GS2020-8

Manitoba till-matrix geochemistry compilations: update and new releases

by M.S. Gauthier

Summary

Four new digital datasets represent the compilation of data from all known public till-geochemistry surveys carried out in Manitoba. The datasets are separated based on analytical method and size-fraction of the till matrix. Additionally, till-matrix carbonate data from surface samples have been compiled for the entire province, and are available as a hand-contoured map. This data can be brought into GIS software and integrated with other geoscience data, to generate new exploration targets and design follow-up exploration programs.

In Brief:

- Compilation of all till-geochemistry data in Manitoba
- Data available in Microsoft® Excel® for ease of use
- Statistics available to quickly quantify regional background and anomalous values

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Introduction

Four new digital datasets represent the compilation of data from all publicly available till-geochemistry surveys carried out in Manitoba (Figure GS2020-8-1). These include

- dataset 1: silt plus clay (<63 µm) size-fraction by instrumental neutron activation analysis (INAA; Gauthier, 2020a),
- dataset 2: silt plus clay (<63 µm) size-fraction by inductively coupled plasma–mass spectrometry (ICP-MS) after an aqua-regia or modified aqua-regia digestion (Gauthier, 2020b),
- dataset 3: clay (<2 µm) size-fraction by atomic absorption spectrometry (AAS) or inductively coupled plasma–emission spectrometry (ICP-ES) after aqua-regia digestion (Gauthier, 2020c), and
- dataset 4: visible gold grains in the heavy mineral (<2 mm; –10 mesh) size-fraction (Gauthier, 2020d).

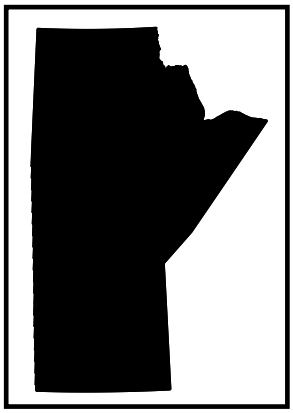
The first three datasets include graphs depicting the relative abundance (background values) of important elements across Manitoba—in both calcareous and noncalcareous till. These data will enable users to quickly identify if or where an element concentration is atypical for an area.

Collection methods

Till samples were collected from road cuts, borrow pits, ditches, natural exposures, hand-dug holes, Dutch-auger holes and boreholes across Manitoba. Wherever possible, till samples were collected from the C horizon in order to minimize potential weathering effects. To learn more about the characteristics of individual till samples, the reader is encouraged to view the individual project publications.

Compilation methods

The digital databases include data from 12 464 till samples collected from 53 different projects. No effort was made to reanalyze, level or otherwise standardize the data.



Carbonate in the till matrix

A significant portion of the till in Manitoba is calcareous. This carbonate has two sources—Paleozoic bedrock within the Hudson Bay Basin in the far northeast, and within the Western Canada Sedimentary Basin in the south (Wheeler et al., 1996). The net carbonate-dispersal pattern within the till is complex (Figure GS2020-8-2), and generally decreases in concentration to the west, southwest and south of Hudson Bay. The concentrations increase drastically within tills south of Flin Flon and Snow Lake, reflecting quick entrainment of calcareous detritus from the Western Canada Sedimentary Basin. Within this larger pattern, however, the calcareous surface tills locally contain a range of carbonate concentrations that relate to overprinting (dilution and/or reworking) and inheritance (preservation) during till transportation and deposition (e.g., Trommelen et al., 2013; Trommelen and Ross, 2014; Gauthier et al., 2019).

