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Rationale and Research Goals

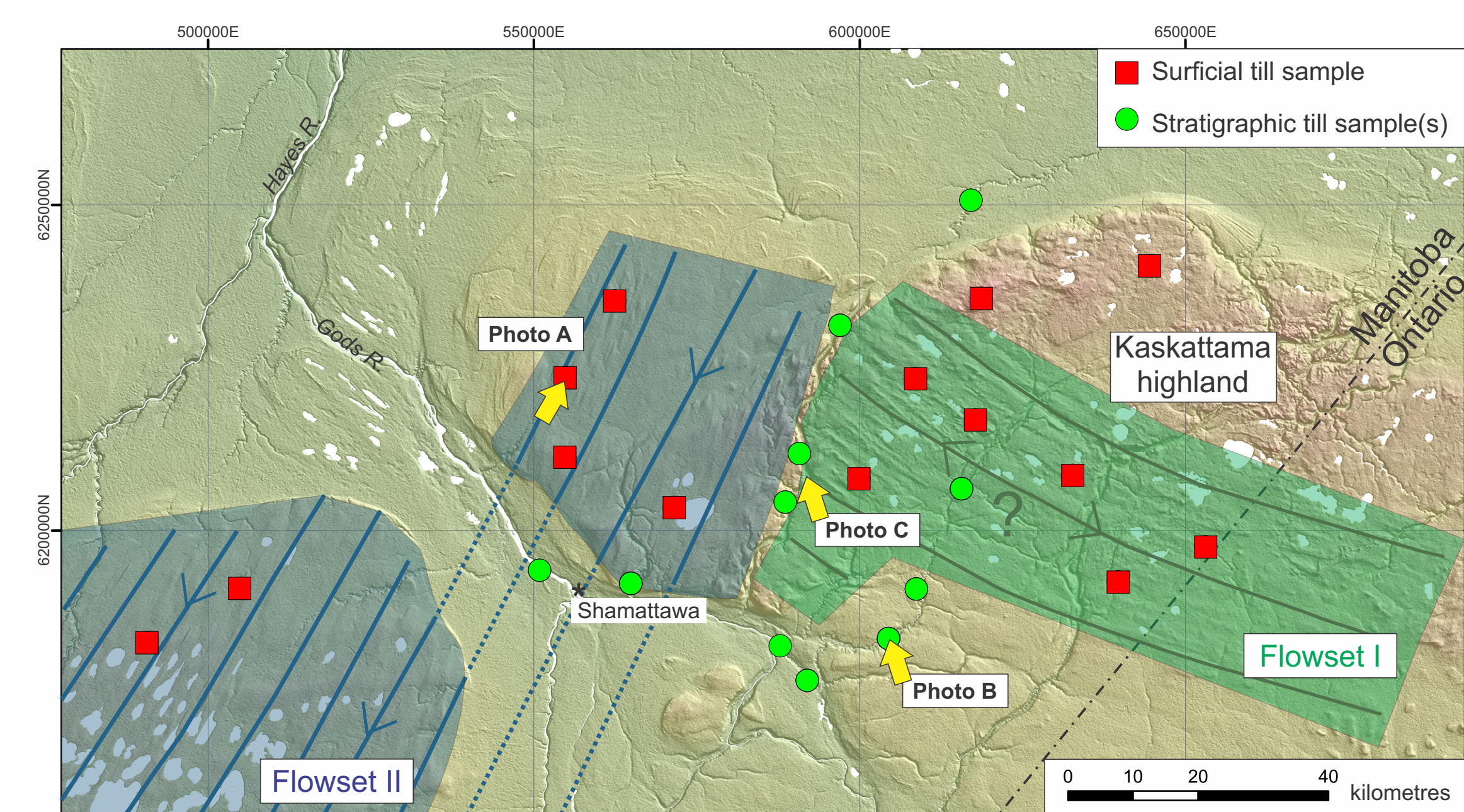
Problem

- The Kaskattama highland is a prominent topographic high in the Hudson Bay Lowland (HBL), though the reason for this elevated terrain within the low relief lowland is not understood.
- A single drillhole from the northwestern part of the highland intersected 223 m of drift – leading to the assumption that the entire highland is composed of thick drift.
- The Quaternary stratigraphy of this region is poorly understood or unknown for most of the study area.

The research goals

- Log the Quaternary stratigraphy and sample surface and subsurface till to investigate the till stratigraphy in the Kaskattama highland area in an effort to link subsurface stratigraphy to geomorphic features.
- Compare the till-composition regionally within the HBL to interpret provenance.

