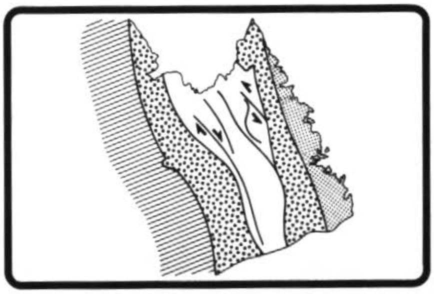
Articles



The eastern Churchill Province, Torngat and New Québec orogens: An overview

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Summary
The eastern Churchill Province, which separates the Archean cratons of the Superior and Nain provinces in the eastern Canadian Shield, is a rare example of a two-sided Early Proterozoic orogenic belt. The interior of the eastern Churchill Province is composed largely of reworked Archean rocks, which appear to form an extension of the Rae Province, sutured against the adjoining Superior and Nain provinces by the New Québec and Torngat orogens. Both orogens contain continental margin sequences that record the transition from initial rift to foredeep environments. Deformation was predominantly of transpressional character and was controlled by oblique convergence of the Superior and Nain cratons on the Rae Province. The New Québec and Torngat orogens have a mirror-image symmetry defined by outward-verging fold and thrust belts associated with dextral (west) and sinistral (east) transcurrent shear on their interior margins. The dominant feature of the New Québec Orogen is its broad fold and thrust belt which is developed in low- to medium-grade rocks and is analogous to the foreland zones of Phanerozoic orogens. The Torngat Orogen, however, is dominated by an extensive sinistral shear system, developed in granulite-facies crust, that provides an excellent lower crustal analogue for modern crustal-scale transcurrent fault systems.

Introduction
The papers presented in this issue result from a two-day conference entitled "Recent Advances in the Geology of the Eastern Churchill Province (New Québec and Torngat Orogens)" which was held in Wakefield, Québec, in March 1990, and was attended by 25 active researchers.

The 2.4–1.8 Ga Churchill Province (Figure 1) has been referred to as "the glue that binds the Canadian Shield", a statement that underlines its monumental importance in the assembly of the North American Shield as a whole. Despite such fundamental significance, it is only comparatively recently that we have begun to understand this enormous and complex orogenic system. Our understanding to date is built principally on detailed work in the western parts of the Province and in the Cape Smith Belt, which has led to a series of regional syntheses, summarized in the Trans-Hudson Orogen Symposium volume (Lewry and Stauffer, 1990), and the landmark compilations of Hoffman (1988, 1990). Although models for the western part of the Churchill Province and Cape Smith Belt, are now relatively well constrained, our knowledge of the rest of the remote northern and eastern regions of the Province remains woefully inadequate.

The first regional syntheses of what is referred to here as the eastern Churchill Province were presented at the Geological Association of Canada — Mineralogical Association of Canada (Saskatoon '87 Annual Meeting) Trans-Hudson Symposium (van der Leeden *et al.*, 1990; Wardle *et al.*, 1990; Hoffman, 1990). Much work has been done since that time, and plans are under way for an enhanced research program in the area. These plans have been given added impetus by the recent approval of the Phase III LITHOPROBE ECSOOT (Eastern Canadian Shield Onshore – Offshore Transect) project which plans to conduct reflection seismic and allied onshore geoscience studies along the Labrador coast and across the strike of the Churchill Province in Ungava Bay (LITHOPROBE, 1990). Planning for this transect formed a major component of the Wakefield meeting.

It has been recognized for some time that the eastern Churchill Province has a fundamental tripartite division, consisting of a western low-grade volcano-sedimentary package (Labrador Trough), a central region of reworked Archean gneiss and Proterozoic cover (Rae Province; Hoffman, 1988) and an eastern region comprising reworked Archean rocks of the Nain Province. Hoffman (1990) has integrated this scheme into his overall synthesis of the Churchill Province and proposed the existence of two orogenic sutures: in the east the Torngat Orogen, which forms the Nain/Rae province boundary, and in the west the New Québec Orogen, which similarly links the Rae and Superior provinces (Figure 2, inset A: **Hoffman**). This terminology has been adopted by the majority of conference participants, though the full extent of the two orogens has yet to be firmly defined. We retain the term eastern Churchill Province for the area affected by lower Proterozoic (Hudsonian) orogenesis as a whole.

The following is a review of the principal aspects of the eastern Churchill Province with emphasis on the contributions of the Wakefield papers. This review also draws extensively on previous work, in particular the results of regional mapping programs by the provincial geological surveys of Québec and Newfoundland (see references *in* Dimroth (1972), van der Leeden *et al.* (1990), and Wardle *et al.* (1990)). Much of the northern part of the eastern Churchill Province is, however, known only from the reconnaissance work of Taylor (1979). References to articles appearing in this issue are shown in bold and are keyed alphabetically to Figure 2.