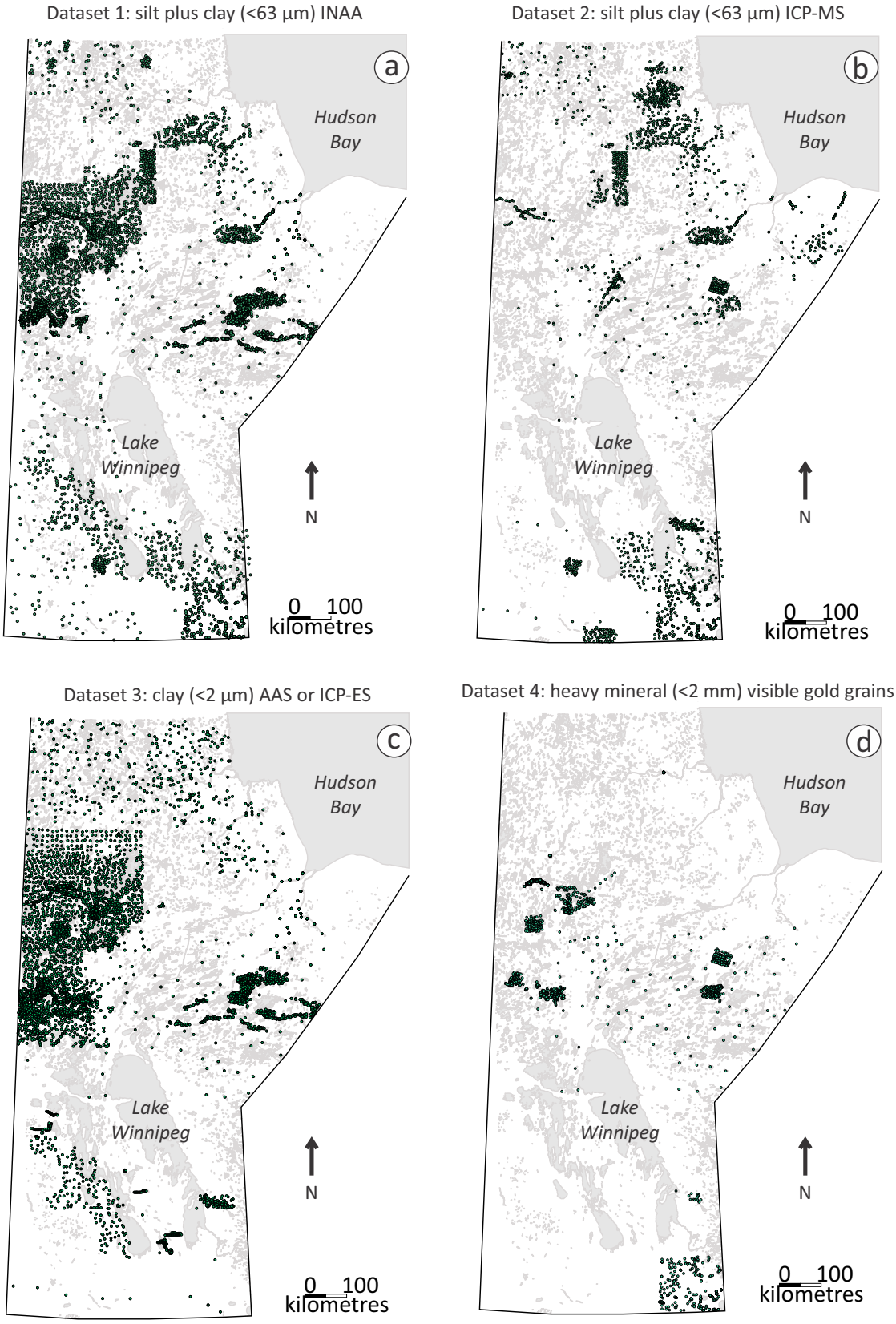


Figure GS2020-8-1: *The spatial extent of compiled till-matrix geochemistry datasets in Manitoba:* ***a)*** *dataset 1, silt plus clay (<63 µm size-fraction) by instrumental neutron activation analysis (INAA);* ***b)*** *dataset 2, silt plus clay (<63 µm size-fraction), analysis by inductively coupled plasma–mass spectrometry (ICP-MS);* ***c)*** *dataset 3, clay (<2 µm size-fraction), analysis by atomic absorption spectrometry (AAS) and inductively coupled plasma–emission spectrometry (ICP-ES);* ***d)*** *dataset 4, visible gold grains in the heavy mineral size-fraction (<2 mm). Green dots mark locations of analyzed samples.*

