

1.) Problems and Objectives

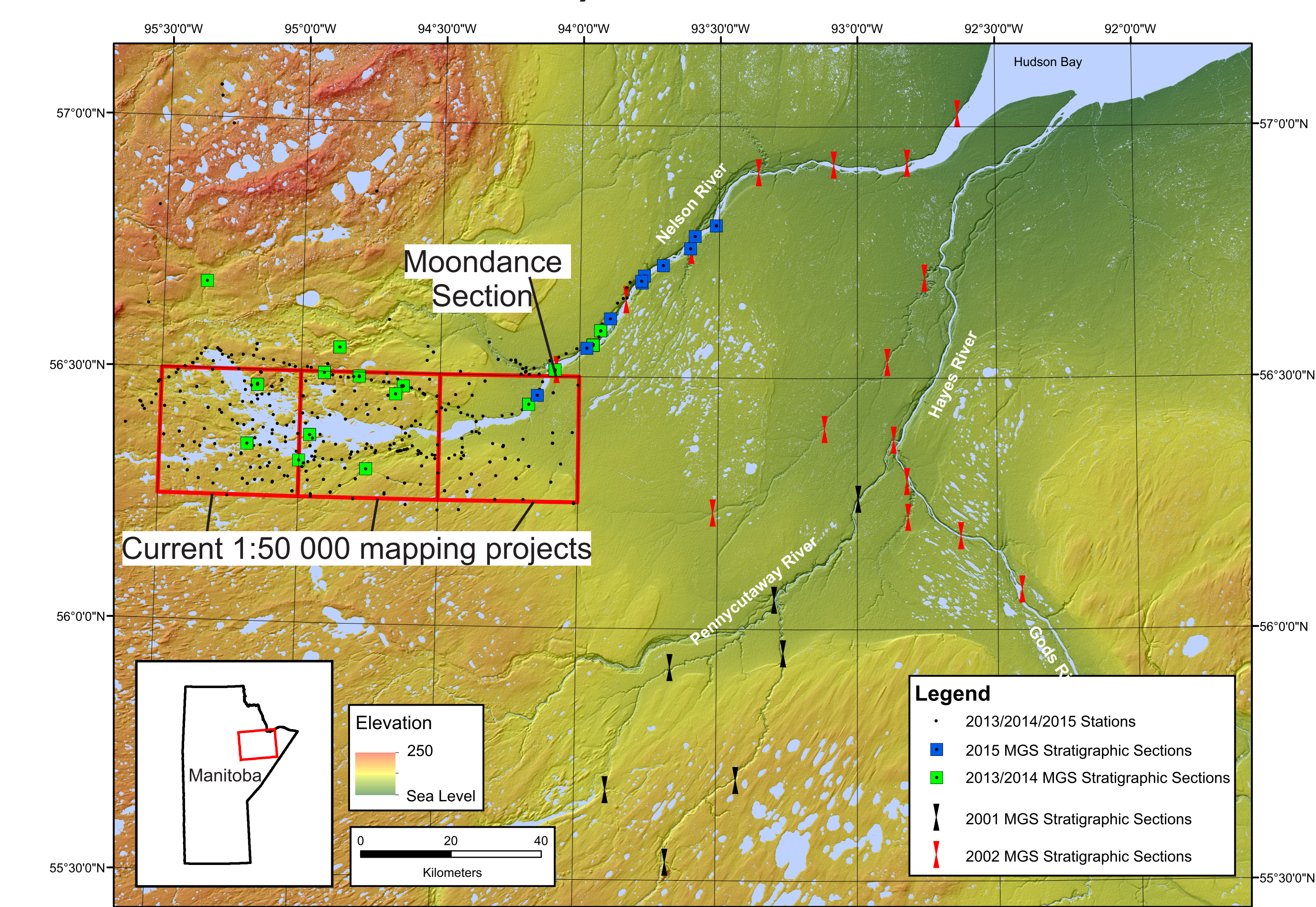
Problems:

- The current till stratigraphy of the Hudson Bay lowland (HBL) contains four units, which have been defined mainly on the basis of a limited number of characteristics or general facies (e.g. color, structure) and contact relationships. Numerous new sections have been discovered from the region and it is becoming clear that the identifying characteristics for these till units are insufficient for correlations and ice sheet reconstructions in the region.
- Clast-fabric analysis is complex, as there are more than four ice flow phases recorded. The erosional record contains a multitude of ice-flow orientations which do not correlate directly to four till units.

