

The historic limestone quarry on Green Head Island in Saint John, New Brunswick, Canada

RANDALL F. MILLER^{1*} AND DIANE N. BUHAY²

1. Steinhammer Palaeontology Laboratory, Natural Science Department, New Brunswick Museum, Saint John,
New Brunswick E2K 1E5 Canada

2. University of New Brunswick, Saint John, New Brunswick E2L 4L5 Canada

*Corresponding author <Randall.Miller@nbm-mnb.ca>

Received 28 November 2013 † *accepted 11 January 2014*

ABSTRACT

Lime, or quicklime, is produced from carbonate sedimentary rocks like limestone. Lime is then used for a variety of purposes in building construction, agriculture, medicine, steel manufacture, and paper-making. By the 19th century, manufacture of lime for mortar and plaster was a significant part of the economy in Saint John, New Brunswick, Canada. Amongst the many quarries and kilns, the operation at Green Head Cove on Green Head Island was among the industry leaders. The Green Head quarry was probably used in the early 1700s or earlier. For many of its busiest years during the 1800s, the quarry was operated by Joseph and Frank Armstrong and was well known throughout the Maritimes and New England as a producer of a high quality product. Joseph Armstrong was referred to in contemporary newspaper stories as a pioneer in the New Brunswick lime industry. The Green Head quarry ceased production in the early 20th century and the site on Green Head Island now preserves the last vestiges and perhaps best example of this once thriving industry.

RÉSUMÉ

La chaux, ou chaux vive, est extraite de roches sédimentaires carbonatées comme le calcaire. On en fait divers usages, par exemple dans les secteurs de la construction, de l'agriculture, de la médecine et de la fabrication d'acier et de papier. Au XIX^e siècle, la production de chaux destinée au mortier et au plâtre représentait un important volet de l'économie de Saint John au Nouveau-Brunswick (Canada). Parmi le grand nombre de carrières et de fours en activité, la carrière de Green Head Cove, sur l'île Green Head, était un des chefs de file de l'industrie. Cette carrière a probablement été exploitée dès le début du XVIII^e siècle ou avant. Pendant la majeure partie de ses années fastes, durant le XIX^e siècle, la carrière était exploitée par Joseph et Frank Armstrong, et réputée dans les Maritimes et en Nouvelle-Angleterre pour la qualité supérieure de son produit. Des articles dans les journaux de l'époque qualifiaient Joseph Armstrong de pionnier de l'industrie de la chaux au Nouveau-Brunswick. La production de la carrière de Green Head a cessé au début du XX^e siècle, et on trouve aujourd'hui sur le site de l'île Green Head les derniers vestiges et peut-être le meilleur exemple de ce qui fut jadis une industrie florissante.

[Traduit par la rédaction]

INTRODUCTION

The lime resources of the Precambrian Ashburn Formation near Saint John, New Brunswick, have been documented (Hamilton 1965; Webb 1997a–f) and the geology mapped (Barr and White 2001); however, little has been done to examine the history of the once thriving lime industry centered on the city. This paper examines the large quarry at Green Head Cove on Green Head Island, one of the many quarry operations that existed in Saint John, with a focus on the current state of this historic place (Fig. 1). The Green Head quarry, which was owned for many years by Joseph and Francis (Frank) Armstrong, was well known in the 19th century as a producer of a high quality product. The quarry ceased production in the early 20th century. The site now includes remains of the quarry, kilns, and building foundations and preserves the last and best historic example of this industry. The Brookville Quarry in east Saint John (Torryburn) is the only remaining active quarry in Saint John that had its beginnings in the 19th century. During the 1800s the lime industry was often reported in local newspapers and these reports provide much of the information about the activities of the 19th century lime industry in Saint John. Transcriptions of newspaper articles can be accessed on the Mineral History database, New Brunswick Department of Energy and Mines (2013).

Joseph Armstrong was born in Dumfriesshire, Scotland, in 1814 (Library and Archives Canada 2013). At 18 years of age he arrived in Saint John (ca. 1831) and found employment as a cooper, making and repairing wooden barrels and casks. Soon after he began work at the Green Head lime quarry making barrels to hold lime.

Lime, or quicklime, is produced from carbonate rocks such as limestone and marble. Calcium carbonate (CaCO_3) is heated to a temperature of about 900°C breaking it down to lime (CaO) and carbon dioxide gas (CO_2). The lime is then used for a variety of purposes in building construction, agriculture, medicine, steel manufacture, and paper-making.

In 1840, after working at the quarry for five years, Armstrong and three of his friends made an offer to purchase the business from the owner, Robert Robertson (*Saint John Globe*, 5 September 1887). Robertson (ca. 1800–1880) (*Saint John Daily News*, 10 February 1880) had operated the Green Head quarry since 1829 (*Weekly Observer*, 19 May 1829; *Saint John Daily Sun*, 3 April 1889) having acquired it from previous owners. Like Armstrong, Robertson was a native of Scotland (Perthshire), and came to Saint John when he was about 28 years old (ca. 1828). Having run a successful business for a decade, Robertson accepted Armstrong's offer to buy the business. Armstrong became the sole owner of the kilns when his friends were no longer interested in the business, and soon after he became partners with his brother Frank Armstrong.