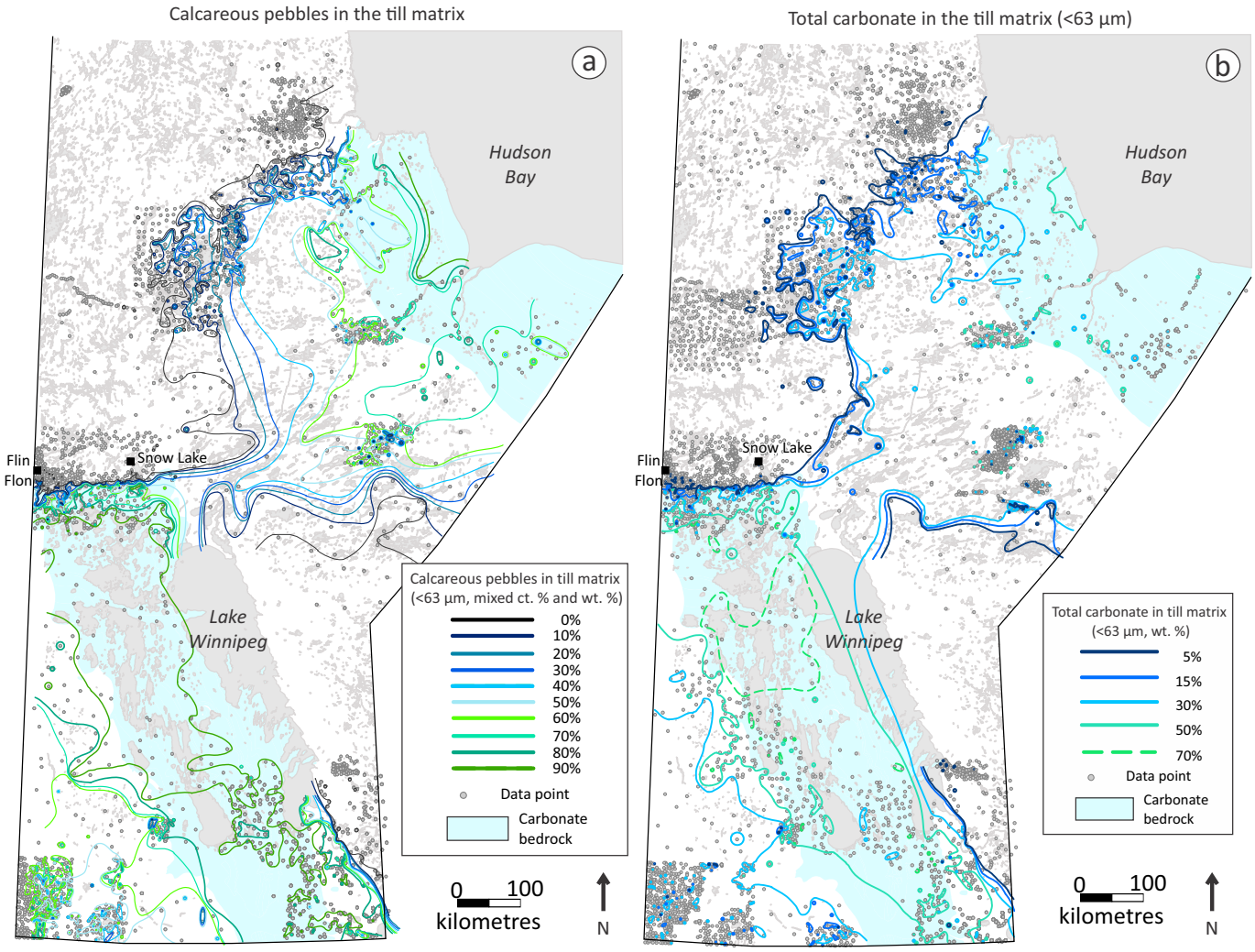


Figure GS2020-8-2: *Hand-contoured distribution of* ***a)*** *calcareous pebbles and* ***b)*** *total carbonate in the till matrix (silt plus clay, <63 µm size-fraction) of surface till samples in Manitoba. These compilations represent ongoing work and are sourced from a number of different studies with slightly different methods (Manitoba Agriculture and Resource Development, 2020). Owing to the limited number of data points in most areas, the hand-contoured data are not accurate at a detailed scale but provide a general overview of the carbonate-dispersal pattern. Similarly, the contours are more detailed where local-scale fieldwork has been conducted. The area in white is underlain by noncarbonate rocks (modified after Manitoba Department of Mines, Natural Resources and Environment, 1979).*

Prospective and background concentrations

Carbonate rocks can mask, or dilute, the 'signature' of elements important to exploration. 'Low' concentrations of desired elements in calcareous till may be more prospective than the same concentrations within noncalcareous till. The reason why a particular relationship occurs would depend on what bedrock the till is overlying, what bedrock types the till is sourced from, and what other materials may have been incorporated into the till (glaciolacustrine, glaciomarine, nonglacial sediments, etc.). In general, calcareous values should be noted and different populations may need to be treated as separate datasets.