Nain and Superior Provinces
The recognition of the predominantly Archean character of the Rae Province has stressed the need for comparisons with the

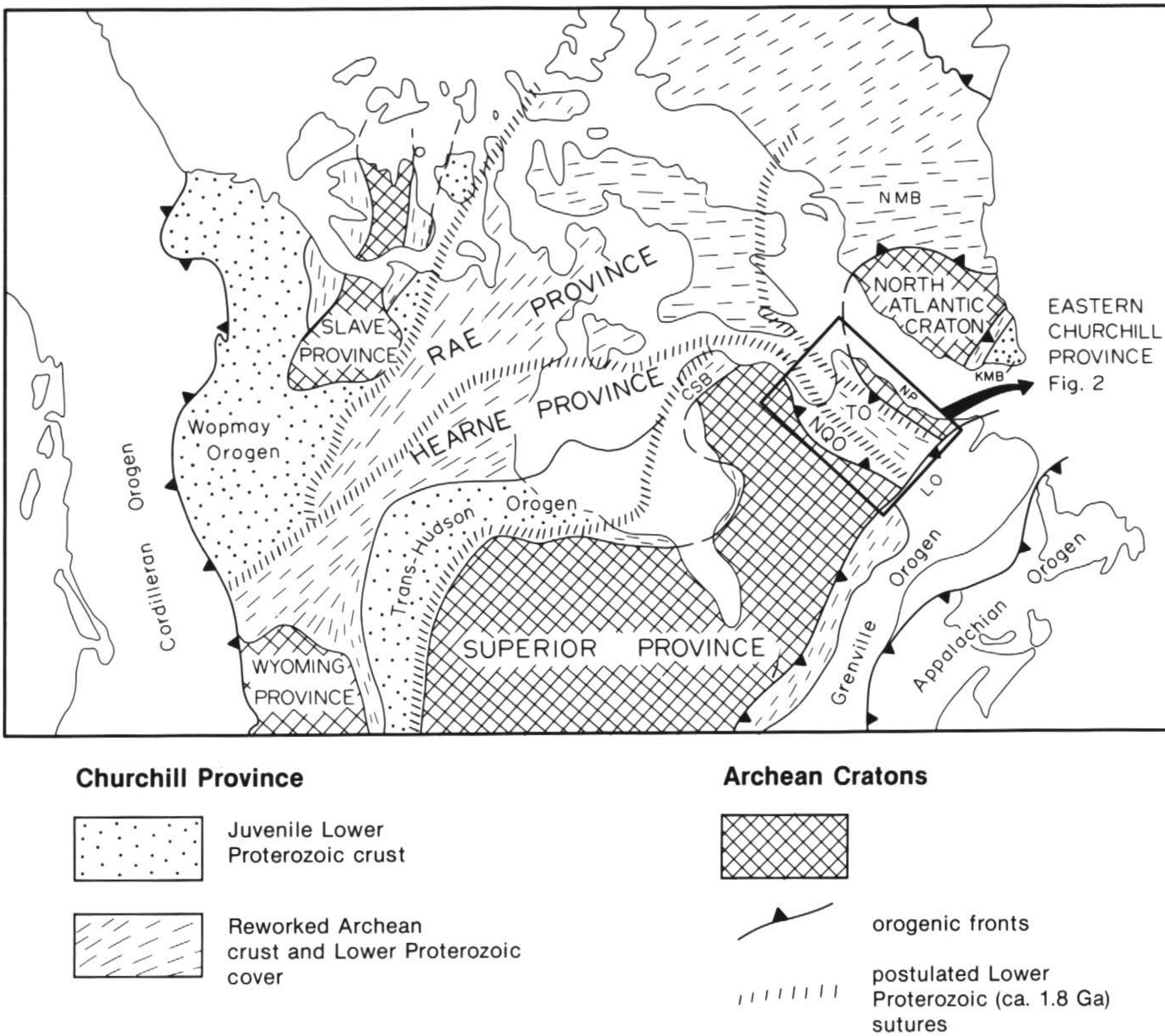
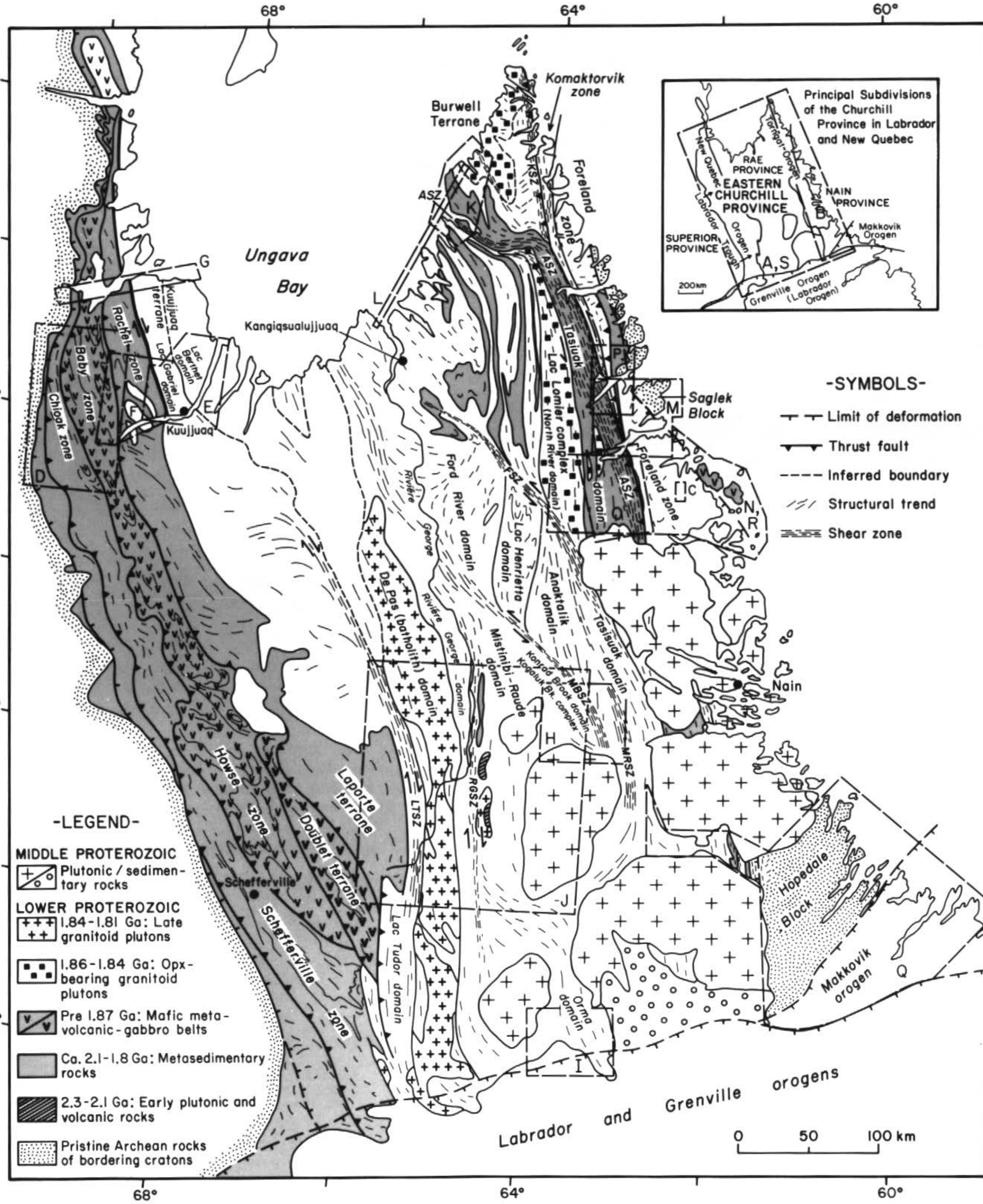


