

Raw Urbanism: the challenges of [re]building ageing hard infrastructure using locally-sourced materials in metropolitan Montréal.

Nom : Heather Braiden

Adresse courriel : heather.braiden@mail.mcgill.ca

Niveau de scolarité : PhD 2

Département : Urbanisme

Institution d'attache : McGill

Nom du directeur et du/des co-directeur/s : Nik Luka

Adresse courriel : nik.luka@mcgill.ca

**Abstract:** The evolution of cities is interdependent on the supply of raw material for the construction and maintenance of its urban infrastructure. Every year Canadian municipalities are forced to rebuild and replace their ageing assets, however many quarries that were once located on the Island of Montréal have been overtaken by urban development. As a consequence, the mining industry and local supply of raw material once used to build the city's foundation infrastructure have been pushed beyond urban limits, bringing to question: What are the historic patterns of extraction and construction and how have they shaped Montréal's urban and peri-urban landscapes? With these timely issues in mind, this paper develops a historical portrait of the spatial relationship between points of natural resource extraction and the physical constructs of urban infrastructure on the island of Montréal in the 19<sup>th</sup> and 20<sup>th</sup> centuries. It describes how industrial advances altered material requirements and how the evolution of transportation technology expanded the flow of foreign material to Montréal. Here, the historic role of local quarrying in the supply of raw material to Montréal's urban infrastructure development is illuminated by bringing spatial relationships to the forefront and is used to shed light on the social legacies of city building. Archival research focusing on construction practices and local mining records are used in critical mapping to reveal the scales of local resource use and physical alterations made to the landscape.

## **Presentation Outline:**

### **Preoccupations:**

As a landscape architect I am surprised by the number of times in recent years I have been encouraged to call overseas suppliers, mostly in China, for granite and marble stone indented for use in urban squares, plazas and general streetscape projects. As a fairly recent immigrant to Montreal, I look around and see a number of rather large scale and structurally failing urban infrastructures and wonder how raw materials will be supplied in their repair or reconstruction and what alternatives to static, high maintenance projects designers might consider. As a means of understanding the potential for the future of infrastructure development, I begin my research by looking at the historic relationship between the extraction, production and consumption of quarried material and their effect on our local and global environments.

### **Theoretical Framework:**

This term I have begun to explore the field of environmental history and its methodologies as a means of understanding the many forces involved in the development and construction of urban infrastructure. At the same time I am considering the role of the environment in provisioning and later the consequence of change on the landscape. Based on the reading and research undertaken this term, my presentation follows a rather simple time line which explains the events leading up to the first of my proposed three case studies; the Victoria Bridge.

### **Timeline:**

Beginning with an overview of Montreal's geological formations and understanding its geographic setting at the confluence of three major North American rivers, the narrative introduces the waterways as not only an vital circulation route within the continent but also as a gateway for European explorers. As an increasing number of Europeans began to arrive and erect somewhat permanent structures on the island in the

seventeenth and eighteenth centuries, I look at how circulation and land division is influenced by the existing landscape and how communication links along waterways and inland are built and maintained. Then, as competition from American counterparts in the fur trade business augment, Montreal and Lower Canada observe a need for bigger and faster routes inland which lead to a number of private initiatives in building infrastructure. Finally, I look at how 'public' infrastructure built in nineteenth century, as a result of industrialization, alters the landscape, leaving permanent configurations as a means of increasing the flow of goods, services and people.

Early developments of the Montreal's harbour, canal systems, railways, bridges and roads all played an essential role in Montreal's industrial success. Of these constructs, I introduce the Victoria Bridge as the first of three intended case studies in understanding Montreal's environmental history with focus on the landscape in provisioning materials used in the construction urban infrastructure. Considered an engineering wonder of its time, the Victoria Bridge was chosen as it was the first bridge to span the St. Lawrence River and continues to function as a connection to outside markets over a century and a half after its initial construction. Here, I describe the extraction, production and consumption of materials used in building the bridge as well as the environmental considerations in its design and realization. Promoters and political influences are discussed along with the influence and placement of existing networks including canals and railways in the success of this piece of foundational infrastructure.

