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QUATERNARY MAPPING AND DRIFT EXPLORATION IN THE CENTRAL MINERAL BELT (13K/7 AND 13K/10), LABRADOR

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Quaternary Geology Section

ABSTRACT

Quaternary mapping in the Central Mineral Belt (13K/7 and 13K/10) is a continuation of work started in 1986 in the Melody Lake area (13K/9 and 13J/12). During the 1987 program, two major flow directions were identified. There was an ubiquitous northeast-directed flow across the area that is consistent with the northeastward flow identified to the east. However, in the Moran Lake area, an eastward-directed flow is the most recent, although it has a limited easterly extent, both altitudinally and laterally. In the Kanairiktok Valley, sediments related to the eastward flow event overly marine silts and clays. This flow may have re-entered the Kaipokok Valley in the West Micmac Lake area.

Upland areas are bedrock dominated. Tills in the map area are generally thin and discontinuous, except near Nipishish Lake. Outwash sediments fill the major valleys, and deltas related to small proglacial lakes are also evident. Fossiliferous marine sediments occur in the Kaipokok and Kanairiktok valleys, although in the latter valley they are overlain by ice-contact outwash sediments. A major glaciomarine delta east of Moran Lake has well-defined levels at 105 m and about 130 m above sea level.

The use of indicator lithologies has demonstrated that dispersal of clasts reflect the most recent glacial-flow events. Dispersal trains are oriented eastward in the western part of the study area, but are deflected northeastward in the Moran Lake area. The previous impression of single glacial-flow pattern in this part of Labrador has been negated. Detailed drift-exploration programs should be placed within a regional framework.

INTRODUCTION

This study represents the fourth year of a five-year project on the Quaternary geology of selected parts of Labrador. The study is part of a joint Provincial–Federal effort to better define and describe Quaternary events in Labrador, particularly in the Central Mineral Belt. The overall aim is to provide a framework in which mineral exploration can become better focused in areas of heavy drift cover. Previous studies have been site specific: dispersal from the Strange Lake Alkalic Complex (Batterson *et al.*, 1985), and boulder tracing in the Two-Tom Lake area (Batterson and LeGrow, 1986).

The present study continues a project that commenced in 1986 to examine the Quaternary geology and its potential effects on mineral-exploration programs in the eastern part of the Central Mineral Belt. Work in 1986 focused on the Melody Lake area (Batterson *et al.*, 1987), an area of intense mineral exploration in the 1950's and 1960's. In 1987, the field area was farther west. Again, the emphasis is on the surficial environment (glacigenic sediment types, ice-flow indicators, glacial transport distance and direction, terrain description) as a key to understanding the subsurface environment and, in particular, to the delineation of areas of mineral potential.

Location and Access

The Moran Lake study area encompasses NTS map sheets 13K/7 and 13K/10, a total area of approximately 1850 km² between 60°30′ and 61°00′ west longitude and 54°15′ and 54°45′ north latitude (Figure 1). Base camp was on a spit on the south side at the western end of Moran Lake, approximately 140 km north of Goose Bay. The nearest community was Postville, roughly 95 km to the northeast on Kaipokok Bay. Access to the field area is by helicopter or float plane, although the study area itself may be traversed by canoe or by foot.

Physiography

The study area is within the 'Postville ecological land region' (Lopoukhine *et al.*, 1977). Physiography is diverse, ranging from level bog and marine sediment-covered

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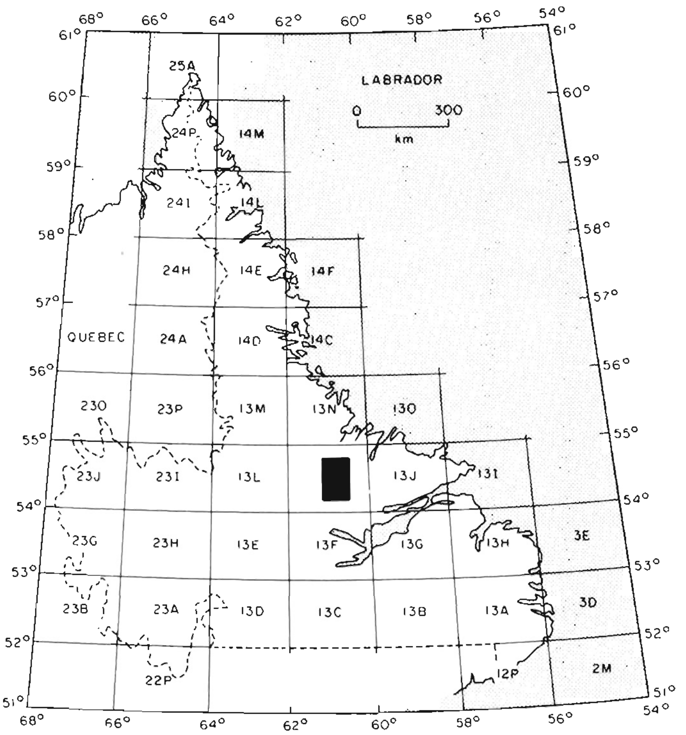

Figure 1. *Location of field area.*

lowlands in the lower reaches of the Kaipokok Valley, to the outwash-filled Kanairiktok Valley, to the rugged, bedrock-dominated uplands north and south of the Kaipokok and Kanairiktok valleys.

Vegetation is also diversified, a reflection of parent material. Well-drained glaciofluvial sands and thin tills support only spruce–lichen associations. Forest growth is sparse, and is best developed along river valleys, such as the Kaipokok Valley, or along lower slopes. The modern pollen spectra reflects the Boreal Woodland vegetational zone of this part of Labrador (Macpherson, 1981).