Figure 1 *Major subdivisions of the Churchill Province showing location of eastern Churchill Province. Boxed area refers to Figure 2.* ***NQO****, New Québec Orogen;* ***TO****, Torngat Orogen;* ***CSB****, Cape Smith Belt;* ***NMB****, Nagssugtoqidian Mobile Belt;* ***NP****, Nain Province;* ***KMB****, Ketilidian Mobile Belt;* ***LO****, Labrador Orogen.*

Figure 2 *(opposite page)* *The eastern Churchill Province of Labrador and northeastern Québec showing tectonic subdivisions. The Torngat Orogen, New Québec Orogen and Rae Province are shown in the inset. Shear zones indicated as follows:* ***KSZ****, Komaktorvik;* ***ASZ****, Abloviak;* ***FSZ****, Falcoz;* ***MBSZ****, Moonbase;* ***MRSZ****, Mistastin River;* ***RGSZ****, Rivière George;* ***LTSZ****, Lac Tudor. Outlined areas refer to papers presented in this issue and are keyed alphabetically to the bold references in the text.*

***(A)* Hoffman**: Dynamics of the tectonic assembly of northeast Laurentia in geon 18 (1.9–1.8 Ga)
(B)* Schiøtte *et al.: U-Pb mineral ages from northern Labrador: Possible evidence for interlayering of Early and Middle Archean tectonic slices
***(C)* Van Kranendonk and Helmstaedt**: Late Archean geologic history of the Nain Province, North River–Nutak map area, Labrador, and its tectonic significance
***(D)* Wares and Goutier**: Deformational style in the foreland of the northern New Québec Orogen
***(E)* Perreault and Hynes**: Tectonic evolution of the Kuujjuaq terrane, New Québec Orogen
***(F)* Moorhead and Hynes**: Nappes in the internal zone of the northern Labrador Trough: Evidence for major early, NW-vergent basement transport
(G)* Mareschal *et al.: Gravity profile and crustal structure across the northern New Québec Orogen
***(H)* Ryan**: Does the Labrador–Québec border area of the Rae (Churchill) Province preserve vestiges of an Archean history?
(I)* Nunn *et al.: U-Pb geochronological evidence for Archean crust in the continuation of the Rae Province (eastern Churchill Province), Grenville Front Tectonic Zone, Labrador
***(J)* Girard**: Evidence d'un magmatisme d'Arc protérozoïque Inférieur (2.3 Ga) sur le plateau de la rivière George
***(K)* Goulet and Ciesielski**: The Abloviak shear zone and the NW Torngat Orogen, eastern Ungava Bay, Québec
***(L)* Seguin and Goulet**: Gravimetric transect of eastern Ungava Bay, northern Torngat Orogen
***(M)* Ryan**: Basement-cover relationships and metamorphic patterns in the foreland of the Torngat Orogen in the Saglek–Hebron area, Labrador
***(N)* Ermanovics and Van Kranendonk**: The Torngat Orogen in the North River–Nutak transect area of Nain and Churchill provinces
***(O)* Van Kranendonk and Ermanovics**: Structural evolution of the Hudsonian Torngat Orogen in the North River map area, Labrador: Evidence for east-west transpressive collision of Nain and Rae continental blocks
***(P)* Mengel and Rivers**: The synmetamorphic P-T-*t* path of granulite-facies gneisses from the Torngat Orogen, and its bearing on their tectonic history
***(Q)* Ermanovics and Ryan**: Early Proterozoic orogenic activity adjacent to the Hopedale block of southern Nain Province
(R)* Bertrand *et al.: Structural and metamorphic geochronology of the Torngat Orogen in the North River–Nutak transect area, Labrador: Preliminary results of U-Pb dating
***(S)* Girard**: Les cisaillements latéraux dans l'arrière-pays des orogènes du Nouveau-Québec et de Torngat: une revue
(Not shown)* Bridgwater *et al.: The Proterozoic Nagssugtoqidian mobile belt of southeast Greenland: a link between the eastern Canadian and Baltic Shields


68°
64°
60°
60°
58°
56°
54°
Komaktorvik zone
Burwell Terrane
Foreland zone
Ungava Bay
Kangiqsualujjuaq
Kuujjuaq
Kuujjuaq terrane
Rachel zone
Baby zone
Chiloak zone
Lac Gabriel domain
Lac Bertrand domain
Tasiuyak domain
Lac Lomier complex (North River domain)
Saglek Block
Ford River domain
Rivière George
De Pas (batholith) domain
Lac Henrietta domain
Anaktalik domain
Tasiuyak domain
Mistinibi-Raude domain
Konrad Brook domain
Nain
Laporte terrane
Howse zone
Doublet terrane
Schefferville
Schefferville zone
Lac Tudor domain
Orma domain
Hopedale Block
Makkovik orogen
Labrador and Grenville orogens
0 50 100 km
ASZ
KSZ
FSZ
MBSZ
MRSZ
RGSZ
LTSZ
Principal Subdivisions of the Churchill Province in Labrador and New Quebec
RAE PROVINCE
EASTERN CHURCHILL PROVINCE
NAIN PROVINCE
SUPERIOR PROVINCE
New Quebec Labrador Orogen Trough
Torngat Orogen
Makkovik Orogen
Grenville Orogen (Labrador Orogen)
200 km
-SYMBOLS-
Limit of deformation
Thrust fault
Inferred boundary
Structural trend
Shear zone
-LEGEND-
MIDDLE PROTEROZOIC
Plutonic / sedimentary rocks
LOWER PROTEROZOIC
1.84-1.81 Ga: Late granitoid plutons
1.86-1.84 Ga: Opx-bearing granitoid plutons
Pre 1.87 Ga: Mafic meta-volcanic-gabbro belts
Ca. 2.1-1.8 Ga: Metasedimentary rocks
2.3-2.1 Ga: Early plutonic and volcanic rocks
Pristine Archean rocks of bordering cratons