Although the term 'infrastructure' did not formally exist until early or mid-twentieth century, the physical construction and maintenance of communication and circulation routes over time play an important role in understanding the evolution of networked systems in the city. For this reason, woven into the development of Montreal's physical time line is a basic analysis of the meaning and understanding of 'infrastructure'. Other terms, such as resource and landscape are introduced for clarity in the overall project along with an examination of local decisions made in the permanently closure of quarries once found on the island.

### **General results and conclusions:**

Although this presentation is only the first of three case studies, I hope to show how the availability of local stone along with environmental conditions, both natural and built, were essential in the transfer of stone material and facilitated the construction of the Victoria Bridge. I also hope to show how environmental considerations taken in its design have enabled it to prevail over the last century and a half. The engineers involved in the design and implementation of the Victoria took their time in ensuring the stability of the structure, something that is often not afforded in construction projects today. As we can see and hear in daily news reports, infrastructure built during the last of Montreal's peak construction period, the 1960s, have not endured the same longevity. Future case studies will continue to look at circulation networks and focus on developments in material use from the solid masonry used in the construction of the footings at the Victoria Bridge to the use of compound materials such as concrete employed in subsequent bridge construction.

### **Future research:**

Although research on the Victoria Bridge is well underway, many of the sources remain secondary. I would like to look deeper into the city archives to better understand the extraction industry throughout the nineteenth and twentieth centuries. Michele Dagenais and Danny Fougères present exemplary cases on the environmental history of water and infrastructure provisioning in Montreal and provide inspiration for looking further into the relationships between the 'natural environment' and the impact of human constructs on the landscape. To this extent, I hope to add a layer of understanding the raw materials used in forming 'new' geologies in the city.

In considering the future case studies, I am uncertain which direction to take. I have considered the Cartier Bridge, built to improve vehicular traffic in the 1920s, its piers are made of poured in place concrete and its construction was also considered an engineering feat of the time. The Champlain Bridge also presents an interesting opportunity in understanding technological advances as its piers are constructed using

precast concrete. Other options include looking further back in time at the construction to the Lachine Canal which was essential in the movement of material used in the Victoria Bridge or even further back at the movement and flow of material used in the construction of the fortified city when more primitive extraction techniques and laborious transportation would have been necessary.

I would also like to begin creating spatial maps, layering information to understand the change in built form and the supply of raw material over the course of time.

### **Bibliography:**

Adams, Frank D. 1903. 'The Monteregian Hills: A Canadian Petrographical Province'. *The Journal of Geology* 11 (3):239-282.

Andreae, Christopher. 1996. *Lines of Country: An Atlas of Railway & Waterway History in Canada*: Boston Mills Press.

Bamforth, Douglas B. 2006. 'The Windy Ridge Quartzite Quarry: Hunter-Gatherer Mining and Hunter-Gatherer Land Use on the North American Continental Divide'. *World Archaeology* 38 (3):511-527.

Bélisle, Jean, Louise Désy, Dinu Bumbaru, David Miller, Clara Gutsche, and Centre canadien d'architecture. 1992. *An industrial landscape observed: the Lachine Canal, 14 July to 25 October 1992*: Canadian Centre for Architecture = Centre canadien d'architecture.

Benoît, Michèle, and Roger Gratton. 1991. *Pignon sur rue: les quartiers de Montreal*. Canada: Guérin.

Borgal, Christopher. 2001. 'Thin-Stone Systems: Conflicts between Reality and Expectations'. *APT Bulletin* 32 (1):19-25.

Brock, R.W.. 1912. *Summary Report of the Geological Survey Branch of the Department of Mines Limestones of Canada, their occurrence and characteristics for the calendar year 1911*. Geological Survey of Canada Publication No. 1218.