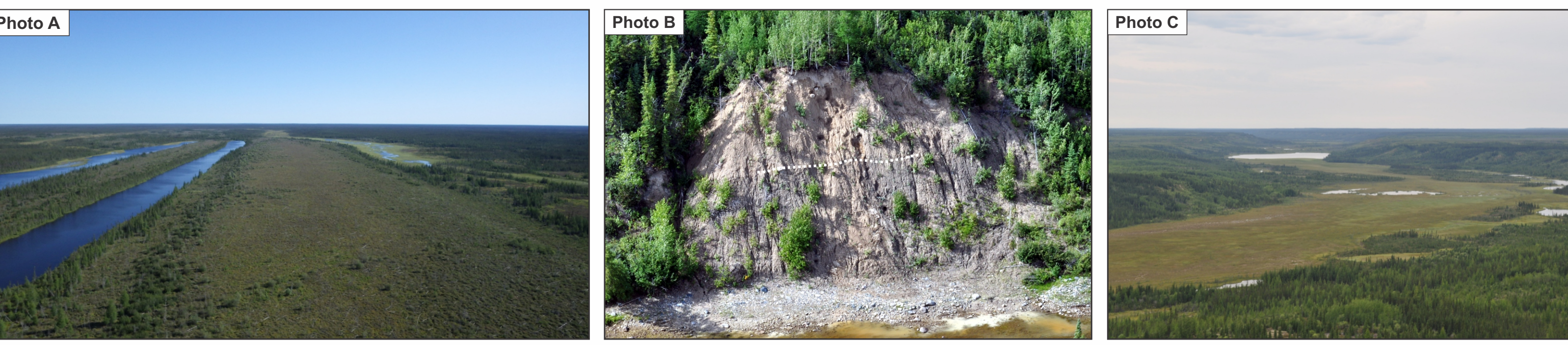
Geomorphology



Two streamlined landform flowsets are recognized within the Kaskattama highland region:
 • Flowset I is either northwest- or southeast-trending
 • Flowset II is related to the southwest-trending deglacial Hayes lobe

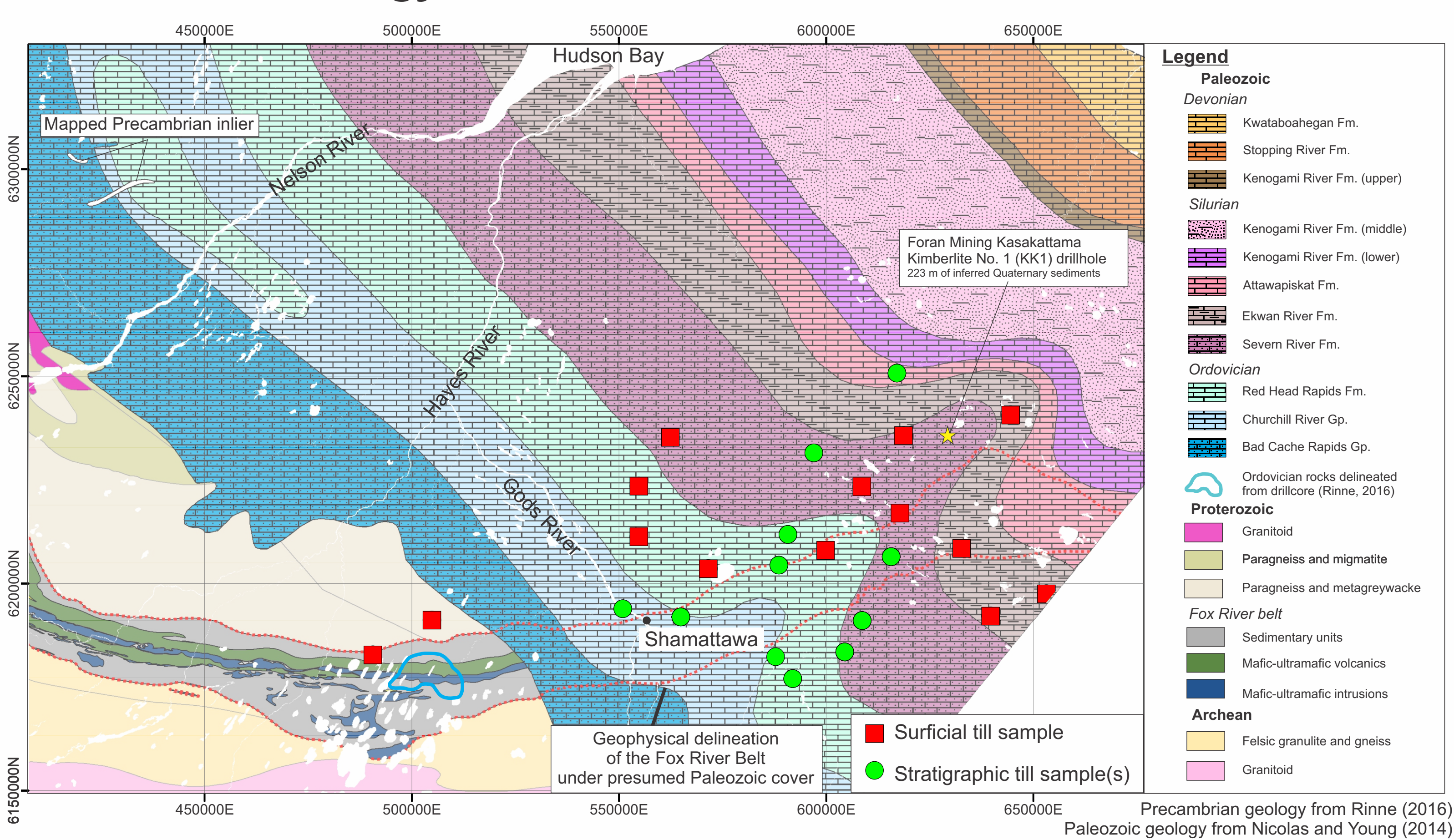
The surficial till was sampled from Flowset I and II to document the till composition.