Objectives:

- Ongoing research aims to further characterize the tills (facies analysis) using a comprehensive approach to improve the framework and overall understanding of glacial dynamics, till production and ice sheet history. Methods being employed in this study include:
 - Clast-lithology counts
 - Till-matrix geochemistry
 - 3D clast fabrics
 - Stratigraphic relationships

2.) Location



Location of the stratigraphic sections incorporated in this study. Ongoing field work is focused on mapping the surface and subsurface sediments within a 6500 km² area, designated by the red polygons. Data from unpublished sections that were studied by the Manitoba Geologic Survey in 2002 are also being revised.

3.) Current Stratigraphic Framework

Undifferentiated Till

Sky Pilot Till

See Dredge and McMartin (2011) for stratigraphic column

Long Spruce Till

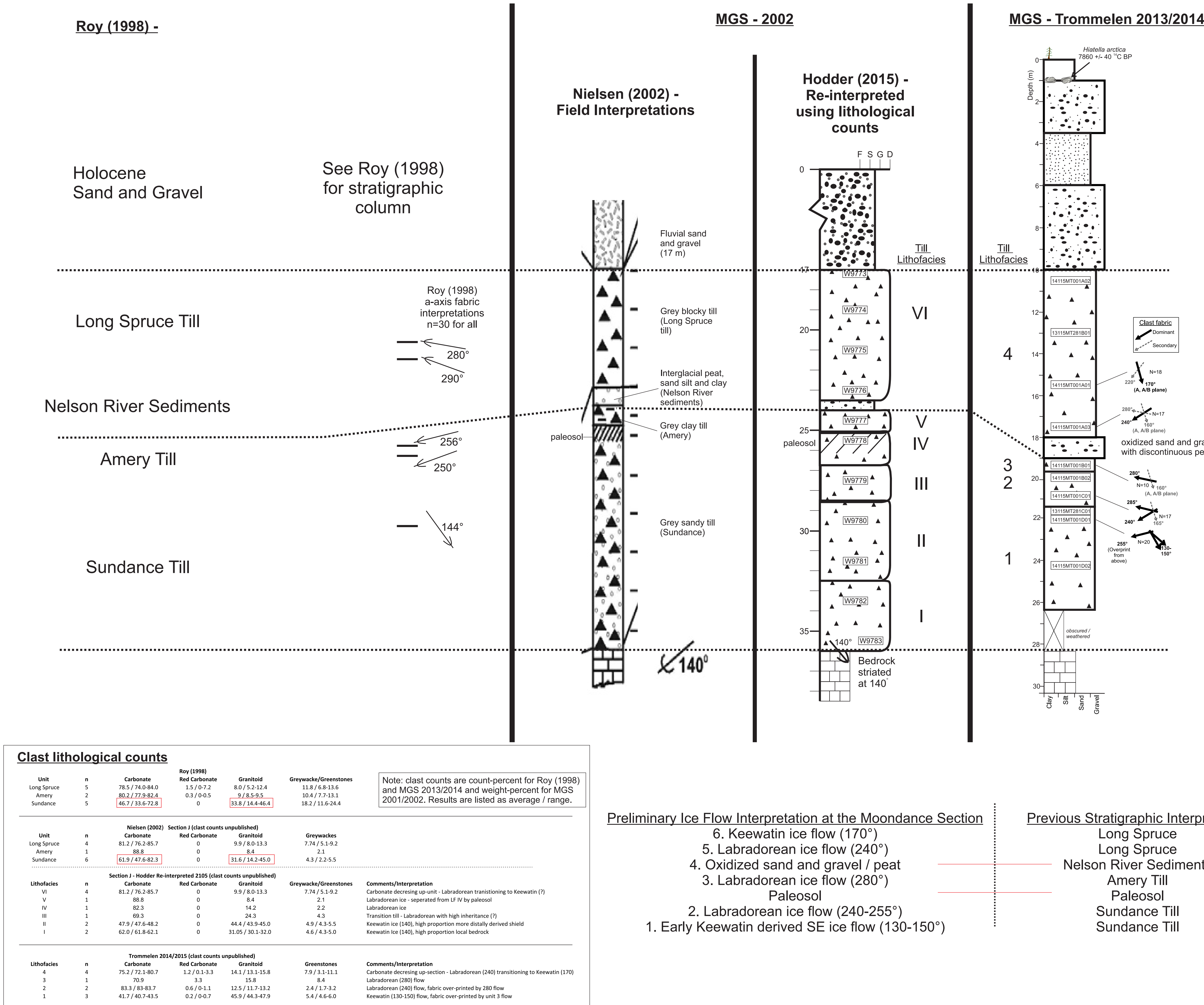
Sangamon Interglaciation

Amery Till

Interglaciation

Sundance Till

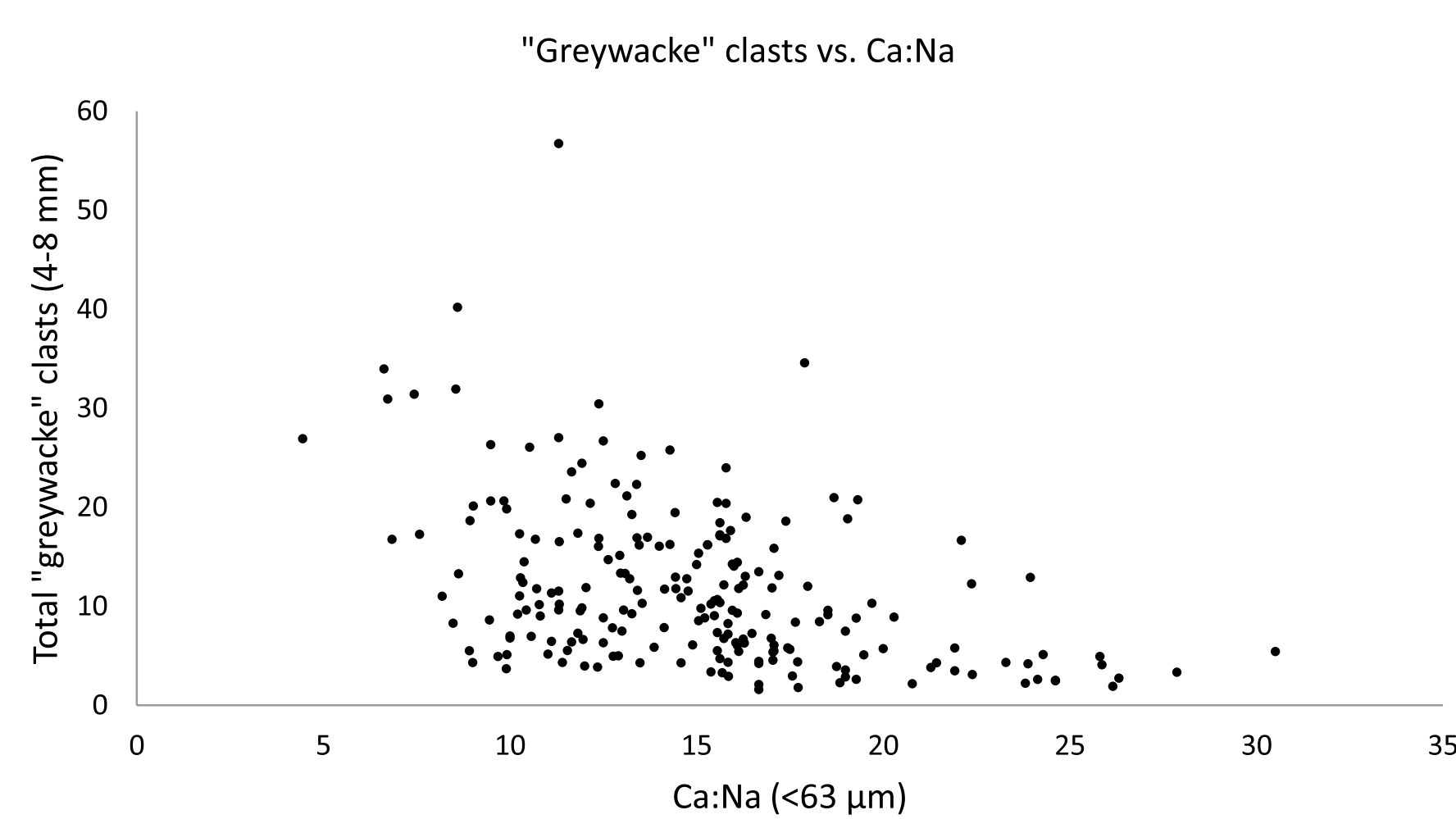
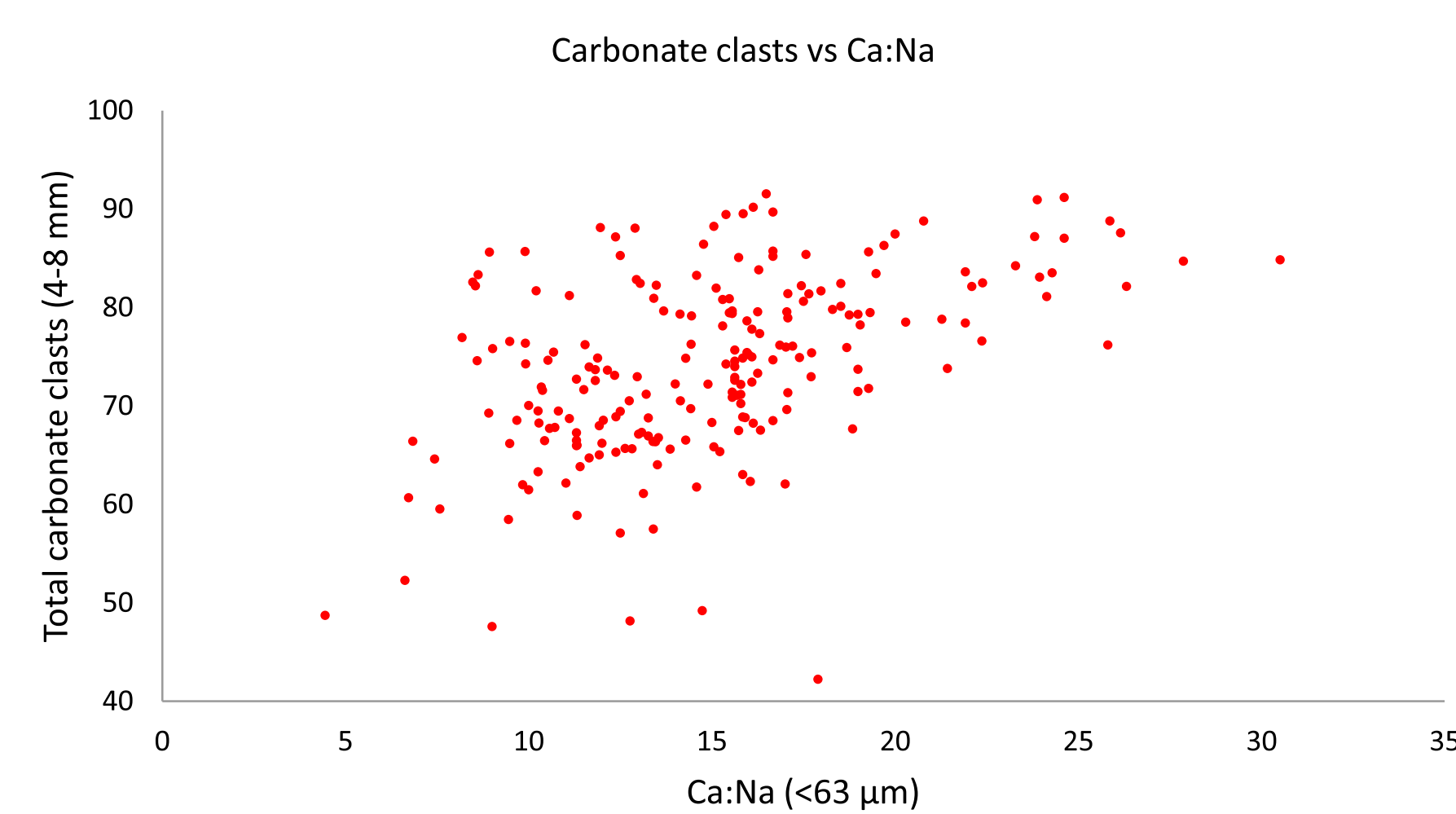
4.) The Moondance section - a comparison of three separate stratigraphic studies