Burgess, Joanne, et al. 2004. *Old Montreal: History Through Heritage*: Les Publications du Quebec.

- Chandler, P. A. 1940. 'The Montreal Botanical Garden'. *Bulletin of Miscellaneous Information* (Royal Gardens, Kew) 1940 (4):148-155.
- Clark, Thomas Henry. 1972. *Région de Montréal area*: Ministère des richesses naturelles.
- Coates, Colin M. 2000. *The Metamorphoses of Landscape and Community in Early Quebec*: McGill-Queen's Press - MQUP.
- Cronon, William. 1992. *Nature's metropolis: Chicago and the Great West*. W.W. Norton.
- Currie, A. 1957. *The Grand Trunk Railway of Canada*. Toronto: University of Toronto Press.
- Dagenais, Michèle, and Caroline Durand. 2006. 'Cleaning, Draining, and Sanitizing the City: Conceptions and Uses of Water in the Montreal Region'. *The Canadian Historical Review* 87 (4):621-651.
- Dechêne, Louise. 1992. *Habitants and merchants in seventeenth-century Montreal*: McGill-Queen's University Press.
- Denault, J. Raymond, and A. J. H. Richardson. 1973. 'Sawing Stone in Canada, 1816'. *Bulletin of the Association for Preservation Technology* 5 (4):76-80.
- Dickinson, John Alexander, and Brian J. Young. 2003. *A short history of Quebec*: McGill-Queen's University Press.
- Fontaine, Achille. 1985. 'Durabilité des mortiers de maçonnerie en pays nordique Durability of Masonry Mortar in a Nordic Climate'. *Bulletin of the Association for Preservation Technology* 17 (2):49-66.
- Fougères, Dany. 2004. *L'approvisionnement en eau à Montréal: du privé au public, 1796-1865*: Les éditions du Septentrion.
- Fougères, Dany. 2006. 'Des eaux indésirables : Montréal et ses eaux de surface, 1796-1840'. *Revue d'histoire de l'Amérique française* 60 (1):95-124.
- Gandy, Matthew. 2003. *Concrete and Clay: Reworking Nature in New York City*: MIT Press.
- Gilliland, Jason. 2004. 'Muddy Shore to Modern Port: Redimensioning the Montreal Waterfront Time-space'. *Canadian Geographer* 48 (4):448-472.

- Goodman, Alvin S., and Makarand Hastak. 2006. *Infrastructure planning handbook: planning, engineering, and economics*: McGraw-Hill Professional.
- Goudge, Monson, and Canada. 1934. *Limestones of Canada, their occurrence and characteristics*. Ottawa: J.O. Patenaude Printer.
- Gournay, Isabelle, France Vanlaethem, and Centre canadien d'architecture. 1998. *Montreal metropolis, 1880-1930*: Stoddart.
- Hager, Albert David, and Elkanah Billings. 1862. *Report on the economical geology, physical geography and scenery of Vermont*. Printed by the Claremont manufacturing company.
- Henris, John, and The University of Akron. 2009. *Apples abound: Farmers, orchards, and the cultural landscapes of agrarian reform, 1820--1860*: ProQuest.
- Hitchcock, Edward. 1831. *Report on the geology of Vermont*. Hager.
- Hobsbawm, E. J. 1998. *On History*. London: Weidenfeld and Nicholson.
- Hodges, James. 1860. *Construction of the great Victoria Bridge in Canada*. London: J. Weale.
- Isard, Walter. 1942. 'A Neglected Cycle: The Transport-Building Cycle'. *The Review of Economics and Statistics* 24 (4):149-158.
- Jenkins, Kathleen. 1966. *Montreal, island city of the St. Lawrence*: Doubleday.
- Lambert, Phyllis, and Alan Stewart. 1992. *Opening the Gates of Eighteenth-Century Montreal*: The MIT Press.
- Legge, Charles. 1860. *A glance at the Victoria Bridge, and the men who built it*. J. Lovell.
- Linteau, Paul-André. 2000. *Histoire de Montreal depuis la Confédération*: Boréal.
- Linteau, Paul André, René Durocher, and Jean-Claude Robert. 1983. *Quebec, a history, 1867-1929*: James Lorimer & Company.
- Logan, Sir William Edmond. 1850. *Geological Survey of Canada - Report of progress for the year 1849-50*. Toronto: Lovell and Gibson.
- Logan, Sir William Edmond. 1863. *Report of progress from its commencement to 1863*: Dawson Brothers.