Economic considerations

Till-sample analysis is commonly used in drift-covered regions to help determine the source area for mineralized erratics, boulder trains and anomalous lake geochemistry or geophysical data. These new till-matrix geochemistry datasets will allow users to quickly view, compile and interact with the data from various regions of Manitoba.

Acknowledgments

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References

Gauthier, M.S. 2020a: Manitoba till-matrix geochemistry compilation 1: silt plus clay (<63 µm) size-fraction by instrumental neutron activation analysis; Manitoba Agriculture and Resource Development, Manitoba Geological Survey, Open File OF2020-2, URL <https://www.manitoba.ca/iem/info/libmin/OF2020-2.zip> [September 2020].

Gauthier, M.S. 2020b: Manitoba till-matrix geochemistry compilation 2: silt plus clay (<63 µm) size-fraction by inductively coupled plasma–mass spectrometry after an aqua-regia or modified aqua-regia digestion; Manitoba Agriculture and Resource Development, Manitoba Geological Survey, Open File OF2020-3, URL <https://www.manitoba.ca/iem/info/libmin/OF2020-3.zip> [September 2020].

Gauthier, M.S. 2020c: Manitoba till-matrix geochemistry compilation 3: clay (<2 µm) size-fraction by atomic absorption spectrometry or inductively coupled plasma–emission spectrometry after aqua-regia digestion; Manitoba Agriculture and Resource Development, Manitoba Geological Survey, Open File OF2020-5, URL <https://www.manitoba.ca/iem/info/libmin/OF2020-5.zip> [September 2020].

Gauthier, M.S. 2020d: Manitoba till-matrix geochemistry compilation 4: visible gold grains in the heavy mineral (<2 mm; –10 mesh) size-fraction; Manitoba Agriculture and Resource Development, Manitoba Geological Survey, Open File OF2020-6, URL <https://www.manitoba.ca/iem/info/libmin/OF2020-6.zip> [September 2020].

Gauthier, M.S., Hodder, T.J., Ross, M., Kelley, S.E., Rochester, A. and McCausland, P. 2019: The subglacial mosaic of the Laurentide Ice Sheet, a study of the interior region of southwestern Hudson Bay; Quaternary Science Reviews, v. 214, p. 1–27, URL <https://doi.org/10.1016/j.quascirev.2019.04.015>.

Manitoba Agriculture and Resource Development 2020: Manitoba carbonate dispersal analyses in till; Manitoba Agriculture and Resource Development, URL <https://www.manitoba.ca/iem/geo/surficial/carbonate.html> [September, 2020].

Manitoba Department of Mines, Natural Resources and Environment 1979: Geological map of Manitoba; Manitoba Department of Mines, Natural Resources and Environment, Mineral Resources Division, Geological Report GR79-2, scale 1:1 000 000.

Trommelen, M.S. and Ross, M. 2014: Distribution and type of sticky spots at the centre of a deglacial streamlined lobe in northeastern Manitoba, Canada; Boreas, v. 43, p. 557–576, URL <https://doi.org/10.1111/bor.12064>.

Trommelen, M.S., Ross, M. and Campbell, J.E. 2013: Inherited clast dispersal patterns: implications for paleoglaciology of the SE Keewatin Sector of the Laurentide Ice Sheet; Boreas, v. 42, no. 3, p. 693–713, URL <https://doi.org/10.1111/j.1502-3885.2012.00308.x>.

Wheeler, J.O., Hoffman, P.F., Card, K.D., Davidson, A., Sanford, B.V., Okulitch, A.V. and Roest, W.R. 1996: Geological map of Canada; Geological Survey of Canada, Map 1860A, scale 1:5 000 000.