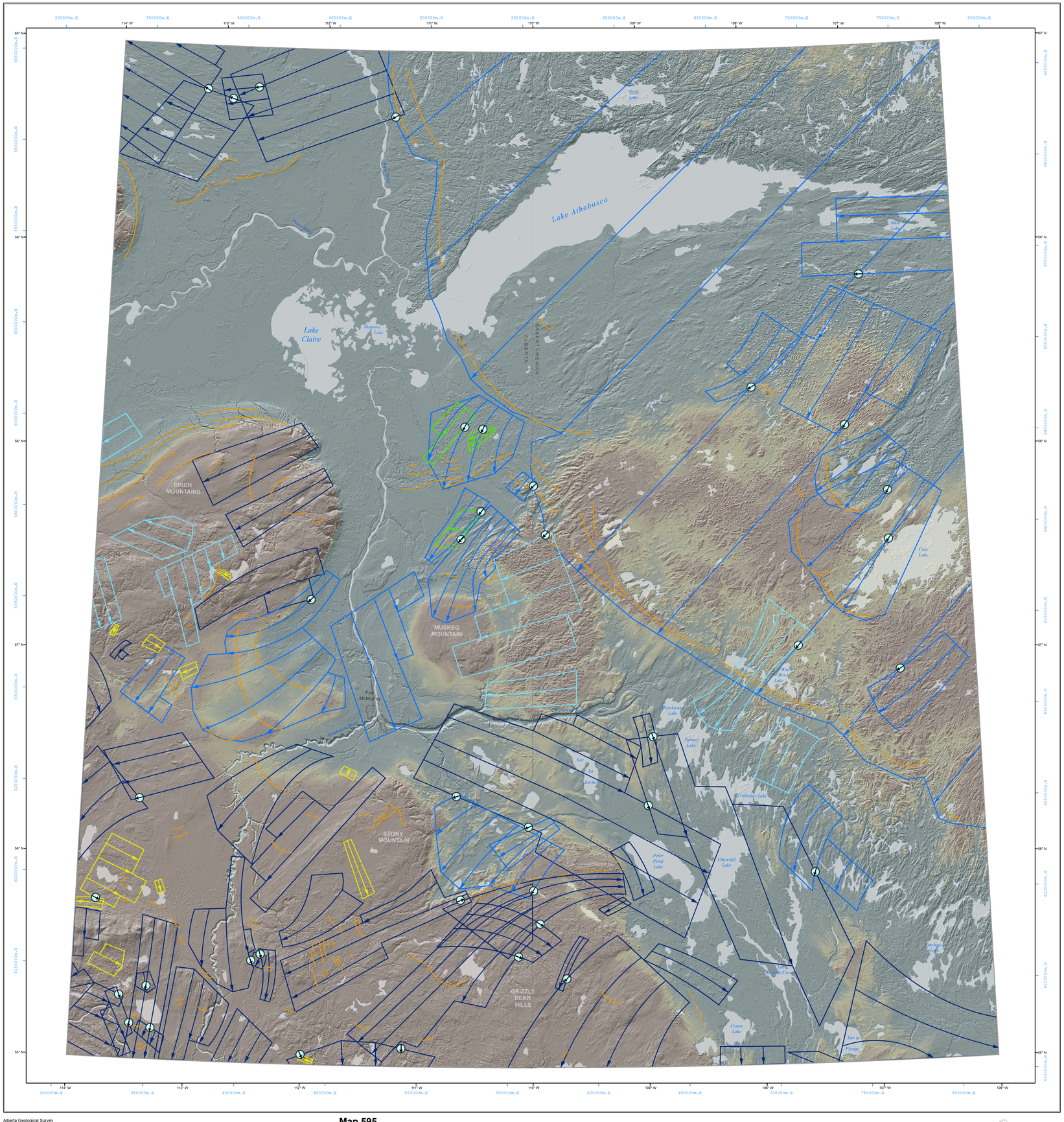

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Map 595

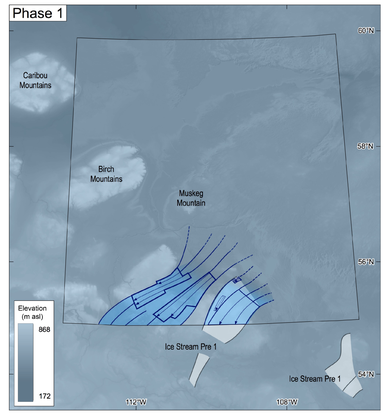
Glacial Flowsets in the Lower Athabasca and Clearwater Region Alberta and Saskatchewan

Geology by: S.L. Norris

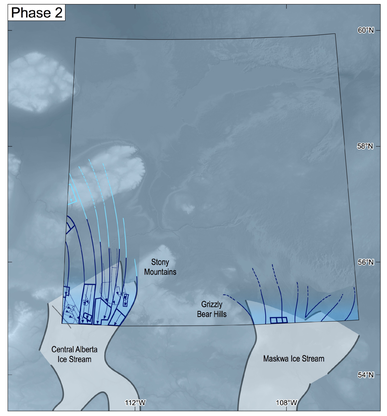
Scale 1:750 000

10 0 10 20 30 40 50 Kilometres
5 0 5 10 15 20 25 Miles

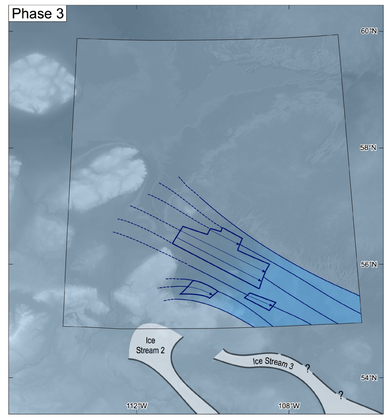
Projection: Universal Transverse Mercator
Datum: North American Datum, 1983