The Armstrong brothers had taken control of one of the oldest lime operations in the area. According to one newspaper story titled 'The Lime Industry', the Green Head kilns began operation in 1812 under the ownership of Mr. Dollard (*Saint John Globe*, 5 September 1887), although another article stated that operations began in 1815 under the direction of Mr. Dallon (*Saint John Daily Sun*, 3 April 1889). For a time it was operated by Mr. Chisholm (*Saint John Globe*, 5 September 1887) before passing to Robertson. Joseph Armstrong has been referred to as "the New Brunswick pioneer of the lime industry" (*Saint John Globe*,



Figure 1. (a) Aerial view of Green Head Island in west Saint John, New Brunswick (45°16'47.14 N / 66°07'39.23 W). Width of island is about 1.25 km; (b) A view along the quarry wall, with arrow on (a) to indicate direction of view.

5 September 1887) since, during more than fifty years in the lime business, many managers of lime kilns in the area learned the business from him.

In addition to the Green Head quarry, Armstrong had interests in other nearby quarries. Although many lime businesses existed in the Saint John area it was reported, “that the leading house was Armstrong Bros., Green Head” (*Saint John Globe*, 14 December 1901). The story reported that “their kilns were probably the oldest in the Dominion having been operated for more than a 100 years supplying lime for plastering all the houses built here in the early days.” This is consistent with reports that the first Europeans who settled Saint John were attracted by the abundance of limestone, especially as the outcrops were situated close to the Bay of Fundy and Saint John River shorelines. James Simonds reportedly settled in Saint John because of this resource (Raymond 1898) and soon discovered that the rock produced excellent quality lime for export. Simonds and his business partners James White and William Hazen shipped lime to New England, Nova Scotia, and Newfoundland during the late 18th century. A letter from Simonds to Hazen and Leonard Jarvis, dated May 27, 1765, described how a

cargo of Saint John lime could not be prepared for shipment since the lime in the kiln had not completely burned due to the wood still being wet from the winter (Simonds 1765).

In those early years four quarries were opened in Saint John, one near the base of Fort Howe, one along the old road from Fort Howe to Indian House, another near St. Luke’s Church and one near the Reversing Falls (Fig. 2). Udd (2000) reported that the first dispute in Canada between First Nations people and Europeans concerning title to minerals was in 1736 when there was opposition to landing ships at Saint John to transport limestone to Port Royal.

Quarrying of Saint John limestone certainly began much earlier than the mid-1700s. Murdoch (1865) reported that in 1701 Monbeton de Brouillan, Governor of Placentia and commandant of Acadia (Baudry 2013), recommended building the fort at Port Royal, Nova Scotia using both limestone quarried in Saint John and rock shipped from France as ballast. A newspaper story in 1895 (*Saint John Daily Sun*, 4 October 1895) also suggests the industry dates back to the early 1600s. “Green Head Lime. - Wm. Murdoch, C.E., has on exhibition several barrels of lime from the celebrated Green Head kilns on the St. John river. When Claude Latour

