Tyndall Stone

Southeastern Manitoba is world famous for Tyndall Stone which is a 450 million years old, fossiliferous-rich, dolomitic-limestone from the Selkirk Member of the Late Ordovician Red River Formation. Tyndall Stone has been quarried at Garson Manitoba since 1910 (Fig. 1). In 2023, it was designated a ***Global Heritage Stone Resource*** (GHSR), the only Canadian stone on a list of 32 heritage stones from around the world. A GHSR designation is awarded to a natural stone that is used in the construction of historic buildings and monuments over an extended period of time (i.e., sometimes centuries). Tyndall Stone's GHSR designation represents international recognition of its historic use, wide-ranging geographic application, use in significant public and industrial projects, acknowledgement as a cultural icon, association with national identity, and contribution to architecture.

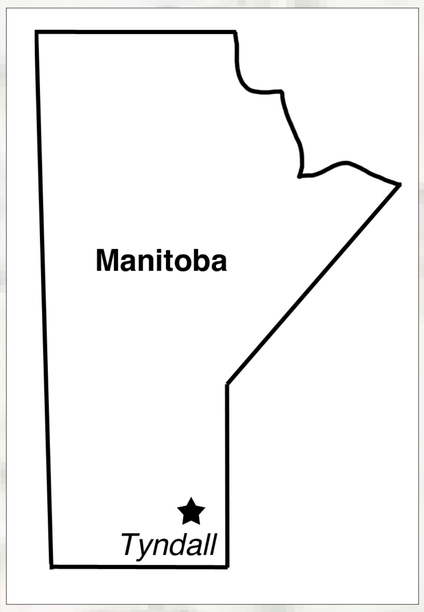

Figure 1. Location of Tyndall Stone Gillis Quarries, Garson, Manitoba (approximately 27 km NE of Winnipeg).

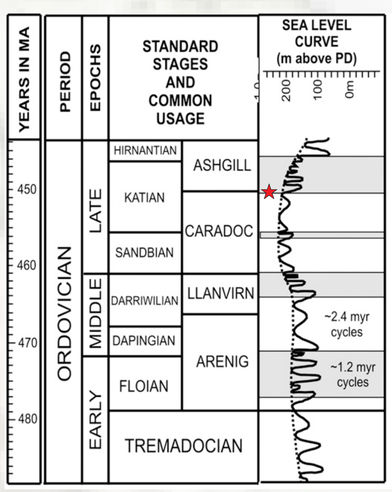

Figure 2. Global sea level was ≈ 200 m higher 450 mya in the Late Ordovician (red star).

Paleogeography

Tyndall Stone dolomitic-limestone originated in shallow tropical waters some 450 million years ago when Manitoba was in an equatorial latitude and Earth was in a naturally occurring greenhouse climatic state. Global sea level was over 200 m higher than today (Figs. 2, 3, 4).

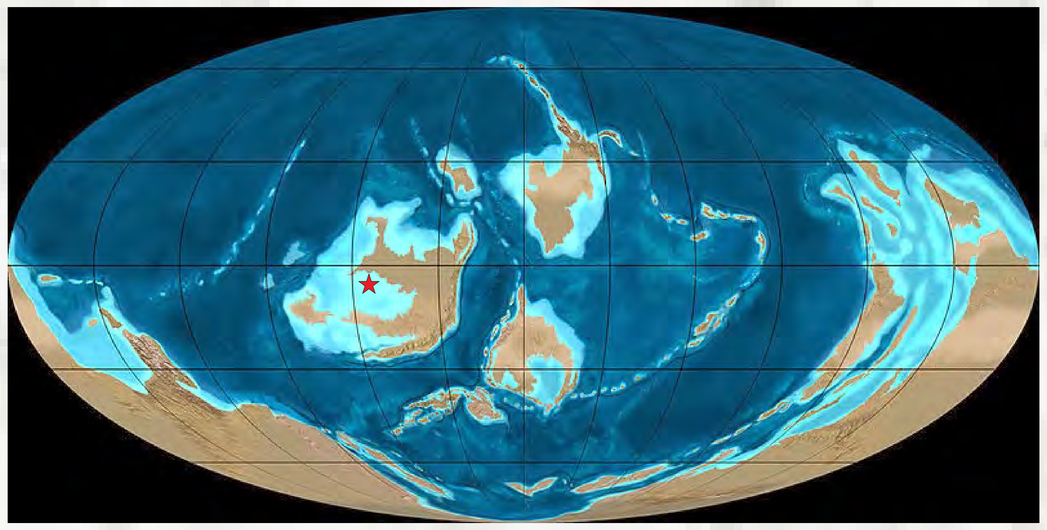

Figure 3. Paleogeography approximately 458 million years ago. Note that the Tyndall Manitoba (red star) region is covered by shallow equatorial seas (light blue).