The area has an interior Labrador climatic regime (Banfield, 1981). Winters are long and severe, with heavy snow accumulation and extended periods below -15°C. Summers are short and cool, although daily maxima may be high (mid 20's C). Annual precipitation is 900 to 1100 mm with a summer maximum. The area lies within the zone of discontinuous permafrost (French, 1976).

Previous Quaternary Geology Research

Despite the long history of exploration in the area, knowledge of the Quaternary geology remains scant, and is restricted to several broad overviews. Rogerson (1982), based largely on data generated by the Glacial Map of Canada (Prest *et al.*, 1968), suggested that glacial-dispersal patterns over Labrador were 'relatively simple', and followed the structural grain in the form of the Grenville Front. Ice-flow patterns, then, were expected to have a general arcuate pattern, issuing from the Labrador Trough and flowing out through the major northeastward-oriented coastal inlets. Recent work (Batterson *et al.*, 1987; Thompson and Klassen, 1986; Klassen, 1983, 1984) has begun to redefine ice-flow patterns in the Central Mineral Belt, and has highlighted several regional-flow events that cross the structural grain. Individual flows may also be topographically controlled, adding to the complexity of dispersal patterns.

Surficial mapping at 1:500,000 scale, based largely on aerial photograph analysis with limited ground checking has been completed for much of the Central Mineral Belt (Fulton, 1986). A reapprasial of this data and a refinement of the surficial map is a component of this current project.

Geological Setting

The study area lies mostly in the Central Mineral Belt, an east-trending belt of Proterozoic supracrustal sedimentary and volcanic rocks and associated granites (Greene, 1974). To the north these rocks unconformably overlie Archean gneisses of the Nain Structural Province, or reworked Archean rocks that comprise the Makkovik Province. To the south, granites of Elsonian age display a strong Grenvillian fabric. The study area has been mapped in detail by Ryan (1984) (Figure 2); the following summary of the geology of the area comes largely from Ryan's report.

Archean Rocks

The northwestern part of the study area comprises Archean rocks of the Nain Province. These rocks, part of the Kanairiktok Valley complex, consist of quartzofeldspathic gneisses (Maggo gneiss), schistose metavolcanics (Florence Lake group) and granitoid rocks (Kanairiktok Intrusive Suite). To the east, rocks of similar lithology exist. However, many have undergone partial retrogression during the Hudsonian Orogeny, from the amphibolite facies of the Kanairiktok Valley complex to a greenschist facies that dominates rocks of the Kaipokok Valley complex.

There is little known mineralization associated with Archean rocks in the study area except in the Florence Lake group, which has asbestos and uranium showings and potential for platinum-group elements (Wardle, 1987).

Aphebian Rocks

These rocks overly the Archean rocks, and occupy northeast-trending belts in west-central and northern parts of the study area. In the west, they comprise the Moran Lake Group (Unit 3), a sequence of quartzite, slate, dolostone and greywacke (Warren Creek Formation), overlain by both massive and pillowed, mafic volcanic rocks (Joe Pond Formation). Polydeformed metasedimentary and metavolcanic (Unit 4) equivalents of the Moran Lake Group occur to the east in the Kaipokok Valley.

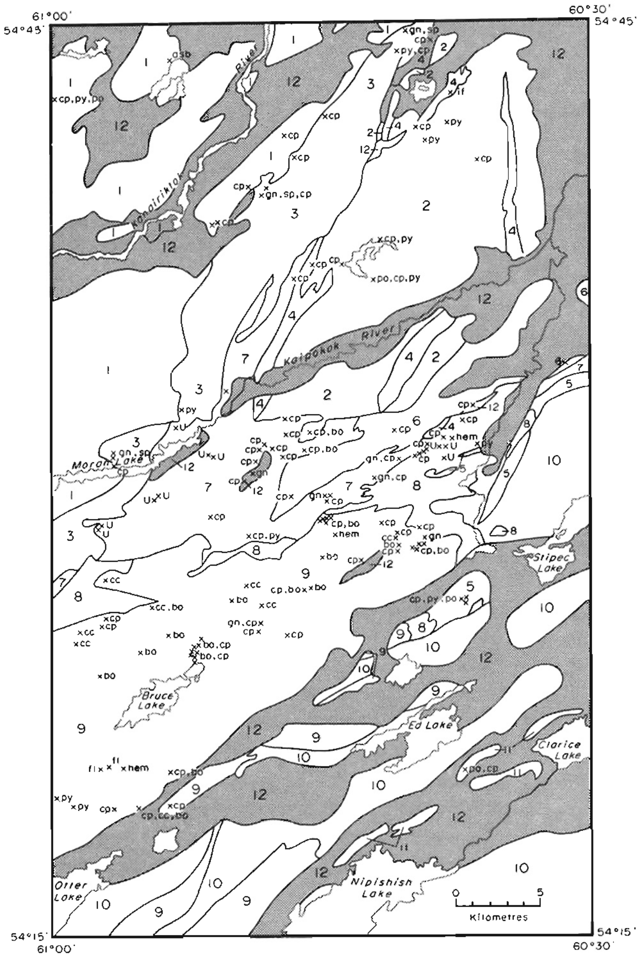

Figure 2. *Geological setting and location of mineral occurrences.*

LEGEND (Figure 2)