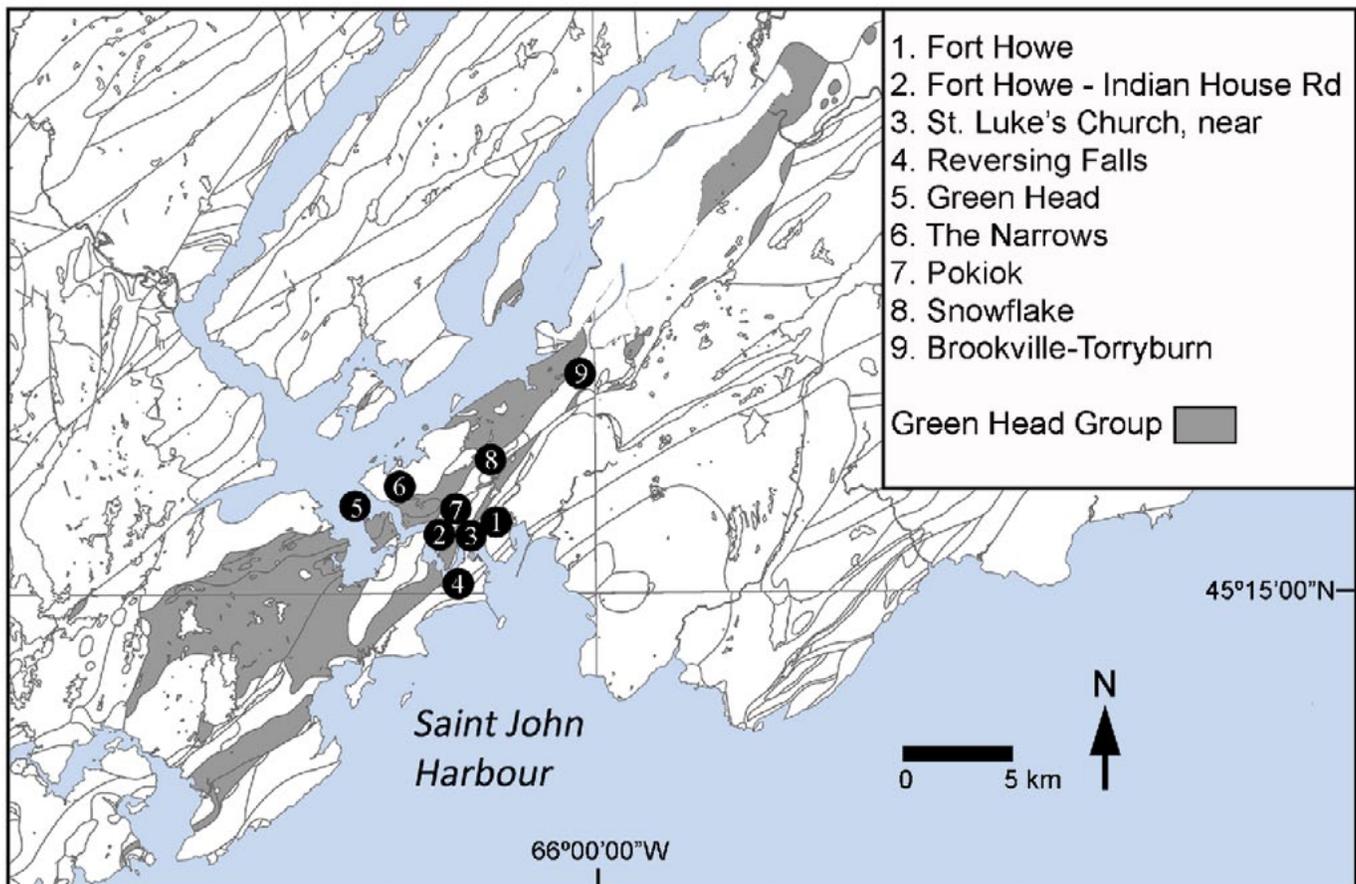


Figure 2. Map showing outcrops of the Green Head Group and the location of historic lime quarries in Saint John noted in the text.

constructed fortifications near Annapolis Royal about the year 1630 the lime he used was the product of ‘The Narrows’ [the part of the Saint John River just east of the Green Head quarry], and from this neighbourhood lime was shipped to Boston by Jas. Simonds before the declaration of American independence. The quarries on both sides of the river have been worked ever since, and the towering cliffs of limestone give promise of boundless resources for ages to come. This lime is considered to be superior in many ways to that manufactured in any other part of the province.”

That the “quarries on both sides of the river have been worked ever since” suggests the Green Head quarry site may have been exploited by the mid 1700s if not earlier. By the time Joseph Armstrong and his partners bought the Green Head quarry (ca. 1840) the lime industry and the Green Head quarry were well established. When Abraham Gesner began his Geological Survey of New Brunswick in 1838 he noted sixteen kilns in operation along a four-mile stretch of the Saint John River near Green Head Island, ‘The Narrows’ (Gesner 1839, p. 65), and probably Pokiok (Fig. 2). Quarries often changed owners and many names are encountered for the same quarry. In addition, small quarry sites were opened and closed as part of larger operations. On Green Head Island several abandoned small quarries were likely worked by the Armstrongs and others. Gesner (1839) reported that the quantity of lime burnt in the previous season amounted to five thousand hogshead (one hogshead equal to 64 dry gallons).

GEOLOGY OF THE LIME RESOURCE

The rock quarried in Saint John to produce lime is from the Precambrian Ashburn Formation of the Green Head Group (Barr and White 2001). The Ashburn Formation consists of marble, low-grade metamorphosed limestone of variable colour and texture that outcrops in a belt trending east-west across the city (Fig. 2). It is described as deposited in a shallow-marine environment, as indicated by the presence of stromatolites (Hofmann 1974). It is typically white to grey and light green, banded, and locally stromatolitic, calcareous to dolomitic marble interbedded with pelite, fine-grained quartzite, minor conglomerate, and mica schist. Geological reports and maps detailing the lime resources have been produced by the New Brunswick Geological Surveys Branch (Hamilton 1965; Davis 1987a, b). Webb (1997) mapped the deposits including the locations of quarries noted above, as well as the Snowflake and Brookville-Torryburn quarries (Fig. 2). Map plate 97-24C (Webb 1997c) provides detail of the Green Head location and the additional maps (MP 97-24A, 24B, 24D, 24E and 24F) by Webb (1997a, b, d, e, f) provide wider coverage of the limestone resources of the Ashburn Formation.