Figure 4. Ordovician sea floor. Shallow marine. Tropical-equatorial. Manitoba 450 million years ago.

Tyndall Stone - Body Fossils

Fossils are ubiquitous including calcified skeletons from invertebrate animals (shells) and traces of their activity (burrows). Whole or partial body fossils of gastropods (snails), cephalopods, corals, and sponge-like organisms (i.e., Stromatoporoids*; Cyclostroma*) are common, while disarticulated-broken invertebrate remains from crinoids, bryozoans, and brachiopods constitute the sand-sized matrix. Body fossils include “chain corals” (e.g., *Halysites*-like), “honeycomb corals” (e.g., *Favosites*), straight shelled cephalopods-nautiloids (e.g., *Armenoceras*; Fig. 5), and “sunflower corals” (i.e., Receptaculites, *Fisherites*; Fig. 6).

Figure 5. *Armenoceras*.

Tyndall Stone - Trace Fossils

Trace fossils are pervasive and are highlighted by the grey-buff-coloured (i.e., darker) dolomitic mottling demarcating shrimp-like (i.e., *Thalassinoides*-like) burrows (Figs. 6, 7, 8). These infaunal benthic invertebrate organisms thrived in the shallow warm tropical waters, mining sediment for food. The slightly darker grey-buff-colour is due to dolomitization, while the surrounding lighter cream-coloured matrix is predominantly composed of calcite (i.e., limestone).

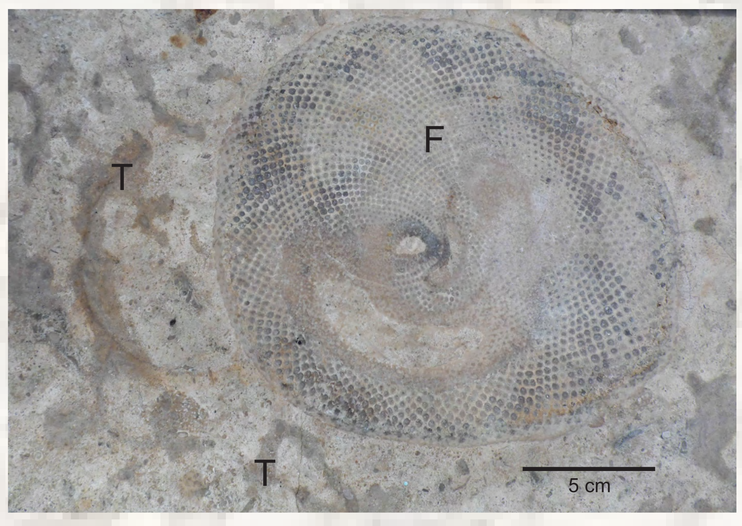

Figure 6. Tyndall Stone with a large “sunflower coral” *Fisherites* (F) body fossil and pervasive bioturbation highlighted by grey-buff mottling from *Thalassinoides*-like (T) trace fossil burrows.

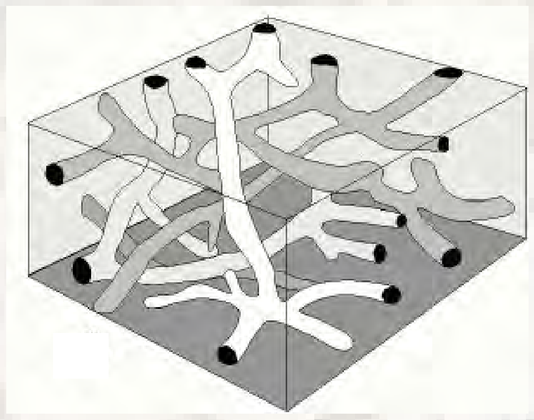

Figure 7. Schematic representation of the 3D *Thalassinoides* trace fossil burrow network.