Newer (Trommelen and Hodder) interpretations rely more on data analysis, while older (Nielsen and Roy) interpretations relied more on field observations to name till units.

5.) Greenstone vs. Greywacke clasts - Precambrian Shield (west and north) vs Proterozoic and Paleozoic (east and northeast) provenance

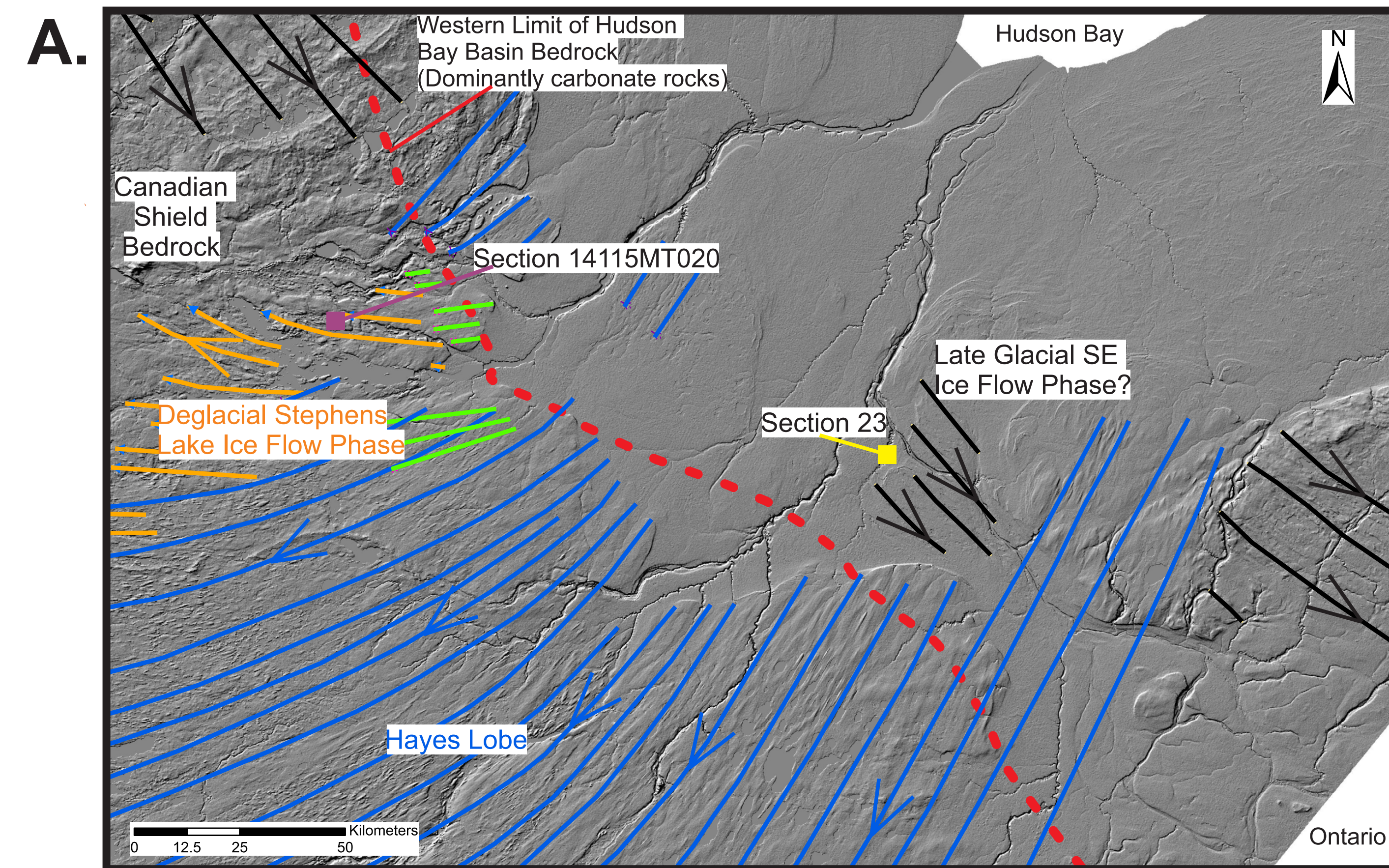
- The proportion of Proterozoic greywackes, interpreted as sourced from the Belcher Group in eastern Hudson Bay (Prest et al. 2000) has been utilized to infer Labradorean ice flow in the past (e.g. Nielsen and Fedikow 2002)
- Caution must be exercised to ensure these clasts are properly identified in clast counts and that they are not of greenstone affinity
- For example, 2001 and 2002 clast counts identified all 'grey' rocks as greywackes. A comparison with Ca:Na ratio of the till matrix (a carbonate-platform signature) shows there is an inverse relationship. Hence, it is more likely that the majority of these grey rocks are actually Precambrian greenstones and not of eastern provenance.
- This highlights one of the challenges of determining till provenance in the HBL that can be enhanced through detailed further geochemical characterization.