PLEISTOCENE

12 *Drift*

PROTEROZOIC

Paleohelikian

11 Michael Gabbro

10 Nipishish Lake intrusive suite: *granite, granodiorite*

Bruce River Group (Units 7–9)

9 Sylvia Lake Formation: *volcanosedimentaries and volcaniclastics*

8 Brown Lake Formation: *volcaniclastic sandstones*

7 Heggart Lake Formation: *sandstones and conglomerates*

6 Southern Kaipokok Valley intrusive suite: *granite, granodiorite*

Aphebian

5 *Metavolcanic and metasedimentary rocks*

4 *Polydeformed rocks equivalent to Moran Lake Group*

3 Moran Lake Group: *sandstone, dolostone, tuffs*

ARCHEAN

2 Kaipokok Valley Complex: *polydeformed equivalents of Kanairiktok Valley Complex*

1 Kanairiktok Valley Complex: *granite, granodiorite, tuffs, gneisses*

Mineral Occurrence Abbreviations

asb	*asbestos*
bo	*bornite*
cc	*chalcocite*
cp	*chalcopyrite*
fl	*fluorite*
gn	*galena*
hem	*hematite*
i-f	*iron formation*
po	*pyrrhotite*
py	*pyrite*
sp	*sphalerite*
U	*uranium*

In the Stipec Lake area, there are metavolcanic and metasedimentary rocks (Unit 5), which are probable remnants of Aphebian strata. These rocks are similar to Moran Lake Group equivalents in the Kaipokok Valley.

Rocks of the Moran Lake Group contain base metal, precious metal and uranium showings, many of which are the result of exploration during the 1950's, particularly by the American Metals Company (AMCO) and British Newfoundland Exploration (BRINEX). Of importance are the Green Pond showing, which contains up to 17.87 percent zinc and 25 g/t silver (Moore, 1954) and uranium showings near Moran Lake.

Paleohelikian Rocks

Four major Paleohelikian rock units occur in the study area. Pink granite and hornblende granodiorite (Junior Lake Granodiorite) of the Southern Kaipokok Valley intrusive suite (Unit 6) occur in the central part of the area. These rocks are unconformably overlain by sedimentary and volcanic rocks of the Bruce River Group, including sandstones and polymictic conglomerate (Heggart Lake Formation, Unit 7), volcaniclastic sandstones (Brown Lake Formation, Unit 8) and volcanic and volcaniclastic rocks (Sylvia Lake Formation; Unit 9). The Bruce River Group is itself intruded by the third major group of rocks, namely granitic rocks of the Nipishish Lake intrusive suite (Unit 10), which may be subdivided into a coarse grained granite, granodiorite and monzonite (Otter Lake–Walker Lake granite) and a biotite to muscovite granite (Crooked River granite). The latter only outcrops in the southeastern corner of the map area. The youngest Paleohelikian rocks in the area are gabbros related to northeast-trending dykes known as the Michael Gabbro (Unit 11).

The Paleohelikian rocks in the study area host both base metals and uranium, particularly in the Bruce River Group. Base-metal showings include chalcopyrite, bornite, chalcocite, pyrite, galena and sphalerite (Moore, 1954), but most produced disappointing results. Of more importance are uranium showings, particularly around Moran Lake. Most were discovered during the 1950's by AMCO and BRINEX, and some (especially the 'C zone') were drilled, although assays were insufficient to maintain interest. More recently, personnel from Saarberg Interplan worked in the Moran Heights area along the contact between Bruce River and Moran Lake Group rocks, and encountered some success following a detailed boulder tracing survey.

There is little known mineralization associated with the Southern Kaipokok Valley intrusive suite, the Nipishish Lake intrusive suite or the Michael Gabbro, within the study area.

Methodology

Mapping and sampling was conducted using a roughly 2- by 2-km grid system. The actual location of sites was determined from a reconnaissance air-photograph analysis and the availability of landing sites. At each site, a pit was dug to a depth that penetrated the surface-weathering horizons (commonly 30 to 50 cm) and a sample of unweathered parent material collected. Clasts (16 to 64 mm range) were collected from either test pits or from the surface, and were used in defining glacial-dispersal patterns. Bedrock was examined for the presence of ice-flow direction indicators.

In areas of known mineralization, samples were collected every 100 m, where possible, in order to more clearly define dispersal patterns. In particular, the uranium showing at Moran Heights was extensively sampled, as a follow up to the work of Vanderveer (1986). The Baikie (Ni) showing near Florence Lake, the Brown Lake (galena–sphalerite–chalcopyrite) showing and the Ellingwood (galena–sphalerite) showing north of Moran Lake were also sampled.

QUATERNARY GEOLOGY

Terrain Units

A generalized surficial geology map showing major terrain features is presented in Figure 3. Six subdivisions are made in the study area.