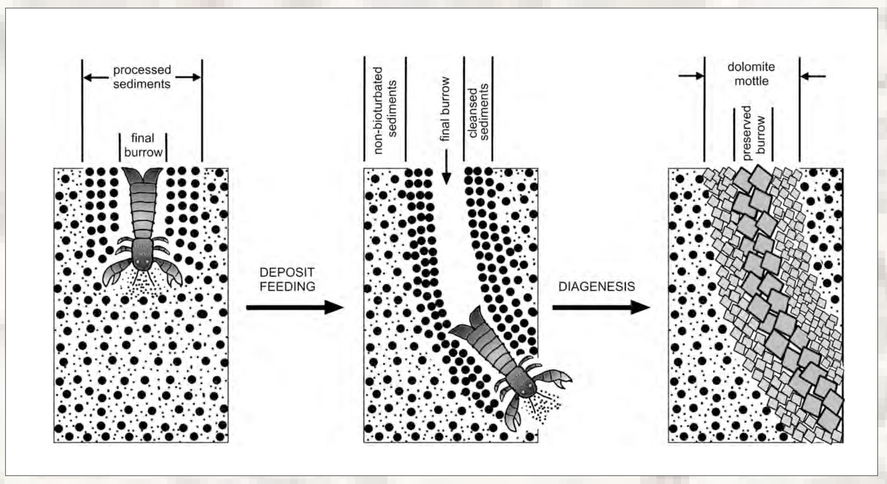

Figure 8. Genesis of the grey-buff coloured dolomitic mottling in Tyndall Stone. Original central burrow and burrow wall casing (i.e., mined sediment) from a shrimp-like (*Thalassinoides*-like) invertebrate organism.

Buildings with Tyndall Stone

Our Parliament Buildings in Ottawa, Legislative Building in Winnipeg, numerous Canadian embassies, and many BU campus buildings, including the foundation and steps of Clark Hall and the Knowles-Douglas Students' Union Centre, and exterior walls of the Health Studies Complex and Healthy Living Centre, to name a few, have Tyndall Stone.

References: Brisbin, W.C., Young, G., and Young, J., 2005, Geology of the Parliament Buildings 5: Geology of the Manitoba legislative building. Geoscience Canada, v. 32, n. 4, p. 177-193. Gingras, M.K., Pemberton, S.G., Muelenbachs, K., and Machel, H., 2004, Conceptual models for burrow-related, selective dolomitization with textural and isotopic evidence from the Tyndall Stone, Canada. Geobiology, v. 2, p. 21-30. Jin, J., Harper, D.A.T., Rasmussen, J.A., and Sheehan, P.M., 2012, Late Ordovician massive-bedded *Thalassinoides* ichnofacies along the palaeoequator of Laurentia. Palaeogeography, Palaeoclimatology, Palaeoecology, v. 367-368, p. 73-88. Lawrence, D.E., 2001, Building stones of Canada's federal parliament buildings. Geoscience Canada, v. 28, n. 1, p. 13-30. Young, G.A., 2017, Presidential Address: Sharing our vital science: observations of a public geologist. Geoscience Canada, v. 44, p. 125-132. Zheng, C.Y.C., , Mángano, M.G., and Buatois, L.A., 2018, Ichnology and depositional environments of the Upper Ordovician Stony Mountain Formation in the Williston Basin, Canada: Refining ichnofacies and ichnofabric models for Epeiric Sea carbonates. Palaeogeography, Palaeoclimatology, Palaeoecology, v. 501, p. 13-29.

