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KINEMATICS OF THE ROCKLAND BROOK FAULT, NOVA SCOTIA: IMPLICATIONS FOR THE INTERACTION OF THE MEGUMA AND AVALON TERRANES

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Abstract—The Cobequid–Chedabucto fault system of northern mainland Nova Scotia represents the surface expression of the Avalon–Meguma terrane boundary, but because it is exposed at high crustal levels in the Cobequid Highlands, the fault system provides little information as to the kinematic relationships of the two terranes in this area. In the eastern Cobequid Highlands, the Rockland Brook Fault (RBF) is exposed within the more deeply eroded highlands massif and juxtaposes units of widely varying ages and lithologies. Therefore, this fault is better suited to define the nature and timing of fault movement associated with Avalon–Meguma terrane interaction.

In several large Carboniferous plutons along the length of the RBF, and in previously deformed Precambrian rocks, mylonitic foliation orientations are predominantly east–west trending and mineral lineations plunge southeast. Kinematic indicators such as minor fold vergence, porphyroclast systems, asymmetric boudins, shear-band fabrics, and preferred recrystallization orientations indicate dextral shear. These data are taken to infer that the central section of the RBF is dominated by dextral strike-slip motion. Transpression occurs locally where the RBF curves into restraining bends. Kinematic data in these bends indicate top to the northwest thrusting. At the easternmost extent of the RBF, high-level brittle normal faults predominate in the locally extensional environment. The timing of RBF movement is constrained only by the *ca* 360 Ma granite bodies which it deforms and by the Westphalian sedimentary rocks which are affected by only the latest stages of movement.

These kinematic data are consistent with previously published kinematic models for the interaction of the southern margin of the Avalon Composite Terrane with the Meguma Terrane in mainland Nova Scotia. These models suggest that regional dextral shear was accompanied by localized components of transpressional thrusting, wrench tectonism, and small-scale sedimentary basin development during Devonian to Carboniferous terrane interaction.

INTRODUCTION

The lithostratigraphy of Appalachian terranes record the development and destruction of the Early Paleozoic Iapetus Ocean and the amalgamation of continents into the late Paleozoic supercontinent Pangea (Wilson, 1966;

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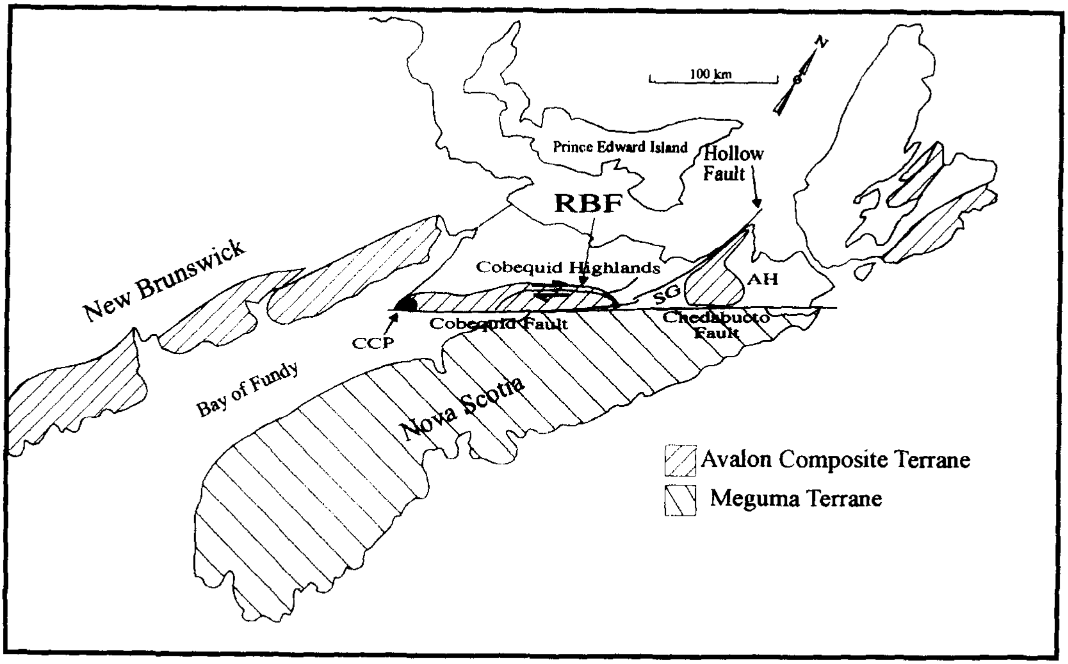


Fig. 1. Selected tectonostratigraphic elements of Nova Scotia and New Brunswick. RBF = Rockland Brook Fault, CCP = Cape Chignecto Pluton, SG = Stellarton gap, AH = Antigonish Highlands (after Donohoe and Wallace, 1982; Keppie, 1982; Waldron *et al.*, 1989).