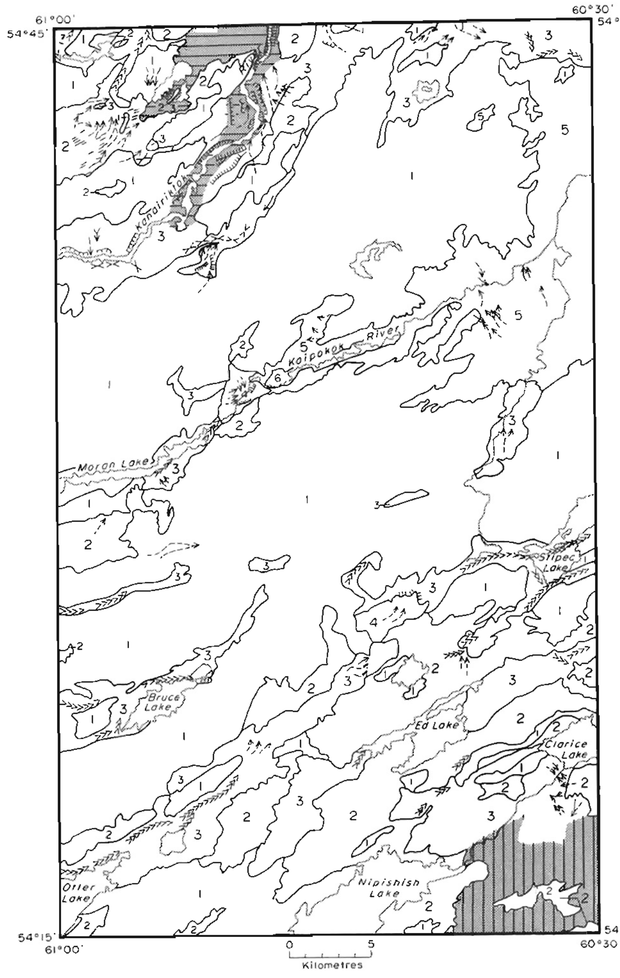

Figure 3. *Generalized surficial geology map.*

Unit 1. Upland areas dominated by bedrock are the most dominant terrain type across the area. Northwest of Moran Lake, these uplands reach 430 m above sea level, whereas south of Moran Lake elevations are generally less than 360 m above sea level. The large area of apparent bedrock domination belies the fact that glacigenic sediment is common, and reaches thicknesses exceeding 2 m, especially in the interfluves between bedrock ridges. However, on bedrock ridges, glacigenic sediment is commonly less than 1 m thick or is absent.

Unit 2. The major area of till across the study area is southeast of the Otter Lake–Stipec Lake valley. Smaller areas are found north of the Kanairiktok Valley and around Moran Lake. The character of the till reflects the underlying geology. Near Nipishish Lake, tills are dominantly sandy, normally consolidated and contain numerous granitic clasts. Tills to the north commonly have a siltier matrix and are reddish in colour, reflecting a significant component of Seal Lake Group lithologies located to the west. The till surface is generally featureless, although erosion channels are locally abundant, especially north of the Kanairiktok River valley.

Legend (Figure 3)

Postglacial

6 Alluvium: *Fine sand to silt deposited by fluvial action. Occurs as expressionless surface adjacent to modern rivers.*

5 Marine: *Red, silty to clayey sediment. Commonly capped by fine sand. Commonly rhythmically bedded, especially in the Kanairiktok Valley. May be overlain by glaciofluvial sediments and has no surface expression. Commonly gullied, especially in the Kaipokok Valley. Unstable. Surface cover of organic deposits is common.*

Glacial

4 Glaciofluvial: *Generally fine- to medium-stratified sands and associated gravels. Moderately to well sorted. Generally confined to valleys. Low relief (less than 3 m); gravel-rich esker ridges (3 to 12 m high) are common.*

3 Glaciolacustrine or Glaciomarine: *Deltaic deposits comprised of fine- to medium-grained sands and associated gravels. Generally confined to valleys. Flat surfaced. No internal structure noted.*

2 Till: *Fine sand to silt matrix, 10-30% clast content. Generally massive. Diamicton probably of basal glacial origin. Ubiquitous across area. Not confined to any geomorphic unit. Surface may have hummocks, gullied or featureless expression. Commonly greater than 2 m thick.*

Preglacial

1 Rock: *Area dominated by bedrock. Numerous pockets of glacigenic sediment present, usually less than 2 metres thick.*

SYMBOLS

⤴ ✝ *Esker (direction known, direction unknown)*

⇢ *Meltwater channel*

∼ *Moraine, transverse to flow*

⊥⊥⊥ *Fluvial terrace*

▤ *Area underlain by sediment of marine origin*

▥ *Area underlain by till*

Unit 3. Glaciofluvial sediments are common within most of the major valleys that traverse the study area. In the Kanairiktok Valley, individual sections expose greater than 20 m of outwash sand and gravel, and low-lying, lichen-covered plains are underlain by coarse gravels and sands. Crossbedded fine sands are rare and reflect the generally high-energy environment within the valley system. The Otter Lake–Stipec Lake valley also reveal evidence of high-energy flow, but these are dispersed amongst units that reflect calmer, more steady-state flows. Paleoflow directions are generally consistent with present drainage patterns. Gravel-rich eskers are common in both the Kanairiktok and Otter Lake–Stipec Lake valleys, some reaching up to 15 m in height. Glaciofluvial sediment within the Nipishish Lake–Clarice Lake valley is anomalous in that the margin of Nipishish Lake (the down valley end) has only till, whereas the rest of the valley is outwash filled. Outwash grades into till along many of the valley sides, and a distinct boundary is commonly difficult to define. Outwash sediment commonly forms a thin (less than 1 m) veneer over till, especially in the Nipishish Lake area.

Unit 4. Deltaic deposits have been identified at various locations across the area. The most evident is downstream of Moran Lake, where a well-defined glaciomarine delta exists. The delta has at least two major levels, one at about 105 m above sea level, and the other at about 130 m above sea level. The delta is underlain by sediment of marine origin. Another large delta exists in the northeast corner of the study area where outwash waters from the Kanairiktok basin entered the headwaters of the Kaipokok Valley. A similar situation occurs along the southern margin of the Kaipokok Valley where waters exiting the Stipec Lake area entered the marine waters of Kaipokok Bay. The elevation of the delta in this area is similar to the upper level of the Moran Lake delta.