GREEN HEAD QUARRY

The Green Head quarry is located on the northwest corner of Green Head Island (sometimes called Randolph Island) in west Saint John (45°16'47.14 N / 66°07'39.23 W) along the shore of Green Head Cove (Fig. 1). The quarry wall measures about thirty metres high in places forming the back of the quarry with the kilns, processing facilities, and wharves on the shore (Fig. 3).

The Green Head quarry was ideally situated (Fig. 4). Not only did it have massive cliffs of excellent quality limestone, but also its location on the Saint John River allowed for convenient transport of the finished product. A good deal of wood necessary for the burning of lime was available on Green Head Island and easily delivered to the site from upriver. Quarrying at the site was relatively straightforward. As Joseph Armstrong himself described it (*Saint John Globe*, 5 September 1887), the quarry is so near the kilns, the rock only had to be wheel-barrowed a short distance and dumped into the kilns. Quarrymen were employed to remove the rock; barrels and casks were manufactured on-site by coopers; firemen operated the kilns; and scowmen moved the finished lime product from the kilns to the shed to be readied for market. The first kilns in the area were round, replaced later by larger square kilns. Both round and square kilns were constructed as stone houses, into which the pieces of lime rock were piled (*Saint John Globe*, 5 September 1887). Fires were lit in openings in the rock piles and left to burn continuously for five days before allowing them to cool off, allowing the lime to be removed. In 1852, the Armstrong brothers were the first to build a square kiln in Saint John and were able to double production from their Green Head quarry. A square kiln could produce 200 barrels of lime per week. By 1882, the newspaper reported the quarry was producing 300 to 400 casks of lime per week (a cask is a more general term for the containers manufactured by coopers, and we assume the newspaper was usually equating cask with barrel). In the 1800s a barrel contained 36 Imperial gallons of liquid (about 164 l), and as a measurement for dry goods, such as flour, a barrel was 196 pounds (89 kg). Their market was local, primarily New Brunswick and Nova Scotia (*Daily Telegraph*, 7 July 1882).

In 1886, they built an even more efficient draw kiln that doubled again the production of the square kiln (*Saint John Daily Sun*, 3 April 1889). The draw kiln was made of stone thirty-five feet high and twenty feet square, and was lined on the inside with firebrick. Unlike a square kiln, rock from the quarry was added from the top. Fires were lit on either side of the kiln and the burned rock drawn out from the bottom. This allowed a kiln to be operated continuously producing about 120 barrels of lime a day, and burning four cords of wood a day. By the next year the Green Head quarry had one draw kiln and three square kilns in operation. Their annual production had expanded from 13,000 barrels in