stable cratons of the Nain and Superior provinces. Relatively little is known about the Superior Province adjacent to the New Québec Orogen, but dating by Mortensen and Percival (1987) and Machado *et al.* (1989) indicates a comparatively short crustal history between 2.8 and 2.65 Ga. **Schiøtte *et al.*** (Figure 2, inset B) review the chronology of the better known Nain Province and describe a fundamental difference between the Saglek (northern Nain) block, which is characterized by 3.86–3.7 Ga crust, and the Hopedale (southern Nain) block, which is dominated by 3.2–3.1 Ga crust. Both share a common Late Archean (post-2.7 Ga) history. **Schiøtte *et al.*** (B) suggest that the interleaving of Early and Middle Archean crust in southern Saglek block is the result of Middle to Late Archean terrane amalgamation. ***Van Kranendonk and Helmstaedt*** (C) describe tectonic relationships between Archean supracrustal sequences and older *ca.* 3.7 Ga orthogneiss crust in the Saglek block and conclude that these are fundamentally no different from those seen in higher level granite-greenstone belts.

New Québec Orogen

This Orogen consists predominantly of the low-grade sedimentary and mafic volcanic rocks of the Labrador Trough (Figure 2) disposed in a west-verging fold and thrust belt. The western part of the belt (Chioak–Schefferville zones) comprises sedimentary rocks inferred to have formed in a setting that evolved from an intial rifted margin to a subsequent foredeep, the latter in response to encroachment of thrust sheets from the east. The Baby and Howse zones and Doublet terrane consist primarily of turbidites, basalt flows and voluminous gabbro sills (including ultramafic sills in the Doublet terrane) interpreted by most workers (*e.g.*, **Wares and Goutier**, D) to have formed during rifting of the Superior continent and the formation of oceanic crust. Initial rifting of the Superior margin appears to have commenced *ca.* 2.1 Ga; paradoxically, the few available U-Pb dates indicate that gabbro sill intrusion culminated at 1.87 Ga, the approximate time of foredeep formation according to Hoffman (1987). A potential resolution of this dilemma is offered by **Hoffman's** (A) model for ocean opening in a dextral pull-apart basin which formed along the eastern edge of the Superior craton during its northward indentation into the Churchill hinterland.

The hinterland of the New Québec Orogen is represented by: (i) the Rachel zone–Laporte terrane, a tract of metasedimentary schist correlative, in part at least, with rocks of the western zones, and (ii) the Kuujjuaq terrane, a metasedimentary sequence underlain by Archean basement and intruded by the 1.84–1.83 Ga Kuujjuaq batholith (**Perreault and Hynes**, E). The calc-alkaline nature of the batholith suggests an origin as a magmatic arc, but it is uncertain whether this was developed on the Superior margin, or accreted against it.

Wares and Goutier (D) analyze the deformational history of the northern New Québec Orogen in the Baby and Chioak zones and distinguish an early episode of low-angle, in-sequence thrusting from a later period of major high-angle, out-of-sequence thrusting. Out-of-sequence thrusting is thought to be responsible for the bulk of crustal thickening in this part of the New Québec Orogen and may have developed in response to syntectonic erosion of the orogenic wedge and attempts by the wedge to maintain critical taper. **Moorhead and Hynes** (F) review the structural development of the Rachel zone and describe large, west-verging, basement-cored nappes that developed through early décollement at the basement-cover interface and were refolded during later northwest- and southwest-directed thrust-fold phases. Gravity modelling by **Mareschal *et al.*** (G) confirms that significant crustal thickening has occurred under the Chioak and Baby zones, presumably in response to southwest-directed overthrusting. An eastward rise in the gravity gradient from the Rachel zone into the Rae Province is proposed to result from crustal thickening and uplift of dense lower crustal material in response to collision and overthrusting of the Rae Province onto the Superior margin.

Initial thrusting and collision in the New Québec Orogen is proposed by **Hoffman** (A), on the basis of comparisons with the Cape Smith Belt, to have commenced no later than 1.88 Ga. An initial metamorphic peak in the hinterland *ca.* 1.84 Ga is separated from a second peak *ca.* 1.83 Ga (Machado, 1990; **Perreault and Hynes**, E) by intrusion of the Kuujjuaq batholith. Penetrative deformation in the foreland (Chioak and Baby zones) appears to have ceased by 1.813 Ga; however, pegmatite intrusion and retrograde metamorphism persisted until 1.77 Ga (Machado, 1990; **Perreault and Hynes**, E).