The Quaternary stratigraphy was logged where natural exposures were present.

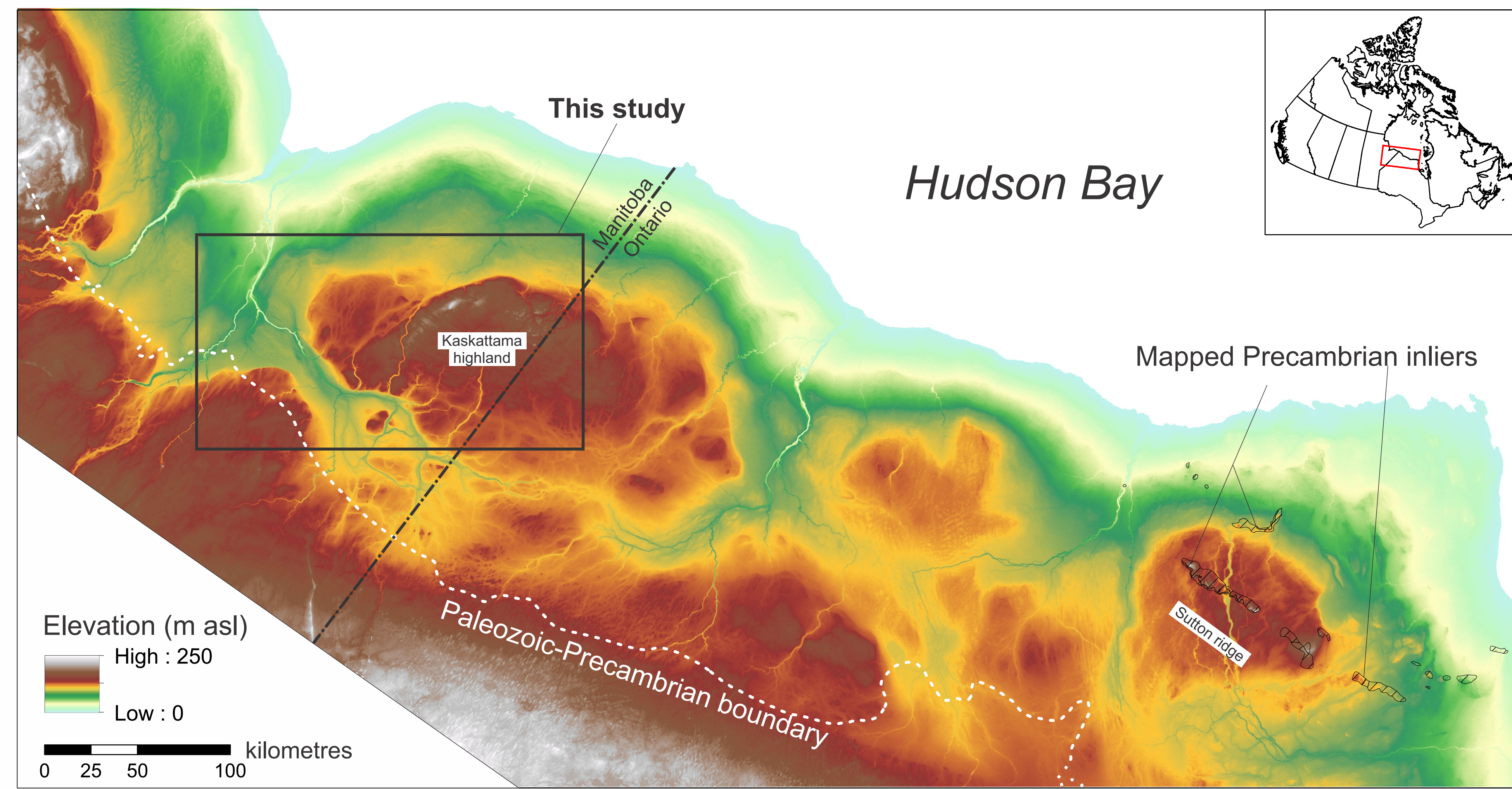


Oblique aerial view of a streamlined landform sampled. Example of a Quaternary section logged. This section has a two till stratigraphy separated by a gravel unit indicated by the dashed line. Oblique aerial view of one of the meltwater channels cutting across the Kaskattama highland.