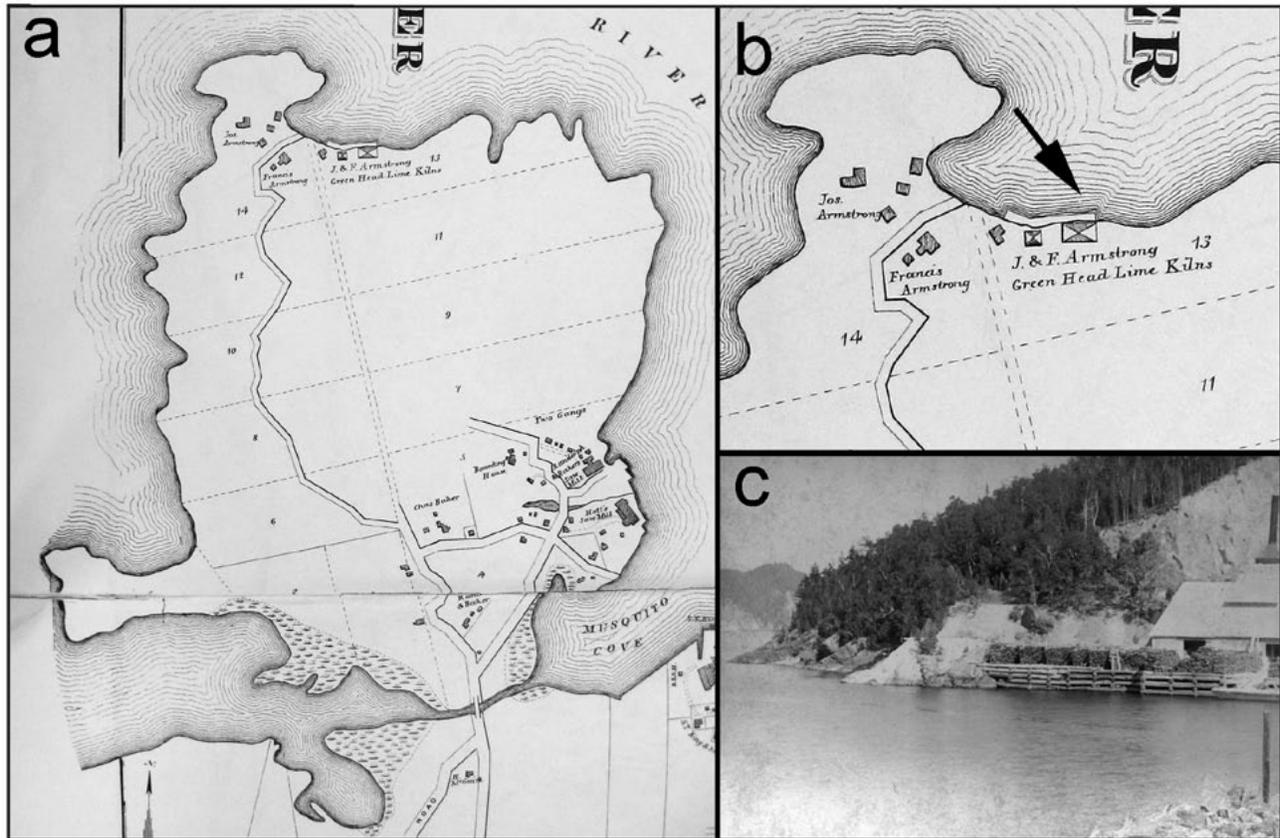


Figure 3. (a) Map of Green Head Island (Roe and Colby 1875); (b) detail of the quarry showing the location of built structures; (c) Photograph of east end of wharf showing wood piles (NBM 1961-25a), with arrow on (b) to indicate direction of view.



Figure 4. Green Head quarry viewed from Joseph Armstrong's summer home on Green Head Island, ca. 1890. Two kilns are visible, identified by the chimneys (NBM X16707-143(2)).

1865 to 15,000 barrels in 1886 to 18,000 barrels in 1887, and in 1888 the yield was greater yet. It was expected that Joseph and Frank Armstrong were to erect another draw kiln in 1889 that would have cost \$2500 at the time. By 1889 the Armstrong brothers were exporting 80% of their output from their quarries outside of New Brunswick (*Saint John Daily Sun*, 3 April 1889). In 1892, they were shipping about 30,000 barrels of lime to customers in the Maritime Provinces and employed about 15 men at the Green Head quarry from March 1 to December 1 (*Daily Telegraph*, 3 May 1892).

Green Head lime in particular seems to have been in demand. Again the *Saint John Daily Sun* (4 October 1895) reported "... The most prominent buildings in St. John have been cemented together with this famous lime, and so great was its reputation that the British government, when extending the accommodation for troops in Halifax in the year 1868, allowed no other lime than the Green Head to be used. The Nova Scotia provincial buildings and the Merchant's Bank of Halifax were built with Green Head lime. The Roman Catholic Cathedral in the city of St. John, which has stood the test of forty years, and been the pride of its parishioners during all of that time, was laid in Armstrong's lime. Perched upon one of the many beautiful and commanding sites at the mouth of the River St. John stands the lunatic asylum [demolished in 1999]. The main structure was erected in the year 1853 by the famous contractors, Crosby & Small, a firm who used Green Head lime and no other. The government of a country always demands the best in any undertaking. With this end in view, when the dominion government erected the two handsome post offices [one which was destroyed by fire in 1877, and the other which stands today] at the corner of Prince William and Princess streets, the lime used in their construction was ordered at Green Head. In like manner, the most important structure of all, and by far the most expensive and magnificent of the federal buildings in the province, was built with Green Head lime...." (Fig. 5). The Green Head name was well enough known that a legal case in January 1882; 'Armstrong vs. Raynes', was heard by the court concerning trademark infringement. The Armstrongs argued that their lime barrels marked as 'Greenhead Lime' had a market value and reputation being undermined by competitors using the word Greenhead on their product label. Raynes was selling barrels marked 'Extra No. 1 Lime, manufactured by Raynes Bros. at Greenhead'. The presiding judge ruled against Raynes to protect the Armstrong trademark (Trueman 1898, pp. 144–150.).

LIFE ON GREEN HEAD ISLAND

Living and working on Green Head Island might have been pleasant for the most part. The lime business was mostly seasonal in the 1800s. Keeping the kilns fired was not possible in the cold winter months so while production was shut down some of the men were employed in cutting wood for the next season. At Green Head the Saint John River would have been frozen much of the winter, making shipping of casks more difficult. Road access allowed the movement of goods to and from the quarry. The current condition of the road suggests it would have been a rugged trip of about two kilometers to reach the quarry.

The Armstrong family had a home on a hill overlooking the quarry. A period atlas (Roe and Colby 1875) shows the structures at the quarry (Fig. 3). Joseph's house on the hill overlooking the quarry, Frank's home below and nearer the quarry, as well as other structures associated with the operation. Photographs of Joseph's house show it was a substantial structure and perhaps more than just a cottage as sometimes described in the newspaper (Fig. 6). The house foundation remains today and period photographs show family and children playing with a view of the quarry below. Joseph's first wife was a sister of his previous employer, Robert Roberson; they had two daughters. His second wife was the daughter of Captain Gray and together they had six children. (*Saint John Daily Sun*, 9 August 1894; 10 August 1894).