Rae Province

The location of the suture(s) that separates the New Québec Orogen and its Superior Province basement from the Rae Province is still uncertain, but must lie somewhere between the Rachel zone–Laporte terrane and De Pas domain. The Lac Tudor shear zone is a possible candidate, but so are the shear zones that bound the eastern margin of the Rachel zone–Laporte terrane. The Rae Province has long been suspected to consist predominantly of reworked Archean crust, a suspicion that is now being confirmed in several areas. Machado *et al.* (1989) have reported ages of *ca.* 2.9–2.8 Ga from the central Rae Province near Ungava Bay. **Ryan** (H) describes a large area of Archean granitoid gneiss and anorthosite cut by early Proterozoic (?) dykes that bears a remarkable resemblance to rocks of the Nain Province; rocks from the same general area have also yielded preliminary Archean zircon ages. Finally, **Nunn *et al.*** (I) report the discovery of a well-preserved Archean (2.7–2.6 Ga) tonalite-mafic volcanic assemblage in the Orma domain of the southern Rae Province.

An intriguing *ca.* 2.3 Ga magmatic event is described by **Girard** (J) from the Rivière George domain. This event, which may be arc-related, probably predates deposition of other Early Proterozoic platformal sequences such as the Lake Harbour Group in the interior Rae Province, and also appears to predate rifting of the Superior Province *ca.* 2.1 Ga (Wardle *et al.*, 1990); its regional significance, however, remains uncertain. A later stage of crustal development in the Rae Province is marked by the *ca.* 1.84–1.81 Ga De Pas batholith, which has been variably interpreted as an Andean-type magmatic arc by van der Leeden *et al.* (1990) and **Girard** (J), and as a syn- to post-collisional batholith by Wardle *et al.* (1990). As the result of Early Proterozoic deformation,the Rae Province was subjected to dextral shearing along the Lac Tudor and Rivière George shear zones and sinistral shearing along the Mistastin, Moonbase and Falcoz shears. The relative timing of these opposed shear events has not been established, but is clearly important. Penetrative deformation apparently ceased by 1.8 Ga, the age of the youngest De Pas plutonism.

The Torngat Orogen

The axis of the Torngat Orogen is the Tasiuyak domain, which together with the Abloviak shear zone forms the postulated suture zone between the Nain and Rae provinces. The effects of the Torngat deformation on the Nain Province wane eastward through the Komaktorvik zone, where they are intense, to the Foreland zone where they die out. In northernmost Labrador, the Tasiuyak domain and Abloviak shear zone diverge from the Nain Province to enclose the triangular Burwell terrane, the age and origin of which are so far unknown. **Hoffman** (A) suggests that the Burwell terrane may represent an independent province that has been sutured along the Abloviak and Komaktorvik shear zones. **Goulet and Ciesielski** (K), however, propose a correlation between metasedimentary gneisses of the eastern Burwell terrane with the Tasiuyak domain and Lake Harbour Group, implying pretectonic continuity across the Burwell terrane–Rae Province boundary and a possible link with the Superior Province. A gravity transect across this boundary (**Seguin and Goulet**, L) indicates a pronounced high over the western Burwell terrane which is attributed to its higher density.

The fundamental components of the Nain–Rae Province boundary south of the Burwell terrane are the Tasiuyak domain, the Lac Lomier complex (part of the North River domain) and reworked Archean rocks of the Nain craton, which are reviewed by **Ryan** (M),

Ermanovics and Van Kranendonk (N), and **Van Kranendonk and Ermanovics** (O). The Tasiuyak domain is composed predominantly of the distinctive garnetiferous Tasiuyak paragneiss, derived by granulite-facies migmatization of a pelitic-psammitic protolith, and elongate bodies of lineated charnockite. A gravity profile across the Tasiuyak gneiss by T. Feininger (summarized in **Ermanovics and Van Kranendonk**, N) indicates an eastward thickening prism which reaches a maximum thickness of 13 km adjacent to the Nain Province. The Lac Lomier complex (**Ermanovics and Van Kranendonk**, N) consists of Archean orthogneiss intermixed with lower Proterozoic (?) metasedimentary gneiss and charnockite plutons. The latter form a magmatic belt that may represent the roots of a magmatic arc (**Van Kranendonk and Ermanovics**, O) along the western side of the Tasiuyak domain.