Bedrock Geology of Northeastern Manitoba

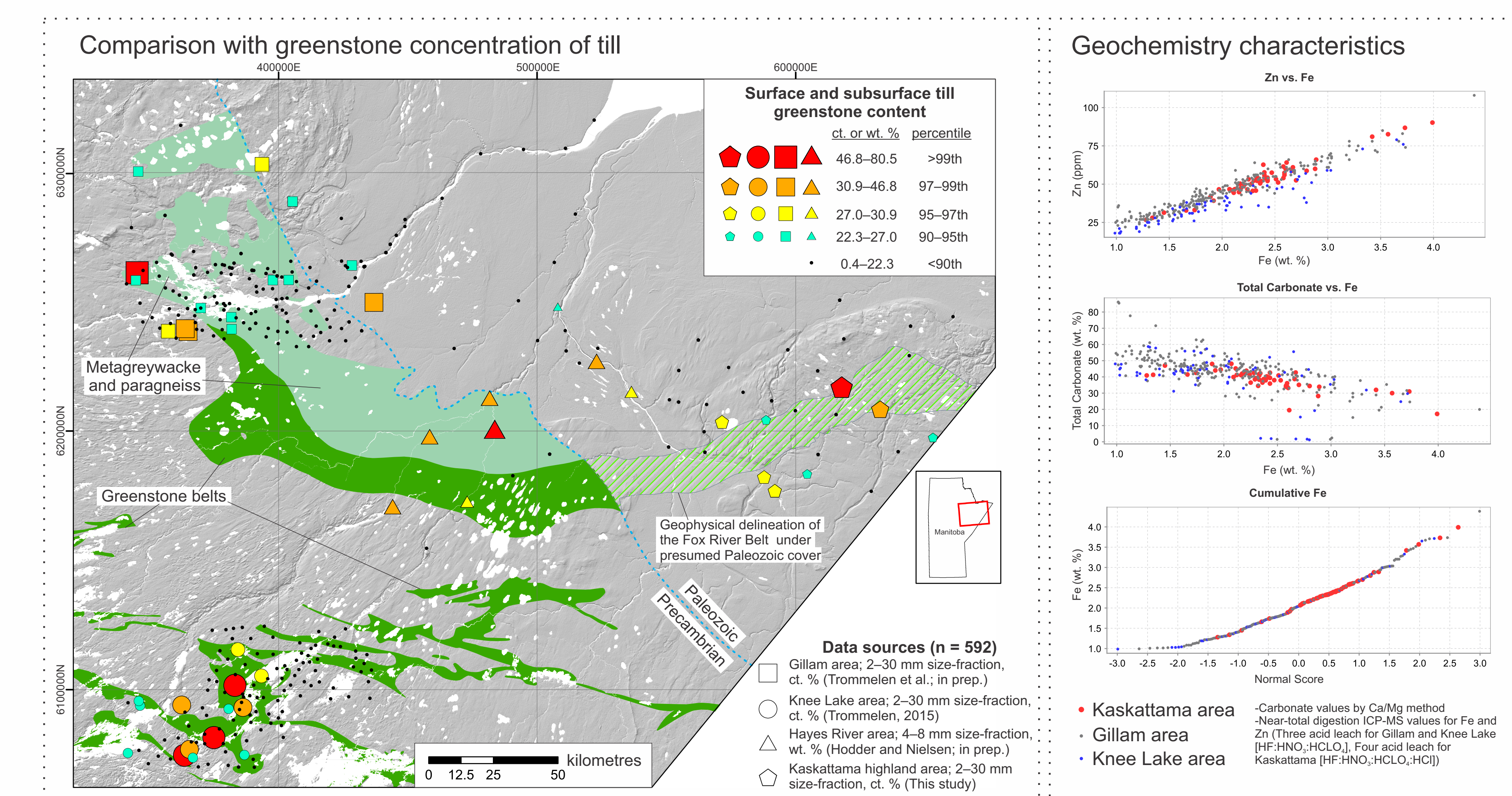


Study Area



Digital elevation model of the Hudson Bay Lowland (HBL) region in northeastern Manitoba and northwestern Ontario. The Kaskattama highland area rises 130 m above the surrounding flat-lying lowland terrain. The Sutton ridge in northwestern Ontario is a similarly enigmatic positive relief feature rising 150 above the flat-lying HBL. The Sutton ridge contains mapped Precambrian inliers in the area (Ontario Geological Survey, 2011).