Summers on Green Head Island must have been picturesque, as they still are. One story associated with the island involves the song 'My Own Canadian Home', known in the late 19th and early 20th century as 'Canada's National Song', prior to 'O Canada' being proclaimed as Canada's national anthem 1 July 1980. 'My Own Canadian Home' became the official song of Saint John in 1967. As the story goes Edwin G. Nelson, a local bookseller, initially wrote the lyrics as a poem while spending an idyllic day on Green Head Island. Inspired by the landscape, Nelson's "thoughts turned to his country's possessions in the way of natural beauty and loyal hearts and in a twinkling the poem was conceived" (MacFarlane 1895, pp. 61–62). 'My Own Canadian Home' was published as a poem in 1887. It was ultimately set to music, several times, with the version by Morley McLaughlin published in 1890, reportedly selling 1.5 million copies according to an 1896 report (Vogan 2013). The story is made all the more interesting by examining a photograph showing a game of croquet at the Armstrong house (Fig. 7). In the photograph the man standing at the right is Edwin G. Nelson, Joseph Armstrong's son-in-law. The older man at the left is likely Joseph Armstrong, and the third man in the middle is another son-in-law, William Murdoch (based on comparison with other photos in the New Brunswick Museum Archives). Murdoch, an engineer, made a significant contribution to geology in 1890 when he



Figure 5. (a) Cathedral, Waterloo Street, Saint John, built between 1853-1885; (b) Old Post Office, Prince William Street Saint John, built between 1877-1880. Prince William Street is recognized by Parks Canada with a 'Designation of National Historic Significance' as an important late 19th century architectural and commercial landscape.



Figure 6. (a) The Joseph Armstrong house ca. 1890 (NBM 1961-25b); (b) Foundations of the Armstrong house in 2009 showing the 'ell', a part of the building with a cellar that lies perpendicular (behind) to the main house.



Figure 7. Croquet on the lawn of Joseph Armstrong's house, ca. 1890, overlooking the Green Head quarry. Man standing on the right is Edwin Nelson, seated on the left is likely Joseph Armstrong, and standing in the middle William Murdoch (NBM 1961-25c).

showed George Matthew fossils that he found on the shore just below the Armstrong house. Matthew described them as *Archaeozoon acadense*, the first Precambrian stromatolite properly identified in the scientific literature (Matthew 1890; Hofmann 1974; Miller 2003). The fossil discovery was described in the local newspaper "Natural History Society. - An Important Discovery at Green Head. - Mr. Matthew Discusses Eozoan Acadiense. - ... The president ... called special attention to a remarkable slab of marble that lay on the table and had the appearance of petrified sticks of wood..." (*Saint John Daily Sun*, 8 October 1889). The slab noted in the newspaper story was donated to the Natural History Society of New Brunswick in 1890 by Murdoch and is now in the collection of the New Brunswick Museum (NBMG 3200).

Life was not always easy, as indicated by a story in the local newspaper "Fire at Green Head. - Mr. Joseph Armstrong, lime burner, Green Head, lost his valuable cottage, which was destroyed by fire on Saturday morning. The fire was discovered by the workmen in the kiln, about

200 yards off. They hastened with Mr. Armstrong to the burning building and began removing the furniture, but, owing to the intense heat of the flames, which threatened the destruction of the outbuildings, not more than half the furniture was removed in safety. The men found it difficult to confine the fire to the main building, but they finally succeeded, by the free application of buckets of water. The main portion of the building was two stories high and the ell two and a half stories. There were nine bedrooms, well furnished, but only the contents of two were saved. Mr. Armstrong kept a safe in the house, containing his books and business papers, all of which were preserved, as the fire did not work into the body of the safe. The building was insured for \$1,000, and the furniture for the same amount, in the Western office." (*Daily Telegraph*, 21 March 1881). The story is interesting in its description of the house; two stories tall with nine bedrooms capable of housing Armstrong's large family; and that the fire occurred in March, suggesting perhaps that they lived there during much of the year once the quarry operations began for the season.

