is with great pleasure that the author (who has lived in the Hamilton area since 1955) notes the prominence of Hamiltonians among those Canadians gaining early geology doctorates. In this, the once active Hamilton Association for the Advancement of Literature, Science and Art may have played an

indirect role: its activities certainly influenced Spencer, and he must have had some influence on Lawson (Armstrong, 1958).

## ACKNOWLEDGEMENTS

Ellis Yochelson and the two journal referees Peter von Bitter (Royal Ontario Museum) and Ward Neale of Calgary kindly made useful comments on an earlier version of this work that have resulted in a greatly improved paper.

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Accepted as revised March 27

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## GEOLOGICAL ASSOCIATION OF CANADA (2003-2004)

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