- Marsan, Jean-Claude. 1990. *Montreal in Evolution: Historical Analysis of the Development of Montreal's Architecture and Urban Environment*: McGill-Queen's University Press.
- Matthews, Geoffrey J. 1987. *Historical atlas of Canada*: University of Toronto Press.
- Matthews, Geoffrey J., and R. Louis Gentilcore. 1993. *Historical Atlas of Canada: The land transformed, 1800-1891*: University of Toronto Press.
- Mika, Nick, and Helma. 1972. *Railways of Canada: A Pictorial History*: McGraw-Hill Ryerson Limited.
- Museum, Redpath. 2002. *What building stones tell: a walking tour focusing on the fossil, rocks and minerals of Montreal buildings*. edited by McGill University: Redpath Museum, McGill University.
- Olson, Sherry. 2007. 'Downwind, downstream, downtown: the environmental legacy in Baltimore and Montreal'. *Environmental History* 12 (4).
- Parks, W. A.. 1913. *Report on the Building and Ornamental Stones of Canada. Volume III – Province of Quebec*. Ottawa: Canada Department of Mines, Mines Branch. Report 279.
- Pinard, Guy. 1987. *Montreal, son histoire, son architecture*: Les Éditions La Presse, Ltée.
- Richardson, A. J. H. 1970. 'Guide to the Architecturally and Historically Most Significant Buildings in the Old City of Quebec with a Biographical Dictionary of Architects and Builders and Illustrations'. *Bulletin of the Association for Preservation Technology* 2 (3/4):3-144.
- Robert, Jean-Claude. 1994. *Atlas historique de Montreal*: Art global.
- Schott, Dieter, Bill Luckin, and Geneviève Massard-Guilbaud. 2005. *Resources of the city: contributions to an environmental history of modern Europe*: Ashgate Publishing, Ltd.
- Selwyn, Alfred R. C.. 1877. *Geological Survey of Canada - Annual report for 1875-76*: Authority of Parliament.
- Tarr, Joel A. 1988. *Technology and the Rise of the Networked City in Europe and America*. Edited by G. Depuis: Temple University Press.

- Thompson, Zadock. 2010. *Appendix to the History of Vermont, Natural, Civil and Statistical 1853*: BiblioBazaar.
- Triggs, Stanley, Brian Young, Conrad Graham, and Gilles Lauzon. 1992. *Victoria Bridge: The Vital Link/Le Pont Victoria : Un Lien Vital*: McGill-Queen's University Press.
- Trudel, Marcel. 1973. *Le terrier du Saint Laurent en 1663*: Éditions de l'Université d'Ottawa.
- White, Richard. 1999. 'The Nationalization of Nature'. *The Journal of American History* 86 (3):976-986.
- Whitford, Noble E., Minnie M. Beal, New York State Engineer and Surveyor, and United States Dept of the Treasury Bureau of Statistics. 1906. *History of the canal system of the state of New York: together with brief histories of the canals of the United States and Canada*: Brandow Printing Company.
- Williams, Michael. 1994. 'The relations of environmental history and historical geography'. *Journal of Historical Geography* 20 (1):3-21.
- Wilson, Alice. 1936. *Contributions to the study of the Ordovician of Ontario and Quebec*. Ottawa: J.O. Patenaude I.S.O. Printer to the king.
- Zardini, Mirko, and Wolfgang Schivelbusch. 2005. *Sense of the city: an alternate approach to urbanism*: Canadian Centre for Architecture = Centre canadien d'architecture.