Supplemental 3: Till compositional data analysis for site 3 and 4 in the Lower Nelson River area to support till stratigraphy correlations.

The till-matrix (<63 µm size-fraction) geochemistry was determined by total digestion (lithium metaborate/tetraborate fusion) and ICP-MS and ICP-OES analysis (Hodder and Gauthier, 2021). The major elements (Al, K, Fe, Ti, Mn, Na, Si, Ca, Mg) from this dataset were then transformed using a centred log ratio (CLR) transformation and analysed using principal component analysis (Figure Supplemental 3-a). Till samples are classified according to their stratigraphic section and interpreted stratigraphic bed that they were collected from. The first principal components account for 52.4% of the variance within the dataset and best describes the compositional difference between Bed B and D (Figure Supplemental 3-a). Positive PC1 values are associated with Bed B and are defined by elements Ca and Mg, which are most prevalent in local carbonate bearing rocks of the Hudson Bay Basin. Negative PC1 values are associated with Bed D and are defined by Al, Fe, Ti and K, elements most commonly associated with igneous sources rocks that were transported into the region from the Precambrian shield. This interpretation is supported by the till clast-lithology data, where Bed D and Bed E have higher proportions of Precambrian clasts (Figure Supplemental 3-b). Bed B has a significantly higher proportion of sand in the matrix compared to beds D and E (Figure Supplemental 3-c). This compositional analysis supports the correlation of Bed B and Bed D between sites 3 and 4, which reinforces that uppermost intertill nonglacial sediments (Bed C) are missing from site 4.

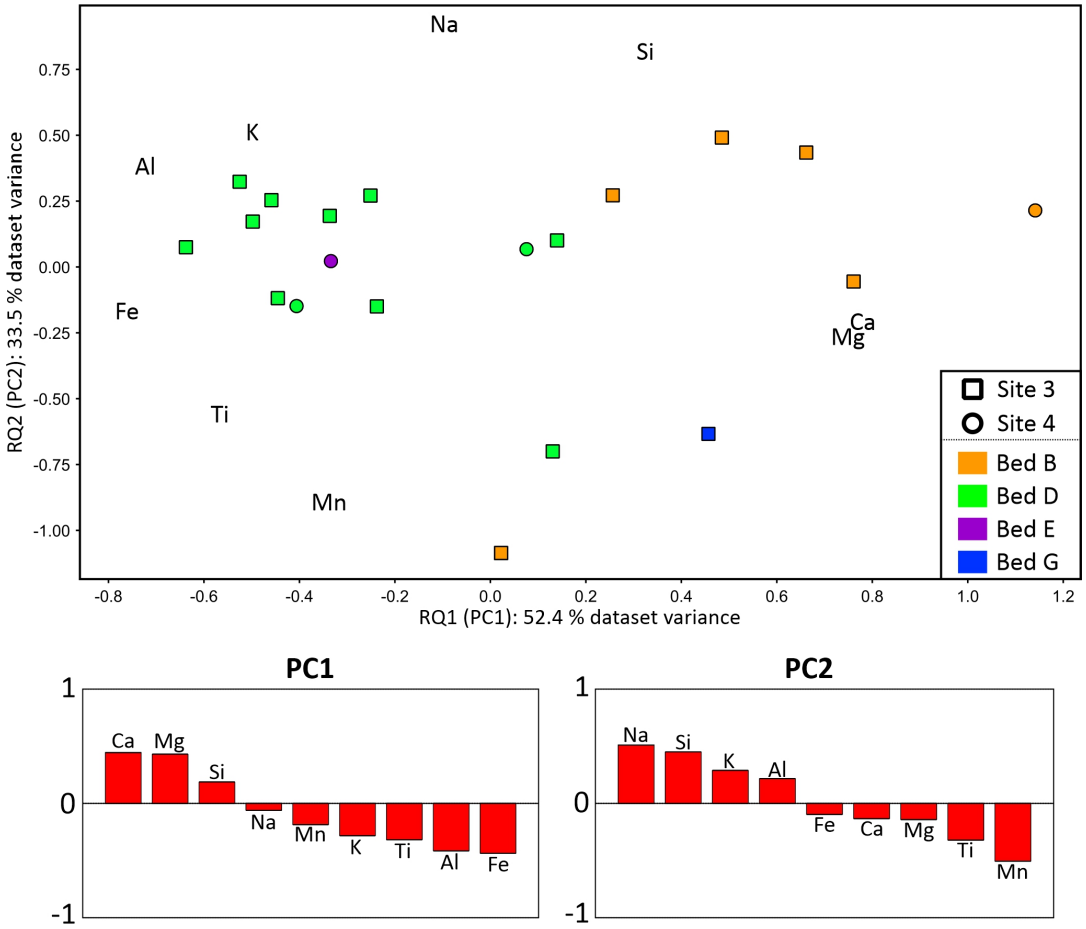

Figure Supplemental 3-a: *Scatterplot of PC2 vs. PC1 and elemental loadings for till samples from site 3 and 4.*

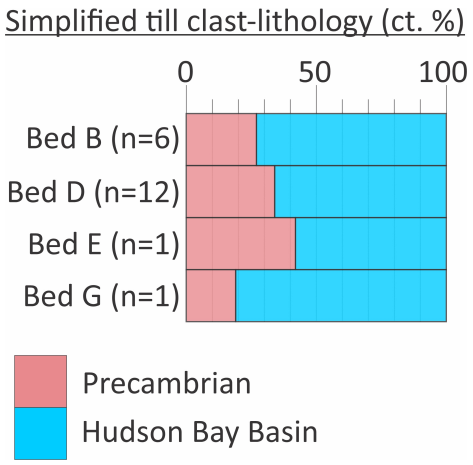

Figure Supplemental 3-b: *Average values for the proportion of Precambrian and Hudson Bay Basin clasts in each interpreted till unit. An average of 398 clasts in the 2–8 mm size-fraction were counted for each till sample.*

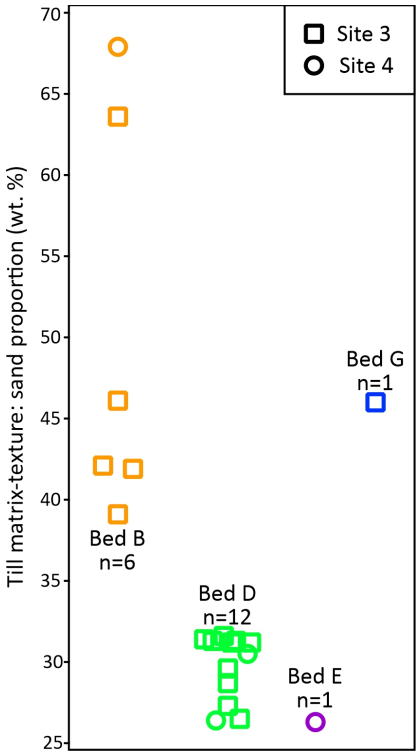

Figure Supplemental 3-c: *Proportion of sand in the till-matrix of each interpreted till unit.*

References:

Hodder, T.J., Gauthier, M.S. 2021. Till-matrix geochemistry data, Machichi–Kettle rivers area, far northeastern Manitoba (parts of NTS 54A–C). Manitoba Agriculture and Resource Development, Manitoba Geological Survey, Data Repository Item DRI2021007, Microsoft® Excel® file.