Smaller, probably freshwater deltas, are also present in the Otter Lake–Stipec Lake valley, as for instance, where an eroded terraced surface at an elevation of about 240 m above sea level shows evidence for the existence of a shallow proglacial lake, upstream from Stipec Lake.

Unit 5. Three of the prominent or possible deltas outlined above formed as meltwater entered the Kaipokok Valley, which was filled with seawater. Marine sediments fill the Kaipokok Valley, up to an elevation of at least 100 m above present sea level, and have modified sediments probably 20 m above that. Marine sediments also underlie outwash sediments in the Kanairiktok Valley.

The character of marine sediment varies between the Kanairiktok and Kaipokok valleys. In the Kaipokok Valley, sediment is commonly a massive to slightly laminated red clay that grades upward into a fine sand capping, less than 1 m thick. In the Kanairiktok Valley, red-coloured, rhythmically bedded silt and clay dominate, although grey fine sand layers are also present. The red colour is a reflection of their source in the Seal Lake Group mudstones or tills derived from those rocks (Thompson and Klassen, 1986). Individual laminae range from 1 to 15 mm. This pronounced lamination is absent within the Kaipokok Valley. Marine sediment within both the Kaipokok and Kanairiktok valleys are fossiliferous.

Within both valleys there is evidence of Quaternary sediment instability. The area is dissected by numerous erosional channels especially in the Kaipokok Valley. Recent slumps and slope failure are evident. At one location in the Kaipokok Valley, an estimated 26,000 m^2 of material slumped across the river after a period of heavy rain. Similar instability may also be expected in areas of the Kanairiktok Valley underlain by marine silts and clays.

Unit 6. Alluvium forms a minor constituent in the Kaipokok Valley where it is underlain by marine sediment.

Directional Indicators

Directions of ice flow range from northward to east-southeastward (Figure 4). There is an even distribution of striations exposed across the study area, a reflection of the distribution of bedrock.

The study area may be subdivided into at least 3 subareas based on ice-flow directions. North of the Kanairiktok Valley and northeast of Copper Pond, a northeastward flow predominates (055° to 070°). This is commonly the only one recorded. South of the Bruce Lake–Stipec Lake valley, a north-northeastward flow dominates (020-040°), and again is commonly the only flow recorded. The remaining area has complex flow patterns. The youngest flow is eastward and overprints a northeastward ice flow. Although this eastward paleoflow is noted across the study area, its major area of influence is west, north and south of Moran Lake. Farther east it is restricted altitudinally and laterally, and is often seen as a faint overprinting on well-developed northeastward striae. The relationships here are often crosscutting, which suggests limited erosion. Around Moran Lake the age relationships are based on stoss and lee features; i.e., evidence of the earlier flow has been removed on stossed faces. The distribution of the eastward, north-eastward and north-northeastward striae suggests that they relate to regional events rather than local influences.

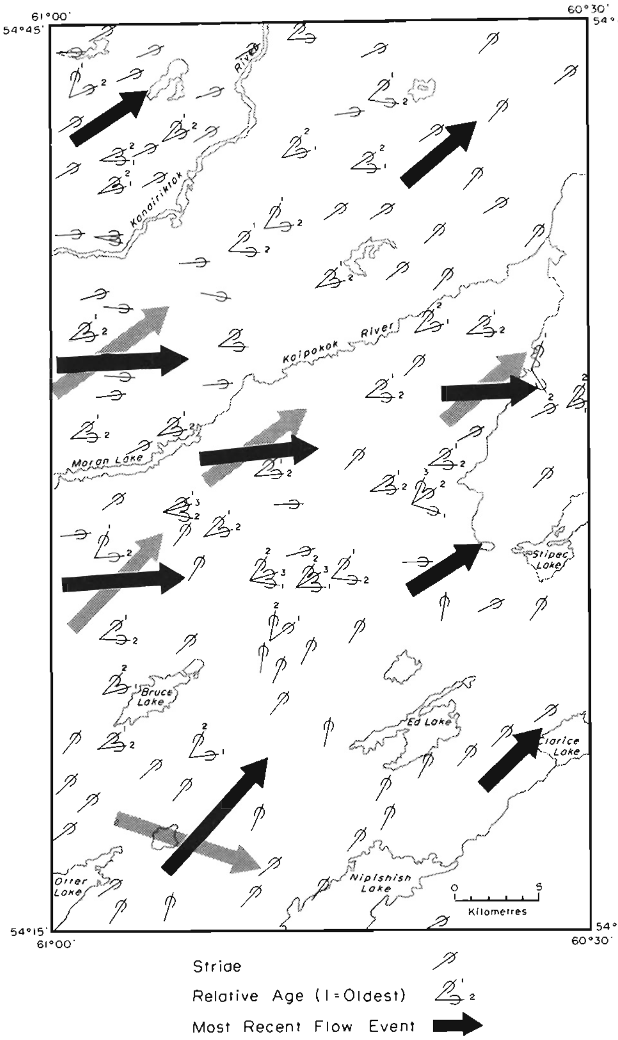

Figure 4. *Ice-flow-trend distribution. The map is based on erosional features, notably striae. Constructional landforms, where observed, are commonly oriented parallel to the most recent flow event.*

Apart from these major events, others are also evidenced. Between Otter Lake and Nipishish Lake, east-southeastward striae may reflect a component of a regional flow event identified south and west of Nipishish Lake by Thompson and Klassen (1986). To the east of Bruce Lake there is a series of northward-directed (000° to 010°) striae. The origin of these is speculative, although they are coincident with bedrock structure. Other striae are minor, locally-related features.