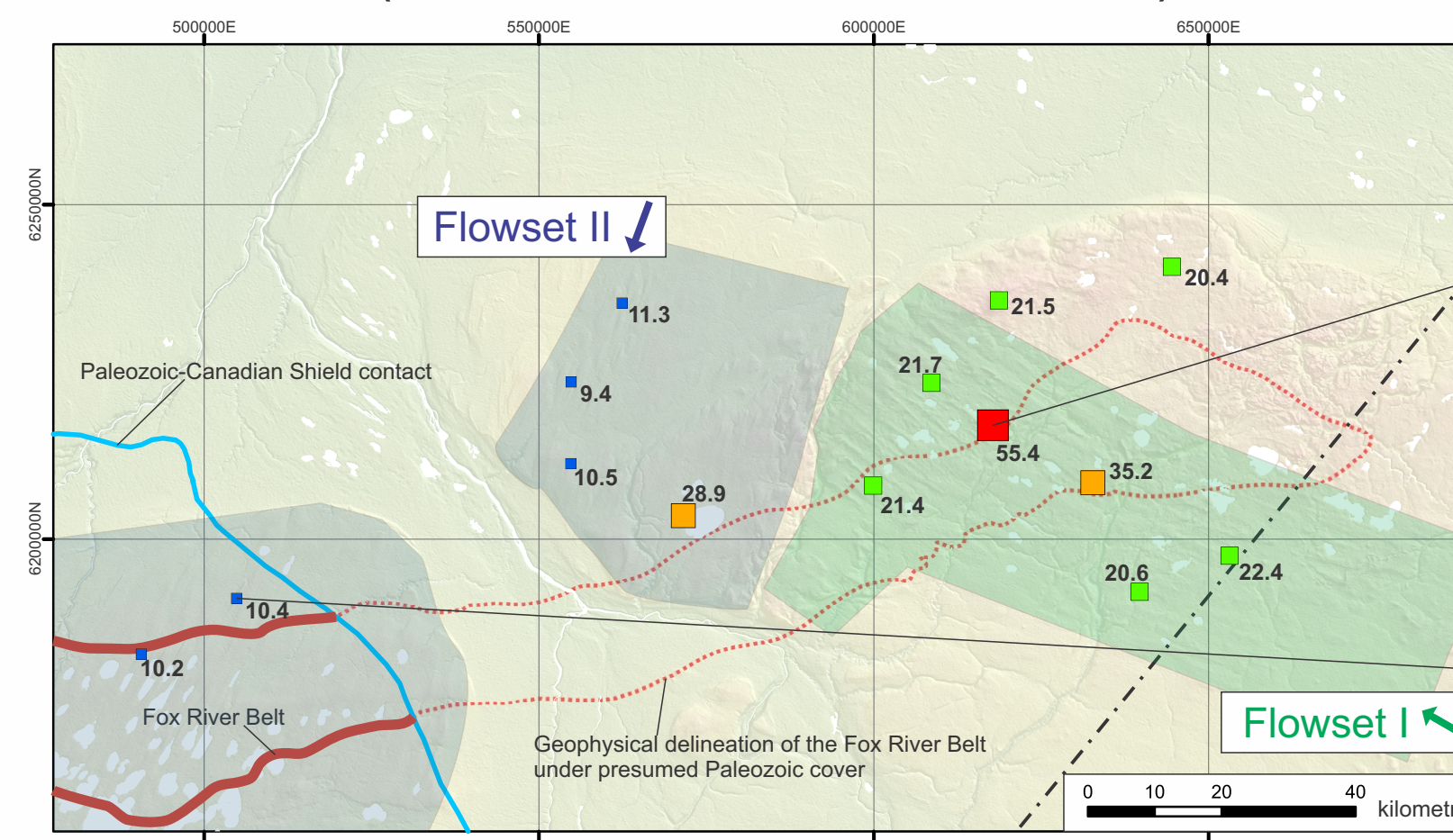
Regional comparison



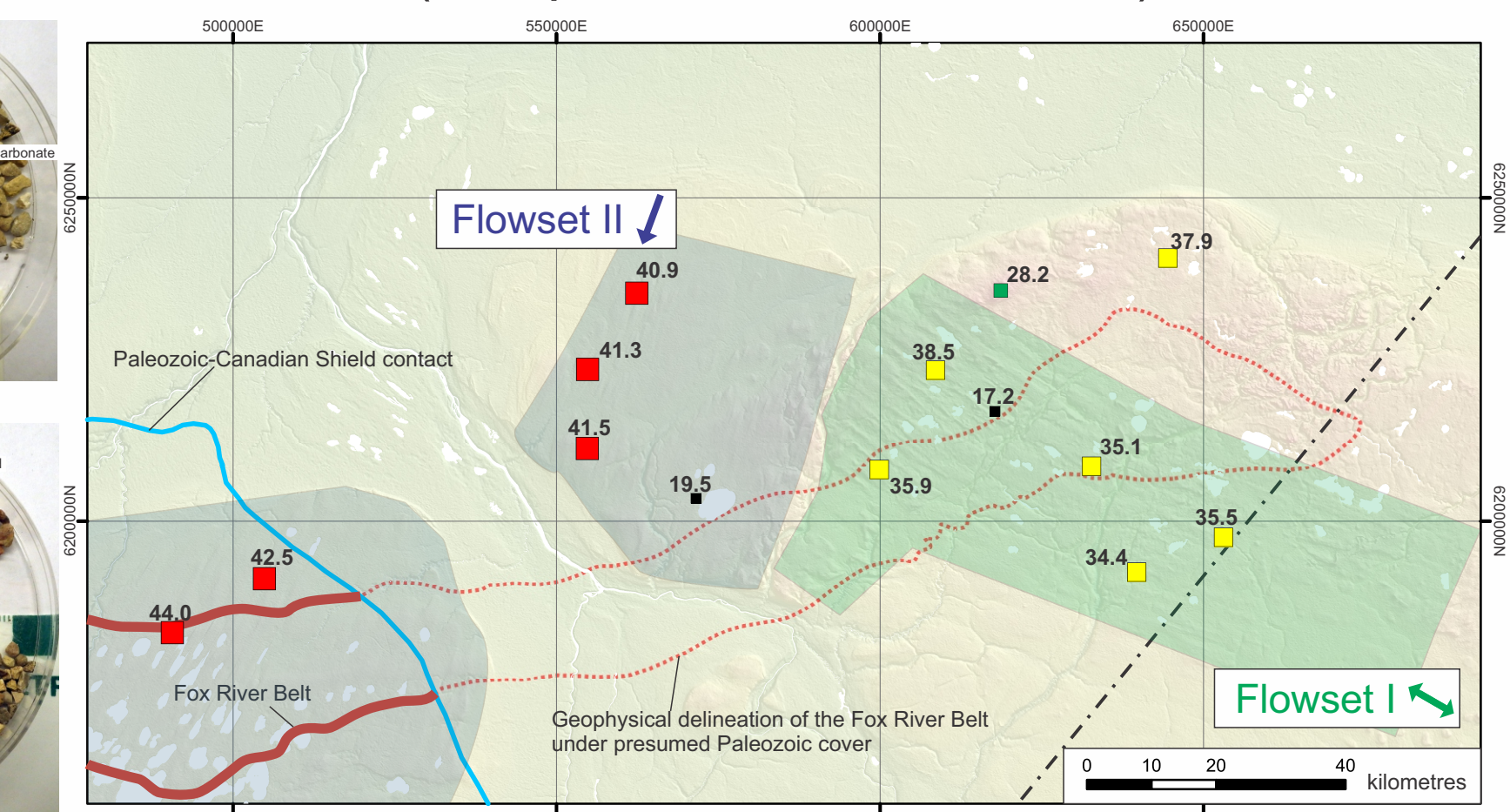
Till samples from the Kaskattama highland have a similar greenstone content as samples overlying greenstone belts and metagreywacke in the Kneelake and Gilliam areas suggesting a similar proximity to source. Elevated iron and zinc within the till-matrix from the Kaskattama highland follow a similar trend to that of samples from Kneelake and Gilliam, supporting the hypothesis of a local greenstone source.

