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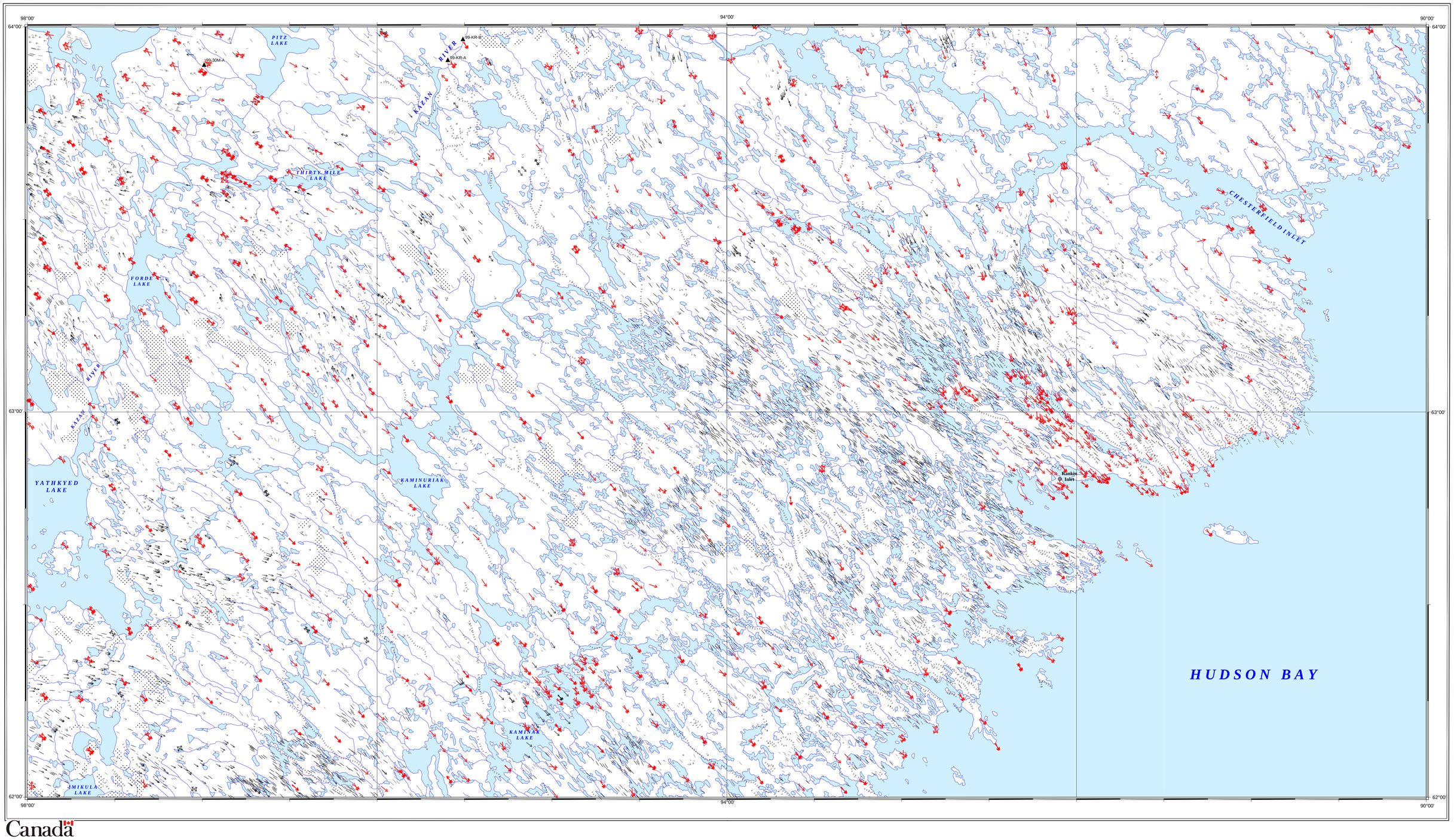
NATMAP CARTNAT
Western Churchill Project



Canada

LEGEND

- *Streamlined landform (drumlin, groove, or fluting, parallel to ice flow; undifferentiated)*
- *Crag-and-tail landform*
- *Roche moutonnée*
- *Striation:*
  - *Well defined*
  - *Poorly defined*
  - *Sense unknown*
- *Stratigraphic section examined* ▲99-KR-A
- *Esker ridge**
- *Hummocky moraine**
- *Trend of drumlin or fluting**
- *Trend of crag-and-tail**
- *Striae**

* Information derived from existing surficial geology maps

This digital map compilation is part of GSC OF 4595 CD-ROM publication (2004). Additional information is presented on the detailed maps (1:200 000 scale).