Figure Links: Figure 1: https://artsandscience.usask.ca/museumofnaturalsciences/programming/downtown-tour/tyndall-stone.php Figure 2: https://www.semanticscholar.org/paper/High-frequency-eustatic-sea-level-changes-during-to-Turner-Armstrong/5ceda2c290774a10ab0610e49888ff31591f368e Figure 3: https://www.geologypage.com/2014/03/ordovician-period.html Figure 4: https://artsandscience.usask.ca/museumofnaturalsciences/programming/downtown-tour/tyndall-stone.php
Figure 5: https://www.chegg.com/flashcards/index-fossils-1e8d13cd-f8f5-4791-86c1-7a89a39ec3ce/deck Figure 6: https://en.wikipedia.org/wiki/Tyndall_stone#/media/File:Tyndal_Stone_with_fossil.jpg Figure 7: http://www.whaton.uwaterloo.ca/waton/s9911.html modified from Ekdale et al., 1984 Figure 8: https://www.sciencedirect.com/science/article/pii/S0031018211002689 Figure 10 in Jin et al., 2012

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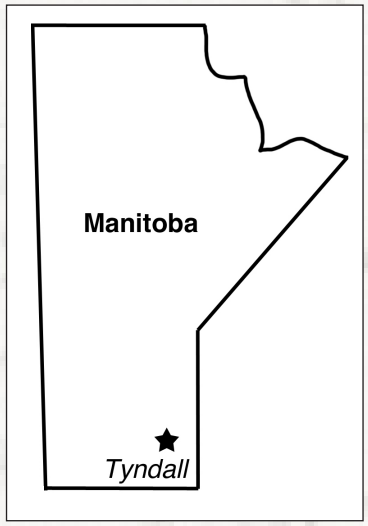

Figure 1. Location of Tyndall Stone Gillis Quarries, Garson, MB (≈ 30 km NE of Winnipeg).

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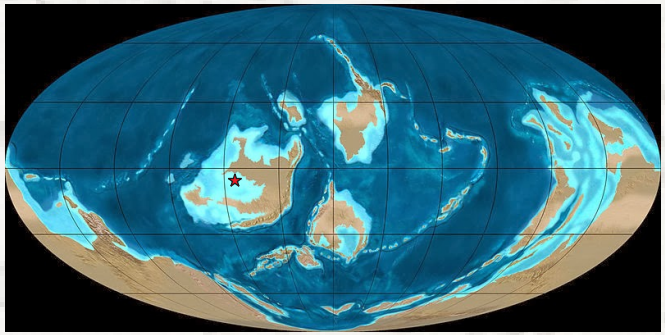

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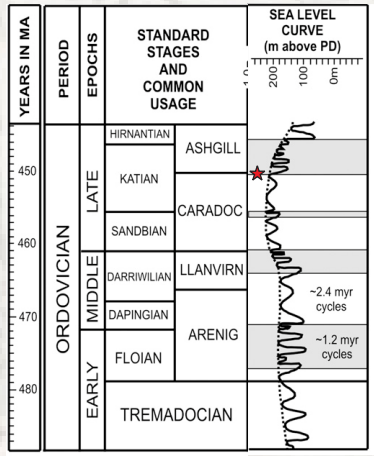