Till Composition

Elevated greenstone-clast concentration in Flowset I (2–30 mm size-fraction; ct. %)

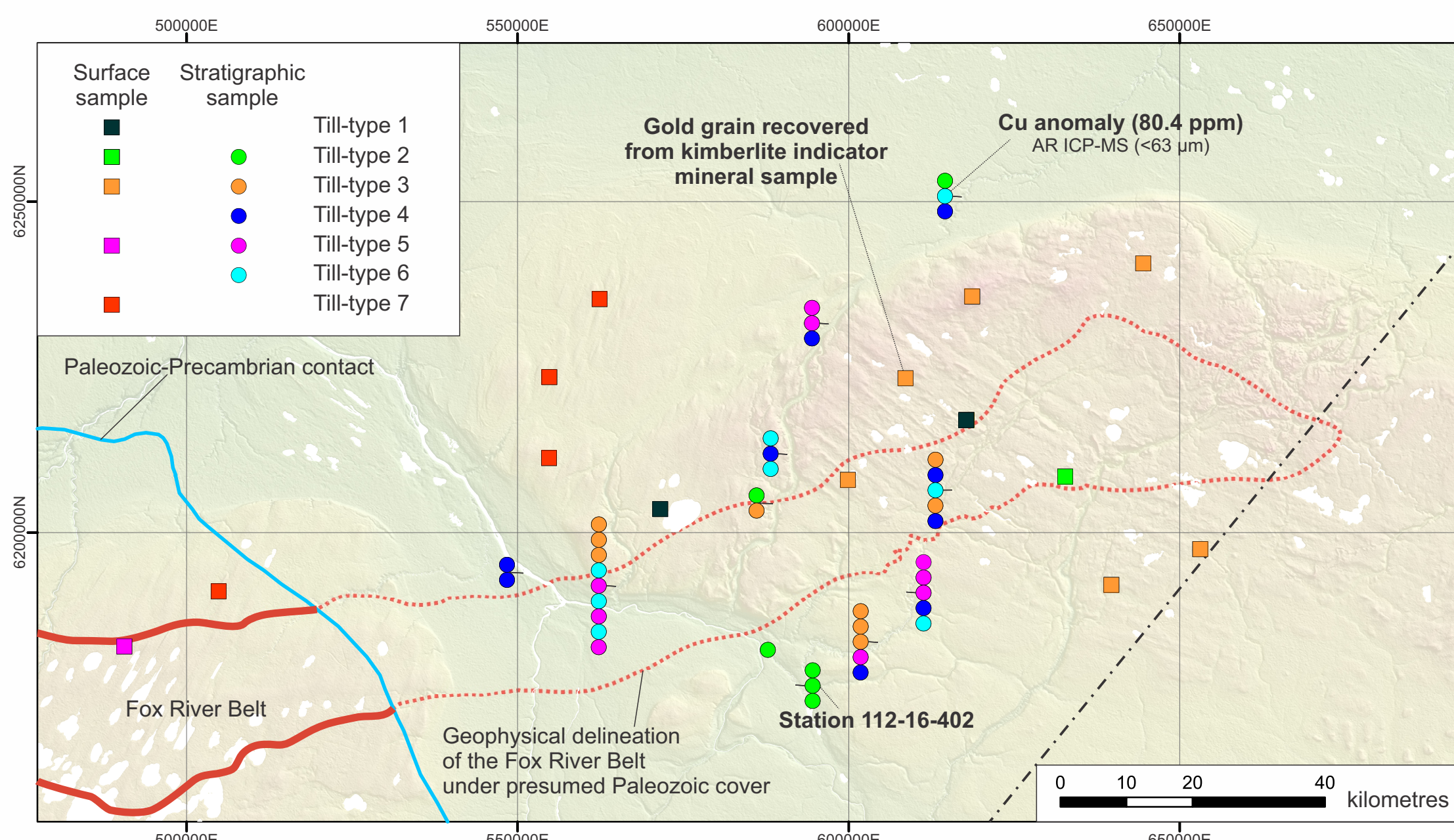


Elevated till-matrix carbonate concentration in Flowset II (<63 μm size-fraction; wt. %)



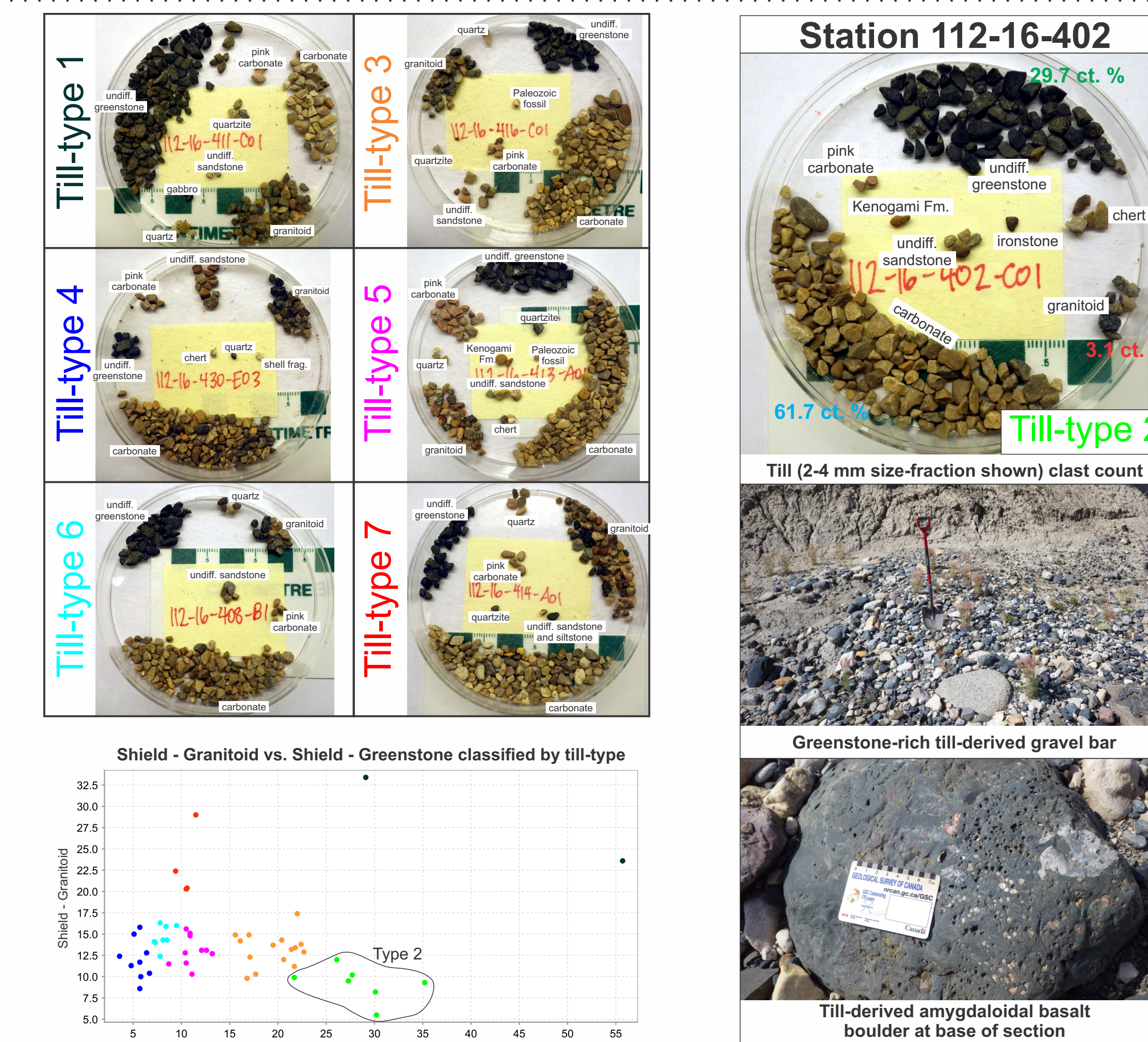
Till-matrix carbonate content is typically 34.4–38.5 wt. % within flowset I and 40.9–44.0 wt. % within flowset II. One sample from each flowset contains samples with 17.2–19.5 wt. % carbonate. These samples have a corresponding high greenstone clast content and are located in close proximity to the delineation of the Fox River Belt under presumed Paleozoic cover.