Clast Dispersal

The use of boulder tracing has been well documented in many heavily drift-covered areas and, in fact, in the Central Mineral Belt it has played a role in finding mineral deposits. The uranium discoveries at Moran Heights (Bayrock 1985), and the yttrium showings around Two-Tom Lake (Batterson and Miller, 1987) are two examples. In both cases, mineralized clasts were common. Usually, however, only a small number of clasts are discovered. To assist in detailing the distances and directions of transport in the Central Mineral Belt emphasis has been placed on tracing indicator lithologies. These distinctive rock types (about 1 in a 1000 can be easily spotted) have a discrete spatial distribution.

Several rock types have been used for boulder tracing in the Central Mineral Belt. These include Snegamook granite from north of Snegamook Lake; a green, aegerine gneiss from the Red Wine Alkaline Intrusive Suite near Letitia Lake; Seal Lake Group basalts (Thompson and Klassen, 1986); and also porcelanite from around Croteau Lake and a plagioclase porphyry from around Camel Lake (Batterson *et al.*, 1987). To this list can be added Crooked River granites that outcrop to the east and south of Nipishish Lake and a dolomite unit from the Moran Lake area.

Batterson *et al.* (1987) suggested that the presence of provenance indicators is related to their transportability (e.g., hard versus soft) and the number of clasts available for examination. At 20 km down-ice from their bedrock source, the probability of finding one indicator lithology out of 100 to 200 pebbles taken from a testpit is low. In the Moran Lake area, mudboils are common on upland surfaces, which are generally devoid of vegetation. The number of observed surface clasts and consequently the probability of locating indicator erratics is therefore increased.

The distribution of Red Wine alkaline rocks and Snegamook granite supports the findings of Thompson and Klassen (1986). Red Wine alkaline rocks are only found north and west of the eastern end of Moran Lake, and Snegamook granites are restricted in, and to the north of, the Kanairiktok Valley. The distribution of porcelanite and plagioclase porphyry produces the clearest dispersal patterns (Figure 5), and refines the comments of Batterson *et al.* (1987). Porcelanite clasts form a fan-shaped dispersal train within the study area. In the west the train is 7 km wide (between Moran Lake and Bruce Lake), whereas in the east the train is 20 km wide. A similar pattern is noted with the plagioclase porphyry dispersal train. At the western end the train is 3 km wide and in the central part of the study area it is 7 km. These patterns are consistent with the ice-flow-directional data. In the vicinity of Moran Lake eastward flow prevailed, whereas east of Moran Lake more northeastward paleoflow is indicated. The dispersal pattern reflects this change of glacial influence and the dispersal train 'dog-legs' accordingly. However, the ice-flow-pattern data suggest that eastward paleoflow extends to the central-eastern parts of the study area, although here it is likely that this influence is restricted to minor erosion rather than major deposition.

Glacial History: Some Preliminary Observations

Data derived from observations of the surficial environment have yet to be compared with radiometric, geochemical and grain-size data. Consequently, only a few speculative ideas are presented at this time.

The study area has undergone a complex glacial history, as evidenced by the variation of terrain types and ice-flow patterns. Reconciliation of these varied aspects is difficult, and fraught with pitfalls. Nevertheless, an attempt to do so shows that the glacial history can be interpreted in terms of three separate phases:

Phase 1 (Figure 6a). This is the period of maximum glacial activity. The area south of the Bruce Lake–Stipec Lake area was affected by a north-northeastward flow, whereas the area to the north was only affected by northeastward-flowing ice. It is not clear whether these events were contemporaneous, but the lack of conflicting glacial evidence and the dominantly unidirectional nature of the flow suggests that they were.

Phase 2 (Figure 6b). This corresponds to a period of deglaciation. The extent of the northeastward–north-northeastward flow event is unclear, although Batterson *et al.* (1987) noted its dominance in the Melody Lake area. However, during its retreat, the associated meltwater and the isostatically lowered coast allowed marine incursion. Marine sediments filled the Kaipokok Valley almost up to Moran Lake and are evident below outwash sediments in the Kanairiktok Valley. The level of deltas entering the Kaipokok Valley suggests marine level reached at least 125 m above sea level, with a major phase at about 105 m above sea level. The meltwater associated with retreat led to the deposition of outwash sediments in many valleys and the development of proglacial lakes; e.g., around Stipec Lake. It is likely that stillstands were associated with the deglacial trend. For example, the north and east shores of Nipishish Lake are till covered despite the fact that ice retreated downslope (i.e., southwestward) from Clarice Lake, and the intervening valley is outwash filled. It is likely that drainage was around the ice in Nipishish Lake and toward the south. A glaciofluvial veneer covers till in this area.