All authors are agreed that the Torngat Orogen developed principally through transpressional deformation and sinistral transcurrent shear. **Van Kranendonk and Ermanovics** (N) propose that early transpression was dominated by thrusting, crustal thickening and attainment of peak (granulite-facies) metamorphic conditions, possibly in relation to the attempted subduction of Nain crust under the Rae Province. Subsequent deformation in the interior of the Torngat Orogen was dominated by sinistral shear, possibly coeval with continued thrusting on the margins of the Orogen, which was localized in the Abloviak shear zone. Sinistral shear propagated into the interior of the Rae Province along the subsidiary Falcoz and Moonbase shear zones, interpreted by **Van Kranendonk and Ermanovics** (N) as crustal-scale extensional shears. The Abloviak shear zone is contained largely within the Tasiuyak gneiss, but also affects adjacent rocks of the Nain and Rae provinces. P-T-*t* studies by **Mengel and Rivers** (P) indicate that sinistral shearing took place in an already thickened (possibly doubled) crust, thus lending support to the concept of early thrust-dominated transpression. Although shearing is most intense within the discrete shear zones shown in Figure 2, it is important to point out that all rocks for a distance of about 70 km west of the Abloviak Zone are affected by a pervasive shear fabric and subhorizontal extension lineation. Wardle (1984), working at latitude 59°N, has described a fan of structural attitudes across this broad shear belt, the eastern side of which is marked by west-dipping structures and the western side, by east-dipping shear fabrics. The east-dipping fabrics, which are probably related to west-directed thrusts, may characterize the western boundary of the Torngat Orogen in this area. A narrow belt of dip-lineated ultramylonites, extending along the eastern edge of the Abloviak shear zone and into the Komaktorvik shear zone, is interpreted by **Van Kranendonk and Ermanovics** (N) to mark a late shortening stage during which the Torngat Orogen was exhumed from deeper crustal levels. In the southern part of the Rae/Nain Province boundary is reviewed by **Ermanovics and Ryan** (Q), who conclude that it is probably a suture marked by a zone of low-grade, west-dipping reverse faults. The Rae/Nain boundary at this latitude lacks the transcurrent shearing which is so dominant farther north, but it is not clear whether this is simply the result of exposure at different crustal levels, or has some other cause. **Ermanovics and Ryan** (Q) also review the effects of deformation in the Early Proterozoic Makkovikian Orogen, the trans-Labrador Sea extension of the Ketilidian Mobile Belt of Greenland (Figure 1), along the southern margin of the Hopedale block. The relative chronology of the Makkovikian and Torngat orogenies is crucial to regional tectonic interpretations, but insufficient data exist for detailed comparisons. Deformation in the Makkovik Orogen terminated *ca.* 1.81 Ga; however the age(s) of initial (high-grade) tectonism is unknown.

The chronology of events in the Torngat Orogen has until now been vague; however, U-Pb dates reported by **Bertrand *et al.*** (R) add important new constraints. Intrusion of the Lac Lomier charnockites probably occurred syntectonically *ca.* 1.86 Ga and was followed by a prolonged period of granulite-facies metamorphism, associated with transcurrent shearing in the Abloviak zone, that lasted until *ca.* 1.82 Ga. Late, east-directed thrusting, accompanied by formation of the dip-lineated ultramylonites and injection of granite and pegmatite, persisted until 1.805 Ga and was followed by the closure of monazite *ca.* 1.78 Ga, and hornblende (**Mengel and Rivers**, P) *ca.* 1.75 Ga (Ar-Ar). It is significant that there is little evidence of Archean inheritance in the Tasiuyak gneiss or the charnockites, hinting that these may represent juvenile crustal elements.

Models and Challenges

The early stages of development in the New Québec and Torngat orogens are at present only dimly perceived. **Girard's** (J) description of 2.3 Ga magmatism is intriguing and indicates a previously unsuspected very early event that may be of considerable importance, particularly if it is arc-related. Development of the Rae/Nain province boundary likely involved early westward subduction of the Nain under the Rae Province to produce the Lac Lomier (arc?) complex. The Kuujjuaq (and De Pas?) batholith may similarly record the early convergence of the Superior and Rae provinces. The late convergent history of the eastern Churchill Province is more completely understood and was clearly dominated by oblique convergence and collision in an overall transpressional environment. **Hoffman** (A) and **Girard** (S) emphasize the mirror-image symmetry of the two orogens in which the west-directed thrusting and dextral shearing of the New Québec Orogen are reflected in the east-directed thrusts and sinistral shear pattern of the Torngat Orogen. The sigmoidal shear-lozenge pattern that dominates the Torngat Orogen and the eastern Rae Province is one of the more obvious effects of this transpression. **Hoffman** (A), using an analogy with the India/Asia collision, has modelled the development of the eastern Churchill Province as the result of northward indentation of the Superior Province into a northern Churchill hinterland, followed by oblique collision and accretion of the Burwell and Nain provinces. This model provides testable predictions that will challenge geologists working in the eastern Shield for years to come.