Striation mapping by I. McMartin and P. Henderson, 1997, 1998, 1999.
Photo-interpretation by I. McMartin and P. Henderson, 2003.

DESCRIPTIVE NOTES

Systematic mapping of ice-flow indicators on bedrock, and photo-interpretation of streamlined landforms in the Kivalliq Region of Nunavut (NTS 55J, K, L, M, N, O and 65I, P) have provided new evidence for the migration of ice divide(s) and resulting major shifts in ice-flow within the Keewatin Sector of the Laurentide Ice Sheet (LIS). This work was initiated as part of the Western Churchill NATMAP Project (1997-2002) and completed through the Western Churchill Metallogeny Project of the Northern Development Resources Program (2003-2006). Field measurements of erosional ice-flow indicators from over 700 sites were recorded in the area in 1997, 1998 and 1999. Existing surficial geology maps (1:125 000 scale) provided an extensive database of drumlinoid and crag-and-tail landforms, but streamlined landforms were systematically re-mapped in 2003 and interpreted in light of the new ice-movement observations.

The record of successive glacial flows is indicated by cross-striations, lee-side preservation of old striations, and cross-streamlined landforms. It is particularly well preserved under the area of the Keewatin Ice Divide (KID), which is the zone occupied by the last remnants of the LIS west of Hudson Bay (Fig. 1). Although this zone is characterized by the absence of esker and ribbed moraine (Fig. 1), the complexity of the ice flow record is extensive, as evidenced from the multiple orientations and directions of both erosional and depositional ice-movement indicators.

A sequence of six distinct regional ice movements was established in the Kivalliq Region based on: 1) the regional association of sets having similar or continuous trends and the same relative age relationships, and 2) cross-cutting relationships between streamlined landforms. At least four of these regional ice-flow events occurred prior to the decay of the LIS towards the KID. The earliest flow recognized was to the southwest (Phase 1). It is poorly preserved and found occasionally across the entire region. This flow may have dispersed from a centre northeast of the study area within the Kivalliq Region, or farther north, maybe as far as the Foxe Basin. The second oldest event is regionally pervasive and indicates ice flow towards the south (Phase 2). Evidence for southward glacial transport includes the presence of quartzite boulders around Pitz Lake derived from the Schultz Lake area (Cunningham and Shilts, 1977) and the dispersal of Dubawnt erratics as far south as the Manitoba border (Shilts et al., 1979). Geochemical composition of till collected in drill core south of Pitz Lake also indicates an early southward flow (Klassen, 1995). The extent of this flow north of the study area is unknown although pervasive, opposite, early northward erosional forms have been observed in the Committee Bay area to the north, suggesting the existence of a dispersal centre or major ice divide immediately to the north of the NATMAP area within the Kivalliq Region if these opposite flows are contemporaneous (McMartin et al., 2003a). The third oldest regional event was east-southeastward (Phase 3). Evidence of this flow is less regionally extensive than for the southerly flow but includes well preserved striae at several sites and till stratigraphy along the Kazan River (Klassen, 1995; this study). A dispersal centre located west of the study area must have been responsible for this early flow. A major north to north-northwest flow occurred during Phase 4 in the western part of the study area, as far east as Kaminuriak Lake. Evidence for this northward flow includes well preserved erosional and depositional ice-movement indicators, particularly under the KID, as well as northward transport of distinctive Proterozoic dolomite boulders from Hurwitz Group outcrops near Imikula Lake over the Yathkyed greenstone belt (McMartin and Henderson, 1999). This flow is significant in that it implies that a zone of outflow existed southeast of the Keewatin Ice Divide, possibly in the Kaminak Lake area, prior to the latest southeastward flows. The last major regional ice-flow event was southeastward as indicated by dominant striae, roches moutonnées and streamlined landforms over large parts of the NATMAP area (Phase 5a). The regional southeastward flow also appears to be the predominant direction of glacial transport in surface till across the area (i.e. Henderson, 2000; Klassen, 1995; McMartin, 2000; McMartin et al., 2003b; Shilts et al., 1979). Southeast flow must have been from a divide first located northwest of the Keewatin Ice Divide central axis in order to bring Dubawnt clasts from the Baker Lake Basin into the NATMAP area (McMartin and Henderson, 2001), an idea first proposed by Klassen (1995) to explain the composition of surficial deposits in the Baker Lake area. Deviation of flow from the southeast is related to the arcuate configuration and southeastward migration to the Keewatin Ice Divide (Phase 5b): the latest flow is more southward in the northern parts of MacQuoid and Gibson Lakes map areas, and more eastward in the Ferguson Lake map area (Fig. 2). Glacial stratigraphy along the Kazan River indicates that surface till in this area was deposited by ice flow to the south-southeast, presumably during Phase 5b. As the divide continued to migrate southeastward in NTS 65P, the flow reversed to a west-northwestward direction (Phase 6). This late flow was from a divide located entirely southeast of the former Keewatin Ice Divide central axis (Fig. 2). The record of late successive flows in NTS 65P suggests that the divide migrated at least 200 km southeastward prior to the final decay of the LIS. This, as well as the multi-directional glacial flow record over the entire area, challenges the view that the Keewatin Ice Divide was a static, long-lived feature of the Laurentide Ice Sheet in central Nunavut during the Late Wisconsinan.