Phase 3 (Figure 6c). As well as stillstands it is likely that a separate pulse of ice was related to deglaciation. The Kanairiktok Valley has ice-contact outwash sediment overlying marine sediment. It is likely that this marine sediment was contemporaneous with that in the Kaipokok Valley because the marine limit is approximately the same. This late pulse produced the eastward-flow pattern in the western part of the study area. It is possible that this flow was less extensive in the central part of the area and more extensive in the Kanairiktok Valley. Ice-contact deposits (e.g., kettleholes and eskers) occur throughout the Kanairiktok Valley and even in the northern parts of the Kaipokok Valley. A series of gravel-rich ridges overlying marine sediment were noted in the Kaipokok Valley by Batterson *et al.* (1987), who assigned them to a marine origin. It is likely, however, that these features are eskers because they are an extension of eskers within the Kanairiktok Valley. Support for this idea of ice crossing the Kaipokok Valley comes from Thompson (personal communication, 1987), who observed southeastward-directed striae in this area. The orientation of the eskers is consistent with that of the Anna Lake valley. The suggestion that an ice tongue, related to that discussed above, pulsed down the Anna Lake valley is speculative.

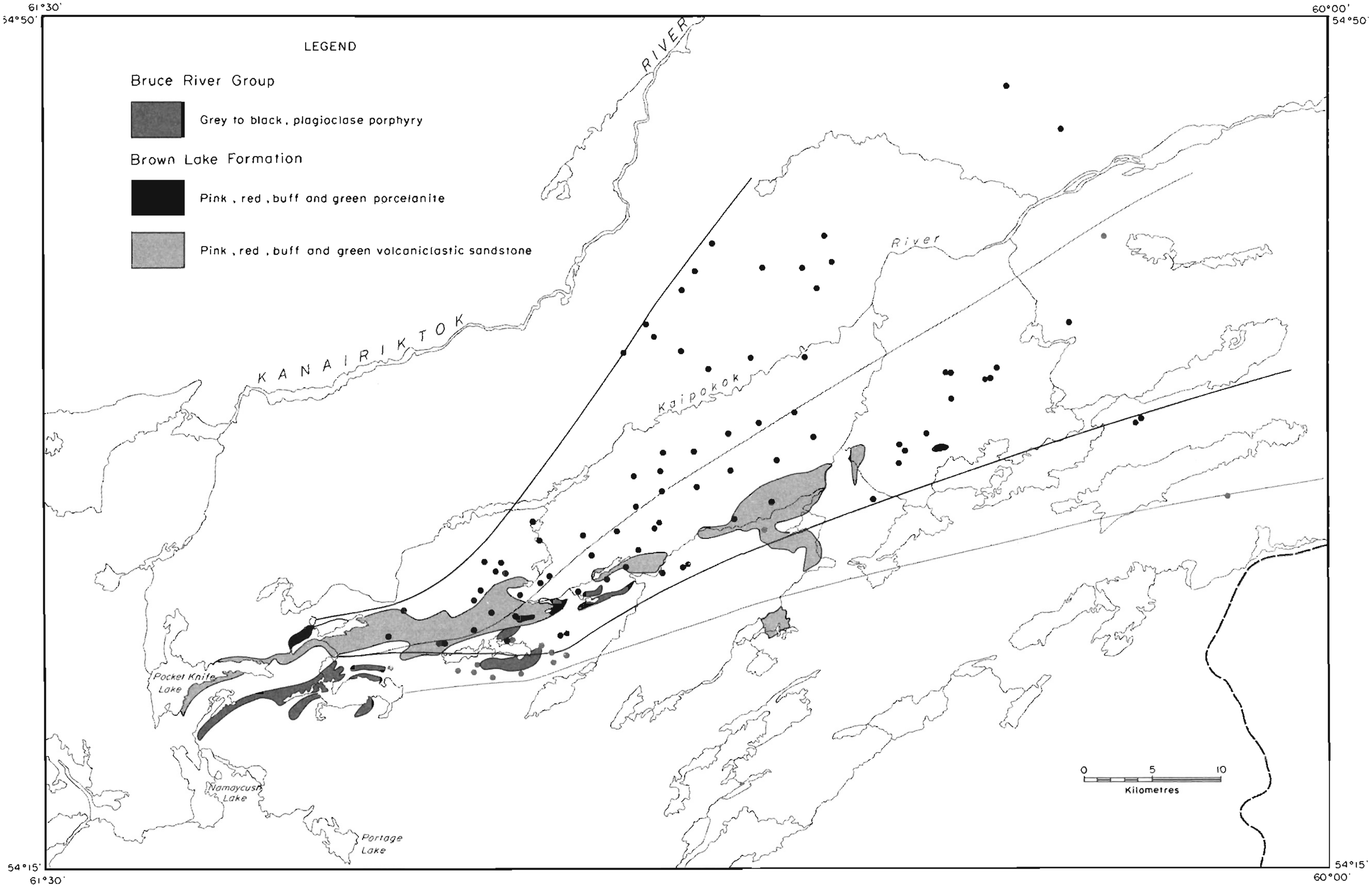

Figure 5. *Dispersal of indicator lithologies from the Bruce River Group and Brown Lake Formation. The occurrence of an indicator is shown as a dot the same shade as outcrop. Volcaniclastic sandstones of the Brown Lake Formation have similar characteristics to the porcelanite, which was mapped near Pocket Knife Lake. However, an unmapped porcelanite outcrop was discovered during the course of fieldwork, and other occurrences may be possible within the volcaniclastic suite.*