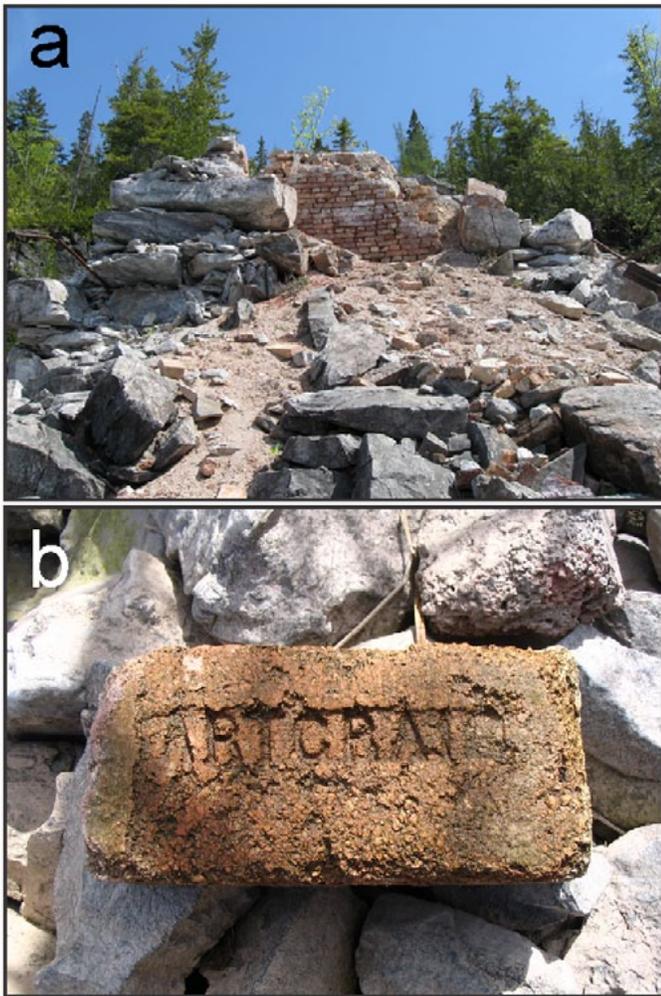


Figure 8. (a) Remains of one of the draw kilns, the same seen at the right of photo in Figure 3; (b) Fire brick manufactured by Gartcraig and imported from Scotland.

A REMINDER OF THE INDUSTRY

Joseph Armstrong died in 1894 at the age of 81 at his home on Green Head Island (*Saint John Daily Sun*, 9 August 1894). By the start of the 20th century the Green Head quarry was being sold to other investors and the industry was turning to the production of cement. Newspaper stories followed the changes with interest (*Saint John Standard*, 7 October 1911; *Saint John Globe*, 2 May 1912, 8 July 1912, 25 July 1912; *Saint John Standard*, 6 September 1912, 7 September 1912), in part because a new industry might be established in Saint John, but also, it seems, a deal by competitors from elsewhere might close down the Saint John cement industry before it started. Plans between the City of Saint John and business interests were made to sell and develop the property. The fledgling New Brunswick Lime & Cement Co., Ltd., affiliated with the Partington Pulp

Mill at the Reversing Falls, bought the land, although the parties had disagreements over conditions and restrictions. Ultimately a cement industry on Green Head Island failed to materialize. The LaFarge Canada Inc. concrete plant is now located in part of the former Snowflake Quarry (Fig. 2) near the corner of Somerset Street and Lime Kiln Road; however, they do not currently use the local limestone.

Today the Green Head quarry is the property of the City of Saint John, zoned as parkland and adjacent to Dominion Park, a popular beach on Green Head Island. The quarry site includes remains of the Armstrong brothers' business with two kilns (Fig. 8), several building foundations and wharf timbers. Two deteriorating structures made of firebricks are the sole remains of the draw kilns described in the newspaper in September, 1887, and April, 1889. Bricks found on-site are stamped Gartcraig (Fig. 8), manufactured near Glasgow, Scotland, and imported to construct the kilns. Firebricks made to withstand the high heat of the kiln were not manufactured in New Brunswick until late in the 19th century.

The Green Head quarry is a fascinating example of industrial archaeology, and preserves the last vestiges, and perhaps best example in New Brunswick, of this once thriving industry that helped sustain New Brunswick's economy. The direct connection to existing historic buildings in Saint John and elsewhere; to one of the world's most significant fossil discoveries; and, to the cultural story of 'My Own Canadian Home' show that this abandoned quarry has significance far beyond the tumbled bricks and rock wall that remain today.

ACKNOWLEDGEMENTS

The authors thank J. Longon of the New Brunswick Museum Library and Archives for assistance and local historian J. Pearce who brought the story of Edwin Nelson to our attention. The Mineral History database compiled by W. Gardiner for the New Brunswick Department of Energy and Mines (Geological Surveys Branch) has been an incredible research resource. We thank reviewers Barry Cooper and Les Fyffe and the editor for helpful comments to improve the manuscript.