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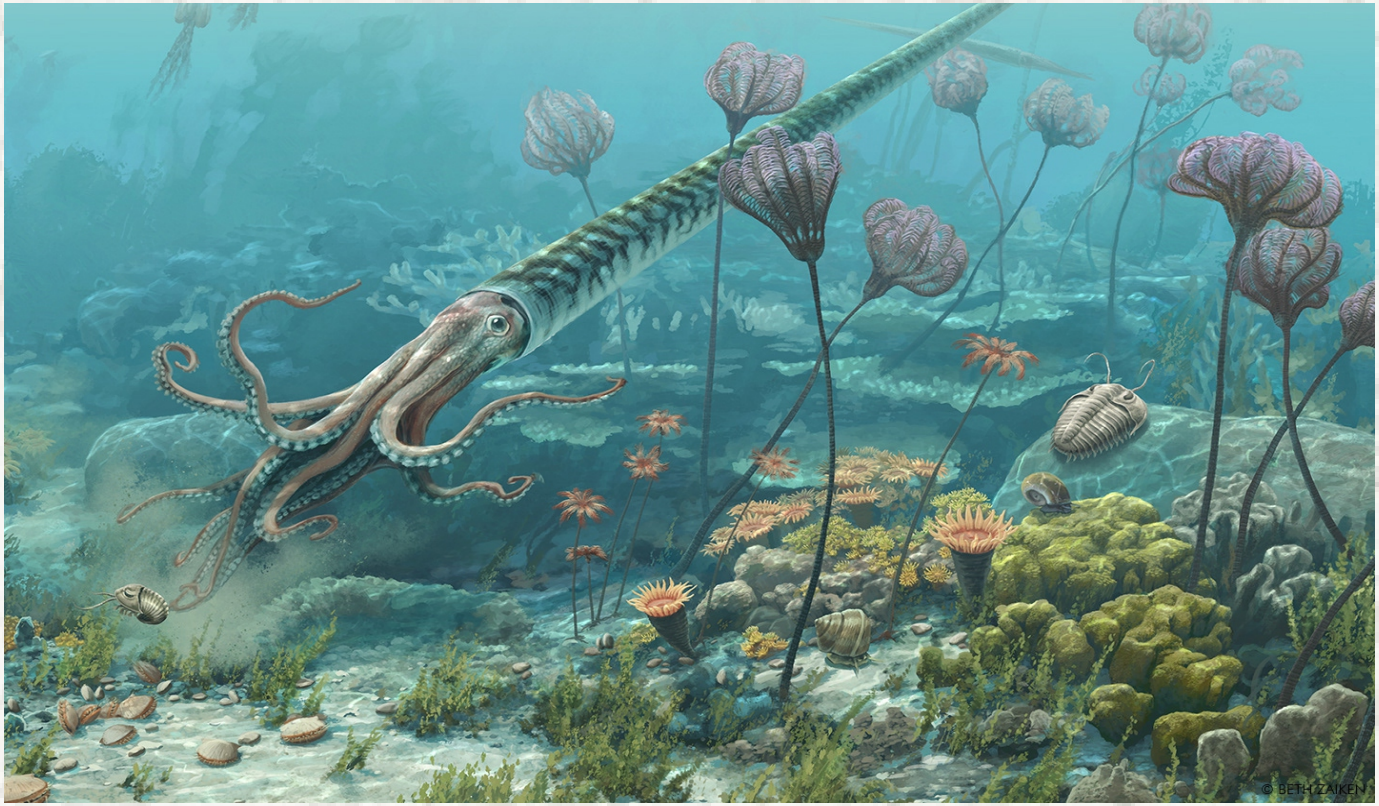

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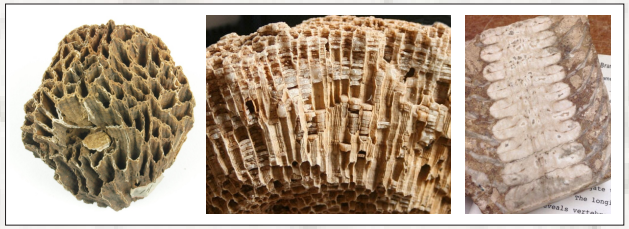

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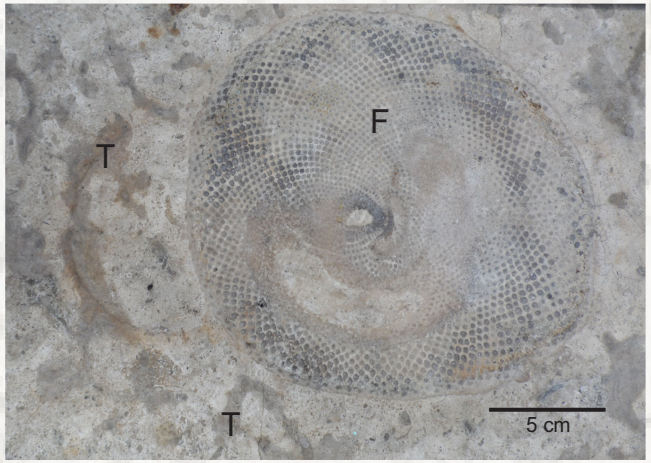

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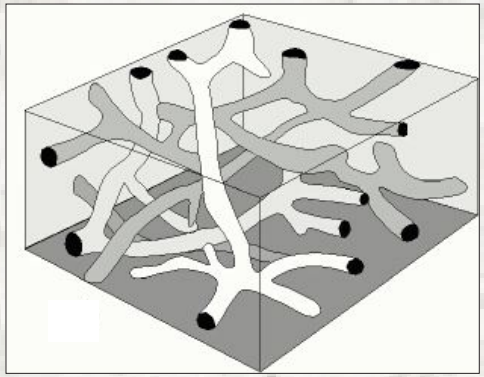

