



Logan at age 58. From a painting, by G.T. Berthon, commissioned by the Canadian Institute. Published in Zaslow (1975).

Sir William Edmond Logan, Father of Canadian Geology: His Passion Was Precision

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William Edmond Logan (1798–1875) was a self-taught geologist who entered the geological profession following more than 20 years in accounting and copper-smelter management. His practice of geology arose from a desire to understand the sources of coal and ores. Because eminent British geologists recognized his abilities, he was selected (1842) to establish the Geological Survey of Canada. Logan directed the Survey for over a quarter of a century, and his achievements as a geologist, administrator, and force in Canada's economic development gained him national and international renown.

Early Years

Logan was born in 1798 in Montreal, the son of a prosperous baker and property owner. Education was a priority for the family; at age 16, Logan was sent to high school in Edinburgh, Scotland, where he excelled. At age 18, he enrolled in Edinburgh University, attending classes in logic, chemistry, and mathematics. Although his academic achievement was high, he left after one year to follow commercial pursuits in London, in the counting house of his uncle, Hart Logan.

First Job

From 1817 to 1831, Logan worked diligently in London, developing business skills and assuming management responsibilities. Despite long working hours, he continued to study geometry and drawing, pursuits that later contributed to the quality of his geological maps and field sketches. Logan's bookkeeping strengths later paid dividends: He kept accounts in perfect order during his leadership of the Geological Survey of Canada. Approaching retirement, he remarked, "After I am dead no one will be able to find faults with my books of accounts."

As time permitted, he learned French, Italian, and Spanish, and he traveled in France, Italy, and, later, Spain. Logan was also fond of painting and music; he sang well and played the flute. When opportunities arose, he enjoyed the outdoors—hunting and long hikes.

Interest in Geology

Logan's attraction to practical geology began at age 33 when he joined another of his uncle Hart's business interests, the Forest Copper Works in Wales. There he was exposed to the work of practical miners and surveyors in the coal fields. His metamorphosis to a geologist is documented by comments in letters to family members: "I shall go down to Wales, where ... I shall spare no pains to make myself master of every branch of the business, and as it is of a scientific nature, I am pretty sure I shall like it" (1831). By 1833, he was joint manager of the Copper Works. He wrote to his brother in Montreal, "Here I am, out of the world altogether, and attending to nothing else but the making of copper and digging coal from morning to night.... The study of the ores of copper has gradually led me to that of mineralogy and geology, and of specimens in both departments I have become a bit of a collector. Now if you could assist me with a few of Canadian origin I should be obliged."

Logan soon established his geological reputation in southern Wales. He was a founder of the Swansea Philosophical and Literary Institution and honorary curator of its Geological Section. Elected to the Geological Society of London in 1837, he wrote to his brother, "I have become a bit of a geologist of late years, and am now entitled to write after my name F.G.S.—being a Fellow of the Geological Society.... The locality to which I have especially directed my attention is this immediate neighbourhood, of which, during the leisure hours, I am gradually getting up a geological survey and sections. If I ever return to Canada again I shall geologize there." That same year, he exhibited his geological maps of the Glamorganshire coal field at the

meeting of the British Association for the Advancement of Science, in Liverpool; the maps came to the attention of Henry De la Beche, director of the Ordinance Geological Survey of Great Britain. Logan's maps and sections were considered of such high quality that they were published without alteration as official Survey documents, bearing his name. They became a model for the Survey map series.

While mapping Welsh coal seams, Logan noted the invariable presence of underclays, containing peculiar vegetable remains, in the footwall of each coal seam. These findings, presented to the Geological Society of London in 1840, established the formation of coal *in situ*, and they place Logan among the pioneers of geological science.

Appointment to Conduct a Geological Survey of Canada

In 1838, following the death of his uncle, Logan resigned his position in Swansea. He pursued other business interests and provided advice, without remuneration, to the Ordinance Geological Survey. His future plans were uncertain. In 1841, he visited coal fields in Pennsylvania and Nova Scotia, and determined that his views about Welsh coals and underclays applied to North American deposits. When he learned that £1,500 had been earmarked to begin a geological survey of Canada, he wrote to De la Beche and others about the job.

Trans-Atlantic communications moved quickly. In March 1842, Canadian Governor General Sir Charles Bagot wrote to the Colonial Office in London, inquiring about Logan's qualifications. The response was immediate and overwhelming. Four leading British geologists—De la Beche (Geological Survey), William Buckland (Oxford), Adam Sedgwick (Cambridge), and Sir Roderick Murchison (Geological Society of London)—all submitted glowing references, on the basis of Logan's work in Wales. Murchison wrote, "Mr. Logan is highly qualified ... to point out the applications of geology ..., an object of the highest importance in a country like Canada, the mineral wealth of which is now so little known." Logan accepted the position on April 14, 1842, now considered the birth date of the Geological Survey of Canada. His transition to professional geologist was complete.

Early Years of the Geological Survey

Establishing the Geological Survey of Canada, under the physical and political conditions of the 1840s, was no task for the frail or faint-hearted. Logan realized he must demonstrate the practical value

of the geological survey to the government and the public. To his credit, he met this huge physical and intellectual challenge in a superior way.