This work provides a framework for interpreting glacial dispersal of mineralized debris and, consequently, has important implications for mineral exploration in the Kivalliq Region. It also questions previous interpretations of large erratic dispersal patterns, such as the Dubawnt dispersal train, and local scale glacial dispersal trains from mineralized bedrock.

OPEN FILE 4595

ICE FLOW INDICATORS

WESTERN CHURCHILL NATMAP AREA

NUNAVUT

Scale 1:500 000

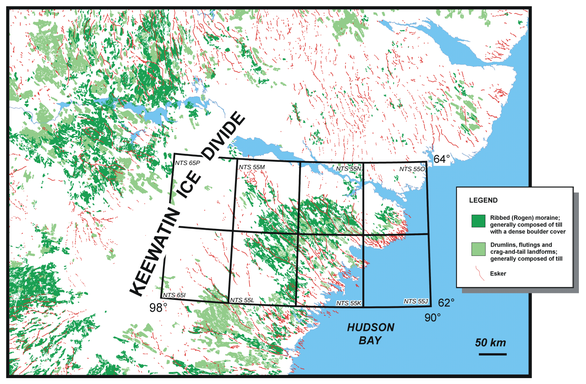


Figure 1. Location map of study area in the Kivalliq Region of Nunavut. Areas of ribbed moraine and streamlined landforms, trends of eskers, and the approximate location of the Keewatin Ice Divide are shown (from Aylsworth and Shilts, 1989).

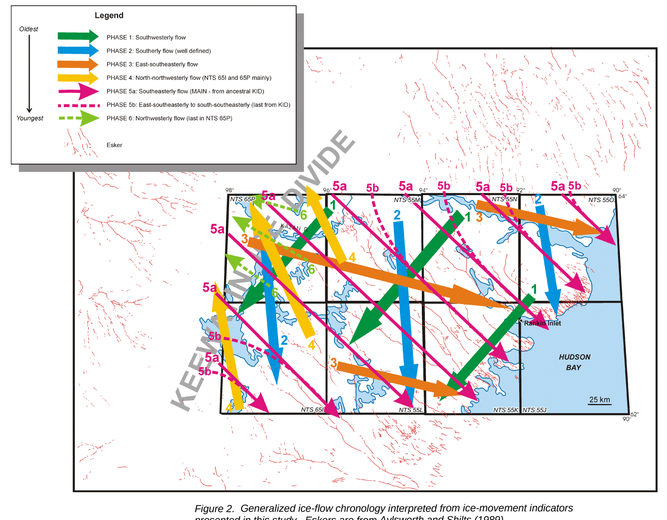


Figure 2. Generalized ice-flow chronology interpreted from ice-movement indicators presented in this study. Eskers are from Aylsworth and Shilts (1989).

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