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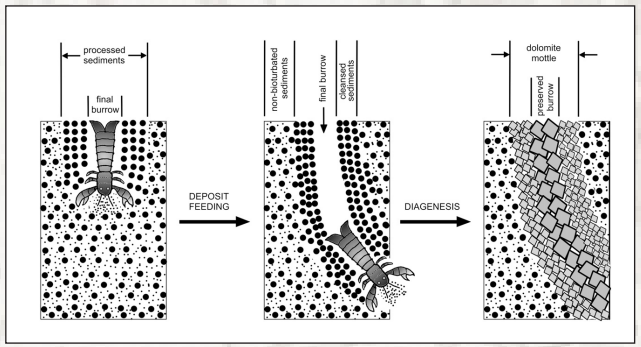

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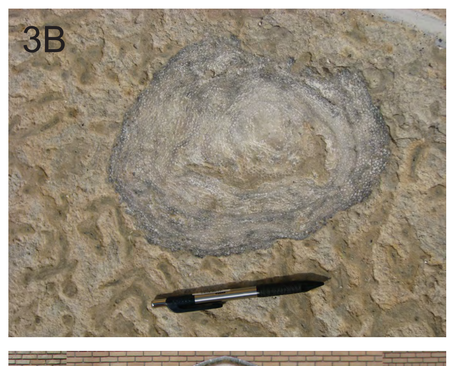
1. Healthy Living Centre

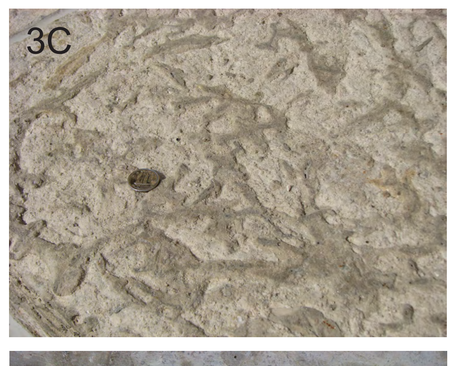
1A. South side walls, HLC. 1B. North side wall at main entrance, HLC. Tyndall datestone (2012).
1C. Gastropod (snail) *Hormotoma* fossil, east wall HLC. 1D. Honeycomb coral *Favosites* fossil, east wall HLC.

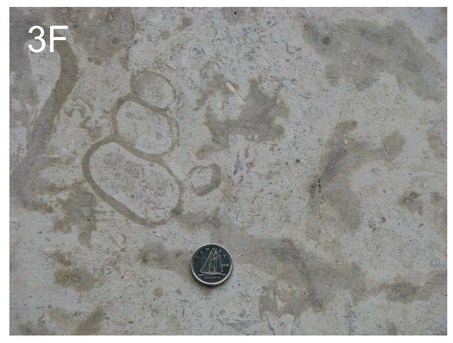
2. Rural Development Institute

2A. Main entrance and east wall, RDI. 2B. Solitary coral *Streptelasma* fossil (arrow), RDI. Dime for scale.