REFERENCES

- Barr, S.M. and White, C.E. 2001. Geology of the Kingston and Brookville terranes, New Brunswick (parts of NTS 21G/01, G/02, G/08, G/09; 21H/05 and H/12). New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Plates 2001-30 to 2001-45, scale 1:20 000.
- Baudry, R. 2013. "Monbeton de Brouillan, Jacques-François

- de”, In Dictionary of Canadian Biography, vol. 2, University of Toronto/Université Laval, 2003. URL <http://www.biographi.ca/en/bio/monbeton_de_brouillan_jacques_francois_de_2E.html>, November 2013.
- Davis, D.W. 1987a. The limestone industry in New Brunswick: volume I. New Brunswick. Mineral Resources Branch. Open file report; 1987 no. 6, 125 p.
- Davis, D.W. 1987b. The limestone industry in New Brunswick: volume II. New Brunswick. Mineral Resources Branch. Open file report, 1987 no. 7, 164 p.
- Gesner, A. 1839. First report on the geological survey of the province of New Brunswick: Henry Chubb, Saint John, N.B. 87 p.
- Hamilton, J.B. 1965. Limestone in New Brunswick. New Brunswick Mines Branch, Department of Lands and Mines, Mineral Resource Report no. 2. 147 p.
- Hofmann, H.J. 1974. The stromatolite *Archaeozoon acadense* from the Proterozoic Green Head Group of Saint John, New Brunswick. Canadian Journal of Earth Sciences, 11, pp. 1098–1115. <http://dx.doi.org/10.1139/e74-105>
- Library and Archives Canada 2013. Census of Canada 1881, Microfilm: C-13178, Item Number: 4773709. URL <<http://www.bac-lac.gc.ca/eng/census/1881/Pages/about-census.aspx>>, November 2013.
- MacFarlane, W.G. 1895. New Brunswick bibliography. The books and writers of the province. Sun Printing Company, St. John, N.B. 98 p.
- Matthew, G.F. 1890. Eozoon and other low organisms in Laurentian rocks at St. John. Bulletin of the Natural History Society of New Brunswick, 9, pp. 36–41.
- Miller, R.F. 2003. George Frederic Matthew’s contribution to Precambrian paleobiology. Geoscience Canada, 30, pp. 1–8.
- New Brunswick Department of Energy and Mines 2013. Mineral History database. URL <<http://www1.gnb.ca/0078/GeoscienceDatabase/MineralHistory/MinHis-e.asp>>, November 2013
- Murdoch, B. 1865. A History of Nova Scotia or Acadie. Volume 1, James Barnes Publisher, Halifax, N.S. 543 p.
- Raymond, W.O. 1898. At Portland Point third paper. New Brunswick Magazine, 1, pp. 132–145.
- Roe, F.B. and Colby, N.G. 1875. Atlas of Saint John City and County New Brunswick, Roe and Colby, St. John, N.B., 85 p.
- Simonds, J. 1765. Letter from James Simonds to William Hazen and Leonard Jarvis, May 27, 1765. In Voices, Vessels and Vellum. Saint John Free Public Library Primary Source Documents Manuscript Number A107. URL <<http://www.lib.unb.ca/Texts/NBHistory/vvv/summary.cgi?file=sja107.xml>>, November 2013.
- Trueman, W.H. (Editor) 1898. New Brunswick Equity Cases being a selection of hitherto unreported cases determined by the Supreme Court in Equity of New Brunswick from 1876 to 1893. The Carswell Company Ltd, Toronto, 602 p.
- Udd, J.E. 2000. A Chronology of Minerals Development in Canada in A Century of Achievement - The Development of Canada’s Minerals Industries. CIM Special Volume 52, 78 p.
- Vogan, N.F. 2013. “Nelson, Edwin G,” In Dictionary of Canadian Biography, vol. 13, University of Toronto/ Université Laval, 2003. URL <http://www.biographi.ca/en/bio/nelson_edwin_g_13E.html>, November 2013.
- Webb, T.C. 1997a. General geology and limestone/dolomite deposits of the Ketepec - South Bay area, Saint John County, New Brunswick (part of NTS 21G/08). New Brunswick. Minerals and Energy Division, MP 97-24A, scale 1:10 000.
- Webb, T.C. 1997b. General geology and limestone/dolomite deposits of the Elliott Road-Hammond River - Nauwigewauk area, Kings County, New Brunswick (part of NTS 21H/05). New Brunswick. Minerals and Energy Division, MP 97-24B, scale 1:10 000.
- Webb, T.C. 1997c. General geology and limestone/dolomite deposits of the Green Head Island area, Saint John (east and west) area, Saint John County, New Brunswick (part of NTS 21G/08). New Brunswick. Minerals and Energy Division, Map Plate 97-24C, scale 1:10 000.
- Webb, T.C. 1997d. General geology and limestone/dolomite deposits of the Saint John east area, St. John County, New Brunswick (part of NTS 21G/08). New Brunswick. Minerals and Energy Division, MP 97-24D, scale 1:10 000.
- Webb, T.C. 1997e. General geology and limestone/dolomite deposits of the Lorneville area, St. John County, New Brunswick (part of NTS 21G/01). New Brunswick. Minerals and Energy Division, MP 97-24E, scale 10 000.
- Webb, T.C. 1997f. General geology and limestone/dolomite deposits of the Nauwigewauk area, St. John County, New Brunswick (part of NS 21H/05). New Brunswick. Minerals and Energy Division, MP 97-24F, scale 10 000.

Editorial responsibility: Sandra M. Barr