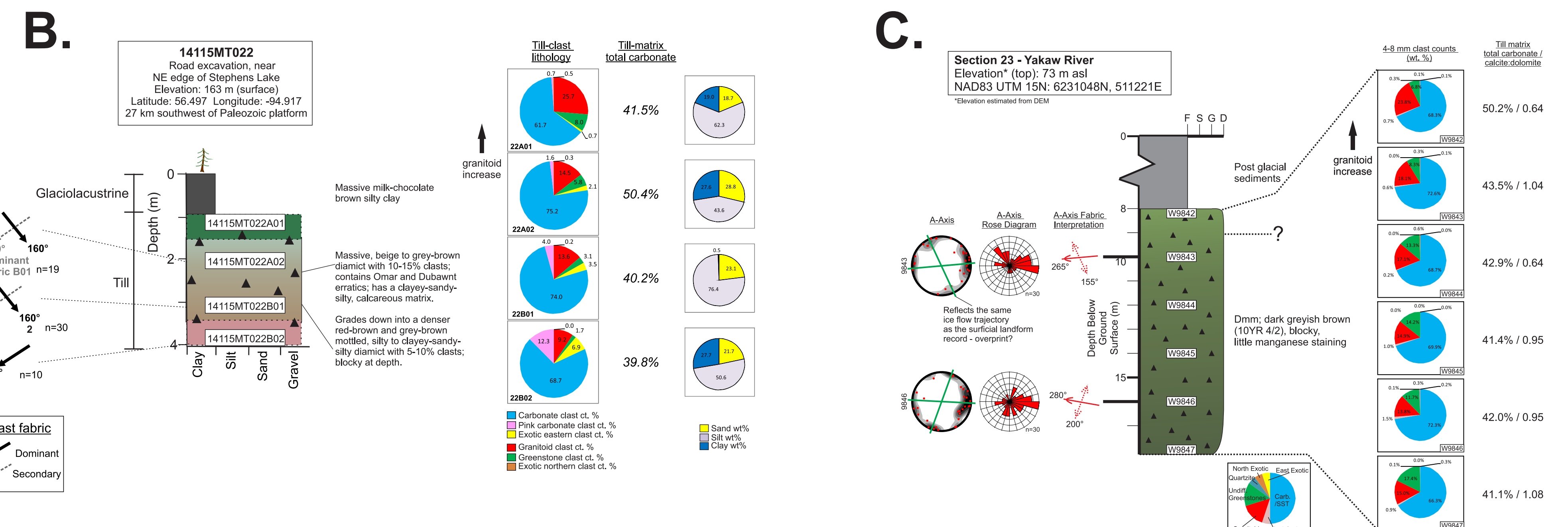
MGS greywacke and carbonate clast counts (weight percent, n=213) from 2001 and 2002 samples compared to the Ca:Na ratio of the <63 µm fraction. The Ca:Na ratio is commonly used as a proxy for carbonate content (e.g. Trommelen and Ross 2014). These plots suggest a shield provenance for the majority of the clasts and should be classified as greenstones.

6.) Unexpected Late Glacial southeasterly flow

- It is important to conduct clast-lithology and clast-fabric analyses as not all ice-flow phases are recorded in the surface geomorphology. As shown below, we have identified a previously undocumented late-deglacial southeasterly ice flow that transported subglacial detritus to the area.



A. Streamlined landform flowsets in the study area. The western limit of carbonate bedrock associated with Hudson Bay basin is depicted by the dashed red line. Several sections within the region have an increased proportion of granitoid clasts in the uppermost till, including sections 14115MT022 (B.) and 23 (C.) depicted below. Clast fabrics from these units suggest a late southeast ice-flow phase, conforming to the black flowset depicted in A.



7.) Current and Future Work

- Processing the geochemistry results and statistical correlation across the study area.
- Comparing till lithofacies results to work towards a stratigraphic framework for the region.
- 2015 stratigraphic fieldwork was concentrated on visiting new sections along the Nelson River and collecting additional observations from previously logged sections.

8.) Preliminary Conclusions

- Using a quantified approach, it is becoming apparent that the Quaternary stratigraphy of northeast Manitoba is much more complex than previously recognized.
- Complex overprinting relationships are recognized by combining **both** till fabric and lithological/geochemical relationships.
- The identification of greywacke clasts needs to be carefully addressed to properly identify till provenance.

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References:

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