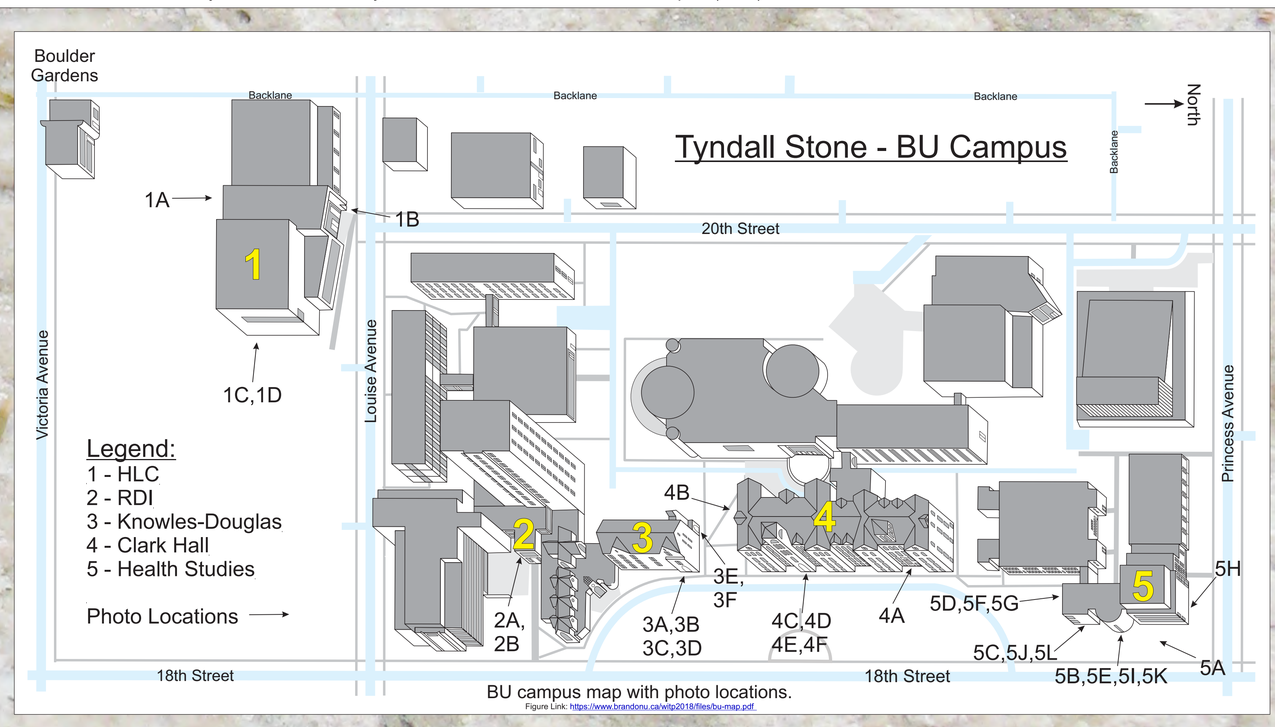
3. Knowles-Douglas Students' Union Centre







3A. Tyndall Stone foundation, steps, and door archway, Knowles-Douglas Students' Union Centre (KDSUC). Datestone (1922) is Tyndall Stone.
3B. Stromatoporoid (sponge-like) *Cyclostroma* fossil, KDSUC step. 3C, 3D. Raised dolomitic *Thalassinoides* (shrimp-like) burrows, KDSUC steps. Grey-buff coloured dolomite weathers slower compared to the surrounding white-cream coloured limestone matrix. Differential weathering. Dime for scale. 3E. Tyndall Stone archway, north entrance KDSUC. 3F. Gastropod (snail) *Hormotoma* fossil, north entrance KDSUC. Dime for scale.



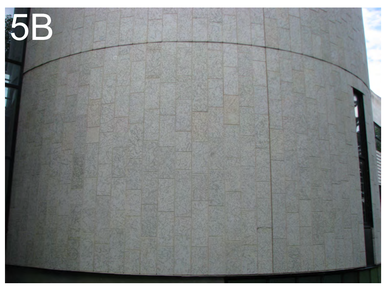
BU campus map with photo locations.
Figure Link: https://www.brandonu.ca/wltp2018/files/bu-map.pdf

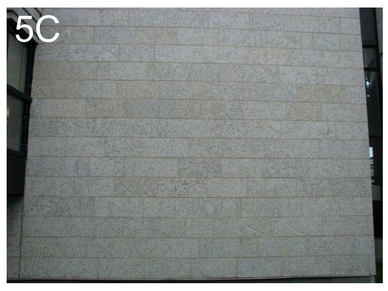
4. Clark Hall

4A. Tyndall Stone foundation, steps, awning, window ledges, and part of door archway, main entrance (east side-north) to Clark Hall (CH). Original building datestone (1900) is Tyndall Stone. 4B. Tyndall Stone foundation, steps, and window ledges, south entrance CH.