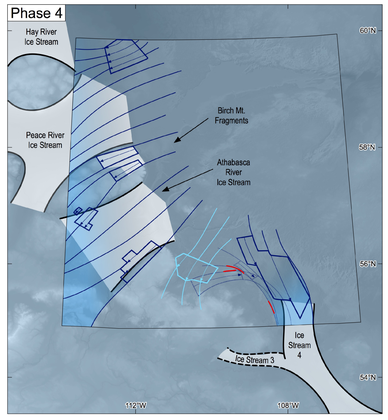
Phase 1 Within the central southern sector of the study area lineations record ice flow from northeast to southwest over the Stony Mountains and Grizzly Bear Hills. This northeast to southwest flow is composed of four flowsets delineated by faint drumlinoid ridges and flutings.



Phase 2 Topographically defined north to south fast flow is defined by 14 flowsets in the Athabasca and Churchill valleys. Flowsets comprise mega-scale glacial lineations, drumlins, meltwater channels and well defined lateral margins.



Phase 3 Flowsets depict a shift to southeastward ice streaming in the Churchill Valley. Flowsets are composed of mega-scale glacial lineations and flutings.



Phase 4 Ice streaming is active in the Peace, Athabasca and Churchill valleys. Northeast to southwest flow is also recorded on the Birch Mountains. Within the Churchill Valley a progressive evolution from southwest to southeast, northwest to southeast and northwest to south is recorded by flutings, drumlins and cross-cut lateral shear margin moraines (shown by red lines).

SYMBOL LEGEND

Ice stream flowsets are the geomorphological signature of ice stream activity. Ice stream flowsets are typically associated with abundant highly elongate flow traces (i.e. glacial lineations) and are composed of groups of bedforms with abrupt lateral margins.

Event flowsets represent areas of the ice sheet that surround ice streams. They can form many hundred of kilometres inside the ice margin and have geomorphological signatures that include flow traces (i.e. glacial lineations) without associated meltwater channels, or with superimposed meltwater traces, such as misaligned eskers. This misalignment is a result of subsequent phases of deglaciation and retreat, which were associated with different flowset geometries.

Deglacial flowsets are characterised by flow traces (i.e. glacial lineations), which are locally aligned with eskers and meltwater channels. These flowsets represent areas of the ice sheet composed of warm-based ice during phases of deglaciation. Deglacial flowsets are formed close to the ice margin and may be time-transgressive due to the inward transgression of warm-based ice.

Palimpsest flowsets represent areas that are overrun and partially hidden and/or overprinted by younger ice flows. These flowsets are often fragmented.

Unknown flowsets: relative age and glaciodynamic implication of the flowsets are uncertain.

End moraine: large ridges of sediment accumulation formed along the margin of the retreating ice sheet.

Shear margin moraine: longitudinal ridge complexes formed along the margins of corridors of faster flowing ice.

Cross cutting indicator: direction of youngest flow indicated by arrow

BASEMAP LEGEND

River

Lake

UTM, Zone 12 Grid 640000m.E

Elevation (m asl)
534
462

Methodology

The distribution of glacial landforms across Alberta and Saskatchewan has previously been portrayed by Atkinson et al. (2014) and Norris et al. (2017), respectively. These data are used here to reconstruct ice sheet evolution and flow dynamics of northeastern Alberta and northwestern Saskatchewan.

Ice-flow patterns are derived and grouped into spatially coherent 'flowsets' (Kleman and Borgström, 1996; Kleman et al., 2006) based upon their morphometry, proximity, parallel concordance (lineations in the same flowset should have near-identical orientations) as well as their sediment-landform association (Evans, 2014; Atkinson et al., 2016). Subglacial bedforms are then used to infer the geometry of the flowsets. Associated eskers, moraines, crevasse fill ridges and lateral meltwater channels are also used to infer glaciodynamic interpretations and ascertain the pattern of ice margin retreat. Each flowset is then divided into one of four categories: (i) deglacial, (ii) event, (iii) ice stream or (iv) palimpsest, with the arrows showing the interpreted ice flow direction.

Ice Sheet Evolution (Inset Figures)

This reconstruction of ice sheet evolution identifies dynamic changes in regions of fast flow in the form of four palaeogeographic maps. This reconstruction describes the sequence of changes in flow orientation that best explains the relative chronology of the flowsets. Where flowsets are concordant with previously identified regions of fast flow (Ross et al., 2009; Ó Cofaigh et al., 2010; Margold et al., 2018) this is indicated by grey shaded regions.

Acknowledgments

This map was developed as part of the authors Ph.D. thesis at the University of Alberta and was produced at the Alberta Geological Survey, under supervision from N. Atkinson, K. Mckay and J. Waters completed the digital cartography and GIS. Government of Alberta provided the base data. M. A. Hanson (Saskatchewan Geological Survey) provided comments on an earlier version of the map.

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Recommended Reference Format

Norris, S.L. (2019): Glacial flowsets in the lower Athabasca and Clearwater region; Alberta Geological Survey, AER/AGS Map 595, scale 1:750 000.

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