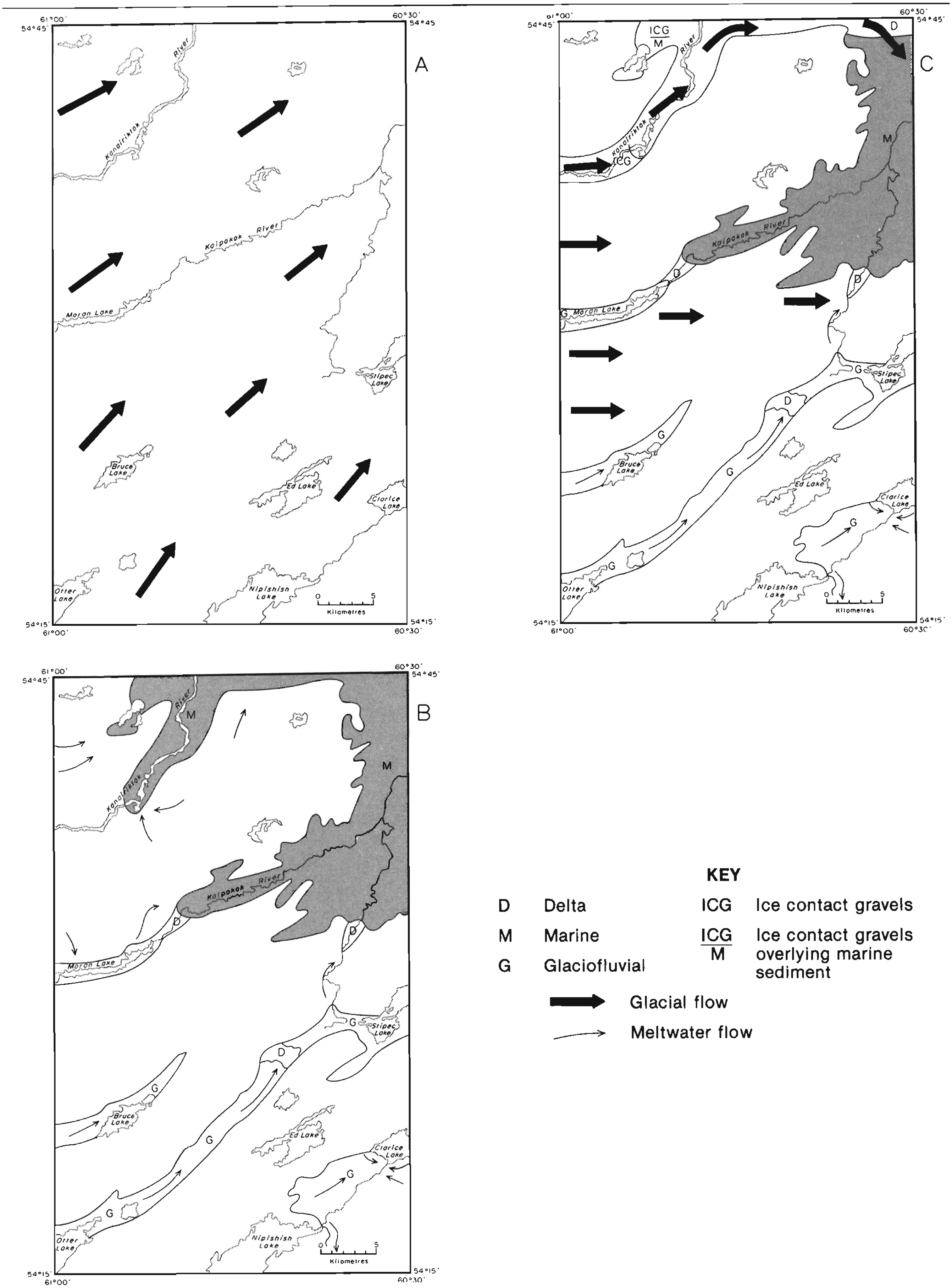

Figure 6. *Speculative phases in the glacial history of the Moran Lake area; model based on glacial striae, terrain mapping and sediment dispersal patterns.*

Many aspects of this suggested late pulse of ice are unresolved. For instance, are the marine sediments in the Kaipokok–Kanairiktok valleys contemporaneous? Is the eastward flow in the Moran Lake area related to the events in the Kanairiktok Valley? Is there supporting evidence from elsewhere? What are the mechanisms behind this pulse? What was the relationship between this pulse and sea level? Had sea level dropped by the time of the pulse? Further study in this area and others is needed to resolve the glacial history of this part of the Central Mineral Belt.

MINERAL EXPLORATION IMPLICATIONS

It has been demonstrated that the glacial history of the Moran Lake area is more complex than previously thought. Based on these findings, the earlier suggestions that drift prospecting is straightforward in central Labrador because of the simple configuration of the Laurentide ice sheet can be negated. There is evidence for two ice-flow events, based on dispersal of indicator lithologies; other ice flows are suggested by variation in orientation of ice-flow-directional indicators.

Drift-exploration programs in this part of Labrador should be restricted to areas underlain by till, and not areas of outwash, marine or lacustrine sediments. The processes by which till is deposited is better understood and more reliable in terms of dispersal, than other glacigenic sediment that may have undergone reworking and be far removed from its source.

SUMMARY

The level of understanding of the Quaternary environment of the Central Mineral Belt is steadily growing through a combined approach by provincial and federal government agencies. The current study has shown that previous interpretations of the Quaternary history in the Central Mineral Belt are too simplistic. Instead, early flows to the northeast and north-northeast have been identified, succeeded by a flow to the east that affected the western parts of the study area and altered dispersal patterns. The age and extent of this late flow is speculative, but may have followed the Kanairiktok Valley and covered the Kaipokok Valley to the west of West Micmac Lake.

This complexity of glacial events stresses the need for Quaternary mapping programs in areas of drift cover in the Central Mineral Belt of Labrador. It also highlights that failure to understand Quaternary environments may lead to erroneous conclusions in any drift-exploration program.

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