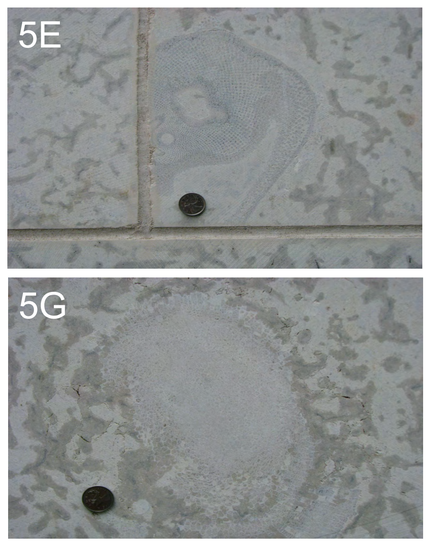
4C. Tyndall Stone foundation, steps, and parts of archway, east side-central entrance to CH.
4D. Tyndall Stone steps, east side-central entrance to CH.
4E. Large nautiloid (≈ 75 cm long) fossil, east side-central entrance steps, CH. Dime for scale.
4F. Well defined nautiloid fossil on the east side-central entrance steps, CH. Dime for scale.

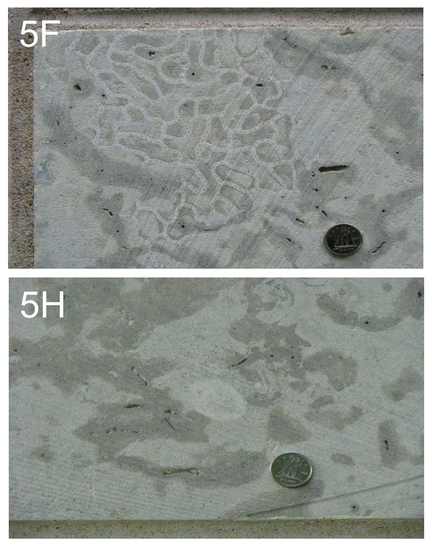
5. Health Studies Complex

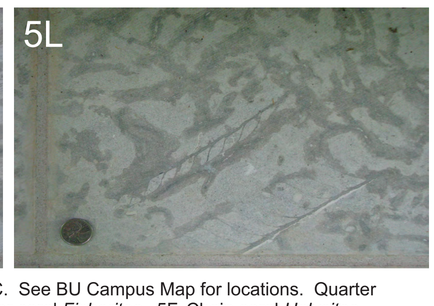


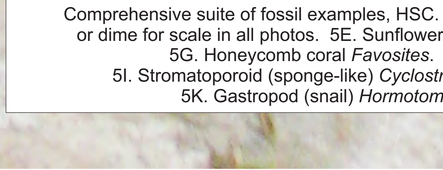


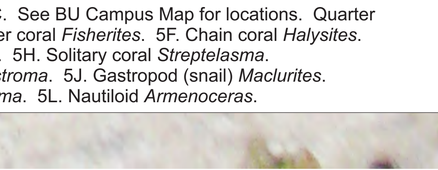
5A. Tyndall Stone, east side of the Dr. James & Mrs. Lucille Brown Health Studies Complex (HSC). 5B. Vertically oriented Tyndall Stone tiles, curved wall, HSC.
5C. Tyndall Stone, east side-south wall HSC. 5D. Tyndall Stone, south wall HSC. Datestone (2003) is Tyndall Stone.











Comprehensive suite of fossil examples, HSC. See BU Campus Map for locations. Quarter or dime for scale in all photos. 5E. Sunflower coral *Fisherites*. 5F. Chain coral *Halysites*.
5G. Honeycomb coral *Favosites*. 5H. Solitary coral *Streptelasma*.
5I. Stromatoporoid (sponge-like) *Cyclostroma*. 5J. Gastropod (snail) *Maclurites*.
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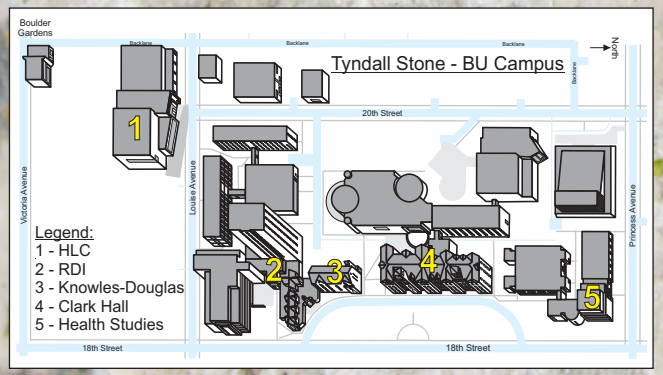

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2. Rural Development Institute

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4. Clark Hall

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