Surface and subsurface clast lithology derived till-types

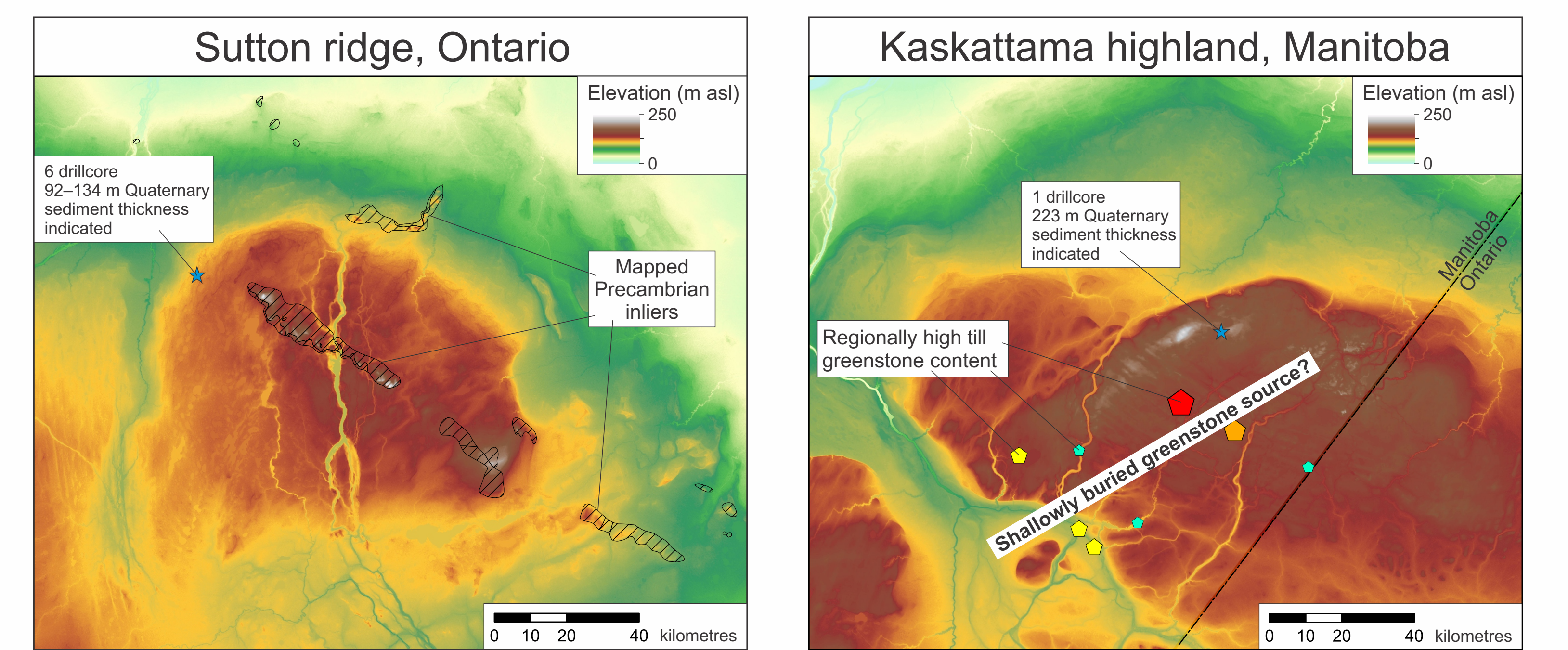


Clast lithology counts were simplified into three provenance classes (Hudson Bay Basin, shield – granitoid, and shield – greenstone). Clast lithology till-types were identified using a K-Means cluster analysis on these three simplified classes (data centered log ratio transformed prior to analysis).

Till relatively enriched in greenstone clasts and granitoid poor (till-type 2) is located in close proximity to the extension of the Fox River Belt under Paleozoic cover.



Sutton inlier as an analogue?



Precambrian inliers have been mapped extensively in the vicinity of the Sutton ridge in Ontario, including outcrops on the highland (Stott et al., 2010). These relatively resistant rocks have acted as large-scale crag and tail features, facilitating sediment deposition. Limited drillcores and outcrops at the Sutton ridge attest to variable sediment thickness of the highland surrounding the resistant bedrock.

We theorize, based on till composition of the Kaskattama highland area and geomorphic similarity to the Sutton ridge, that a similar Precambrian inlier is possibly responsible for the presence of the Kaskattama highland.

Future Work

- Compare till-composition across the HBL (clast lithology and till-matrix geochemistry) to establish genetic relationships for till units across the region, shedding light on past glacial dynamics.
- GEM-2 magnetotelluric (MT) survey, being conducted in the summer of 2017 on the Kaskattama highland, may be able to confirm our hypothesis of a Precambrian inlier supporting the highland.
- Additional till-sampling, tentatively planned for the late summer of 2017, will add additional detail as well as till fabric information to our dataset.

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