Working days and field seasons were long, and conditions were primitive. Beyond the settled areas, travel was largely by canoe or on foot. The geology was virtually unknown. The lack of topographical maps required detailed measurements by pace, compass, Rochon micrometer, and barometer to represent the land surface; these were supplemented by astronomical observations. Although Logan was small physically, he was energetic, of strong constitution, and able to endure hardship.

Even when he was not in the field, Logan's working hours were long. He established quarters in Montreal, where he plotted maps, prepared reports, examined fossil and mineral specimens, reviewed the work of his assistants, and met members of the public. The initial funding for the Survey was insufficient, and Logan frequently used his own money for travel, hiring assistants, and purchasing supplies. He lobbied legislators and worked unceasingly on a new Survey bill, passed in 1845, that provided £2,000 annually for the next five years.

By 1850, Logan could report to the Governor General that with the aid of assistants Alexander Murray and James Richardson, as well as Indians and woodsmen, he had examined the Gaspé Peninsula, parts of the Eastern Townships south of the St. Lawrence River, and areas around lakes Ontario, Erie, Huron, and Superior. Three major geological units had been defined—folded Paleozoic rocks of Gaspé and the Eastern Townships (Eastern Division); flat-lying Paleozoic rocks extending west from Montreal to Lake Huron (Western Division); and Primitive (Precambrian) rocks to the north (Northern Division). Important observations and conclusions were presented on their stratigraphy and structure, on the absence of coal, and on the potential for copper in the Lake Superior region. Logan produced detailed maps, annual reports of progress, and a catalogue of economic minerals and deposits of Canada. A museum was established in Montreal containing “a large and valuable collection of specimens ... to illustrate the minerals, rocks and fossils of the districts examined.” The museum was put to good use to educate legislators and the public on the practical benefits of Logan's surveys.

Exhibitions and Rewards

For Logan, the 1850s were marked by alternating demands on his time. First, he had to continually justify the Geological Survey and its needs to political bodies in turmoil. At times the Survey was on the brink of extinction. Fortunately, Logan was an excellent witness and lobbyist. Second, he oversaw presentations of Canada's resource wealth and scientific capability to the international community (London, 1851; Paris, 1855). The earlier work of the Survey, leading to the preparation of a catalogue of Canadian economic minerals, coupled with Logan's interest in the public display of minerals, fossils, and rocks, made him a logical person for these time-consuming duties. He had less personal time for field work, but his achievements and honors led to extraordinary years for the Survey. Geology in Canada grew in status, as did Canadians' pride in their country. Logan was elected a Fellow of the Royal Society (1851), was named to the French Legion of Honor by Emperor Napoleon III (1855), was knighted by Queen Victoria (1856), and received the Wollaston Medal of the Geological Society of London (1856). In Canada, he was lauded by the newspapers and the public, and he received an Honorary Doctor of Laws from McGill University.

Logan to De la Beche, April 20, 1844: “I worked like a slave all summer [Gaspé, 1843] ... inhabiting an open tent, sleeping on the beach in a blanket sack with my feet to the fire, seldom taking my clothes off, eating salt fish and ship's biscuit, occasionally tormented by the mosquitoes.” GSC photo 1110111.

Completing the Geology of Canada

The 1860s brought renewed political turmoil and ongoing fiscal woes to the Survey. Logan found it necessary to retrench and reduce field activities, while completing a major publication on the geology of Canada. The massive *Geological Survey of Canada: Report of Progress from its Commencement to 1863* (1863, 983 p.) incorporated contributions of Logan, Billings, Hunt, Murray, and others. Work on the accompanying maps continued through 1868 (causing considerable eyestrain for Logan). The report, written for a broad public audience, received glowing praise in the press and the scientific community for its content and precision. The Survey was seen to have completed its original purpose of “making the geological survey of Canada,” as Canada was politically defined at the time, and it was ready to focus on studies of special problems.

Closing Years

Following completion of the 1863 report, and despite declining health, Logan led the Geological Survey until 1869 (age 71). He continued field studies in the Eastern Townships. He oversaw the start of the evolution of the Geological Survey of the Province of Canada toward the larger Geological Survey of the Dominion of Canada, with responsibilities stretching “from sea to sea.” Following retirement, he continued to provide advice and, on occasion, to serve as acting director. In 1874 he returned to Wales to live with his sister. There, while planning to drill a 950-foot hole, at his own expense, to resolve a stratigraphic sequence in the Eastern Townships, his health failed. He died on June 22, 1875, at the age of 77.

Logan's name lives on in countless publications and topographical features (Mount Logan, in the Yukon, is Canada's highest mountain). Geological terms also bear his name (Logan's line, Logan sills, weloganite, *Loganograptus logani*). Logan medals are awarded by the Geological Association of Canada and McGill University. Other examples abound.

Logan was a self-motivated learner with a passion for precision, and these attributes are the foundation of his remarkable accomplishments. He raised Canadians' pride in their geological endowment and competence and in their stature in the international community. He laid the groundwork for the Geological Survey of Canada, which continues the work Logan began.

For more on Logan:

- Geological Survey of Canada, 2000, Sir William Logan: www.nrcan.gc.ca/gsc/logan.
- Harrington, B.J., 1883, *Life of Sir William E. Logan Kt.*: Montreal, Dawson Bros, 432 p.
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- Winder, C.G., 1998, Logan's birthday: <http://publish.uwo.ca/~cwinder/logan/>.
- Zaslow, M., 1975, *Reading the rocks*: Toronto, Macmillan Company of Canada, 599 p. ■