In the final contribution, **Bridgwater *et al.*** summarize the eastern Nagssugtoqidian Mobile Belt of Greenland; a trans-Labrador Sea analogue of the eastern Churchill Province that provides a connection with the Baltic Shield.

It was obvious from the animated discussions at the Wakefield meeting that work in the eastern Churchill Province has reached an exciting and crucial stage. Sufficient data are now available to support general working models; however, much remains to be done before these can be verified, and many surprises are undoubtedly in store. It is perhaps fitting to end this overview with a summary of the major challenges that lie ahead. The most important requirement is obviously for more regional mapping in the area south and east of Ungava Bay. The Burwell terrane/province is a key element in the reconstruction of the Churchill Province in this region and must be investigated in more detail. In the Torngat Orogen, the Abloviak shear zone provides what may be the type example of a transform plate boundary exposed at lower crustal depth. The coincidence of the Tasiuyak gneiss and Abloviak shear zone in this context has to be explained; for example, is the gneiss the root of an accretionary complex? The dramatic north to south change in character of the Torngat Orogen also requires further investigation: is this transition simply an apparent one due to the exposure of higher crustal levels to the south, or is there a fundamental change in tectonic environment?

In the New Québec Orogen, priority needs to be given to establishing the location of the suture with the Rae Province, and to delineating the full extent of the Kuujjuaq batholith. With regard to the Rae Province, it is essential to establish its parentage; is it a rifted fragment of the Nain or Superior provinces, or an independent plate? In this respect, the detailed crustal-age model provided by **Schiøtte *et al.*** (B) will provide a powerful tool for testing potential comparisons with the Nain Province. Finally, it is obvious that throughout the eastern Churchill Province there is an urgent need for greatly expanded geochronological studies.

The eastern Churchill Province is a unique and superb example of a two-sided, Early Proterozoic orogen that is exposed in complete coastal cross-section. With sufficient commitment, there is, therefore, no reason why these challenges cannot be overcome in the years ahead.

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[Note: bold references in the text are listed in the caption to Figure 2.]

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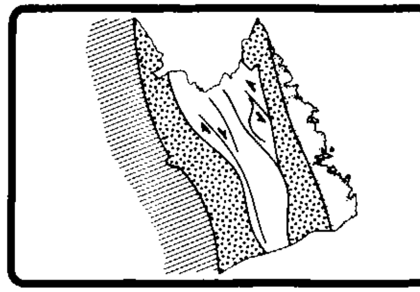

Dynamics of the tectonic assembly of northeast Laurentia in geon 18 (1.9–1.8 Ga)

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Summary
A tectonic model is proposed, based on the Cenozoic evolution of Southeast Asia, in which the southeast arm of the Rae Province rotated clockwise in response to collisional indentation of the Superior Province. A dextral pull-apart basin characterized by mafic sill-sediment complexes formed along the leading edge of the rotating block. Relics of this basin, analogous to the Andaman Sea basin of Southeast Asia, were subsequently thrust onto the Superior Province margin where they occur as allochthons in the Labrador Trough. A wedge-shaped ancestral Baffin basin, analogous to the South China Sea, opened simultaneously in the wake of the rotating block. The margins of this basin are delineated by the Foxe–Rinkian and Dorset fold belts; their convergence and disappearance westward reflect the primary shape of the basin. Northwest-dipping subduction beneath the mouth of the basin accommodated convergence of the Burwell and Nain provinces from the southeast and gave rise to the Cumberland batholith. Docking of the Burwell and Nain provinces caused compressional collapse of the ancestral Baffin basin and sinistral transpression of the Torngat Orogen, respectively. The model is well constrained by existing U-Pb geochronological data and makes predictions which can be tested by additional data.

Introduction
Key to the tectonic assembly of northeast Laurentia in geon 18 (1.9–1.8 Ga, Hofmann, 1990) is the tangle of orogenic belts that welds the Superior, Rae, Burwell and Nain provinces (Figure 1). The Trans-Hudson Orogen has long been viewed as a collision zone between the Superior and Churchill (Hearne, Rae and Burwell) provinces (Wilson, 1968), and the other orogenic belts may also repre-