Williams, 1979; Williams and Hatcher, 1982). These terranes are necessarily fault bounded, and the boundary faults may record complex multi-stage movement histories of the adjacent terranes. Differentiating the kinematic history of these boundary faults is, therefore, an important factor in understanding the nature of terrane accretion in the development of the Appalachian orogen.

In the northern Appalachians, Devonian–Early Carboniferous ("Acadian") deformation has been interpreted as recording the progressive dextral transpressive accretion of the Meguma Terrane to the Avalon Composite Terrane (Keppie, 1993). This event accompanied, or was immediately succeeded by the Devonian to Carboniferous intrusion of voluminous high-level bimodal plutonic suites in both terranes. In mainland Nova Scotia, the late-stage dextral transpressive nature of this collision is recorded in the Cobequid–Chedabucto fault system (Fig. 1) which locally deforms plutons of the bimodal suite (Eisbacher, 1969; Donohoe and Wallace, 1982; Mawer and White, 1987; Keppie, 1982). This fault system is the dominant tectonic feature in the province and represents the surface expression of the boundary between the Meguma and Avalon Composite terranes (Fig. 1). The kinematic history of the Cobequid–Chedabucto fault system is, therefore, important to an understanding of the accretion of these two terranes.

The Cobequid Fault represents the segment of the terrane boundary fault system which, along much of its length, forms the southern limit of the Cobequid

Highlands (Fig. 1). Because of its location relative to the highlands the fault was buried by Late Paleozoic and Mesozoic detritus shed from the uplifted massif. It is, therefore, not exposed at deep crustal levels and most commonly separates Carboniferous sedimentary rocks which provide little information about the earlier kinematic history of terrane interaction.

In order to better constrain the interaction between the Avalon and Meguma terranes, a detailed kinematic study was undertaken on an adjacent fault parallel to the Cobequid Fault. The Rockland Brook Fault (RBF) is located within the Cobequid Highlands massif but is exposed at deeper crustal levels than is the Cobequid Fault. The RBF was active during or soon after the emplacement of the voluminous Carboniferous grantitic plutons (Miller *et al.*, 1989). This suggests that at least some movement on the RBF accompanied that on the Cobequid–Chedabucto fault stystem during interaction of the Avalon and Meguma terranes. The RBF affects units that range in age from Precambrian to Late Carboniferous and records variations in deformational style that yield important information on the nature and timing of accretion of the two terranes. A nearby fault that shows little evidence for Paleozoic movement was previously interpreted as a continuation of the RBF that defined a pre-existing thrust within the Avalon Composite Terrane (Murphy *et al.*, 1988; Miller *et al.*, 1989). The purpose of this paper is to examine the kinematic history of the RBF as it relates to the accretion of the Meguma Terrane, and critically re-evaluate the evidence for a pre-existing Avalonian thrust fault.

REGIONAL GEOLOGIC SETTING

The Avalon Composite Terrane in the nothern Appalachians is defined by the presence of early Paleozoic platformal successions containing Acado-Baltic fauna, and by Late Proterozoic arc-related volcanic-sedimentary successions and cogenetic plutonic rocks (Williams and Hatcher, 1982; O'Brien *et al.*, 1990). Rocks of this terrane record the tectonostratigraphic evolution of a late Precambrian (*ca* 620–580 Ma) magmatic arc through a latest Precambrian (*ca* 550 Ma) transform margin to an early Paleozoic shallow-marine platform bordering Gondwana (O'Brien *et al.*, 1983; Nance *et al.*, 1991; Keppie and Dostal, 1991). The Avalon Composite Terrane underlies much of northern mainland Nova Scotia and is exposed in two fault-bounded massifs, the Cobequid Highlands and the Antigonish Highlands (Fig. 1).

In the Cobequid Highlands, Precambrian rocks occur primarily south of the Rockland Brook Fault. The majority of the Precambrian rocks comprise the Bass River Complex (Fig. 2) which includes poly-deformed hornblende amphibolite, hornblende granitoid orthogneiss, and psammitic paragneiss of the *ca* 580–605 Ma (Doig *et al.*, 1990) Great Village River Gneiss and platformal quartzite, pelitic schist and metacarbonate of the Gamble Brook Formation (Fig. 2). The latter is unconformably overlain by greenschist facies mafic metavolcanic sequences of the Folly River Formation. Minimum depositional

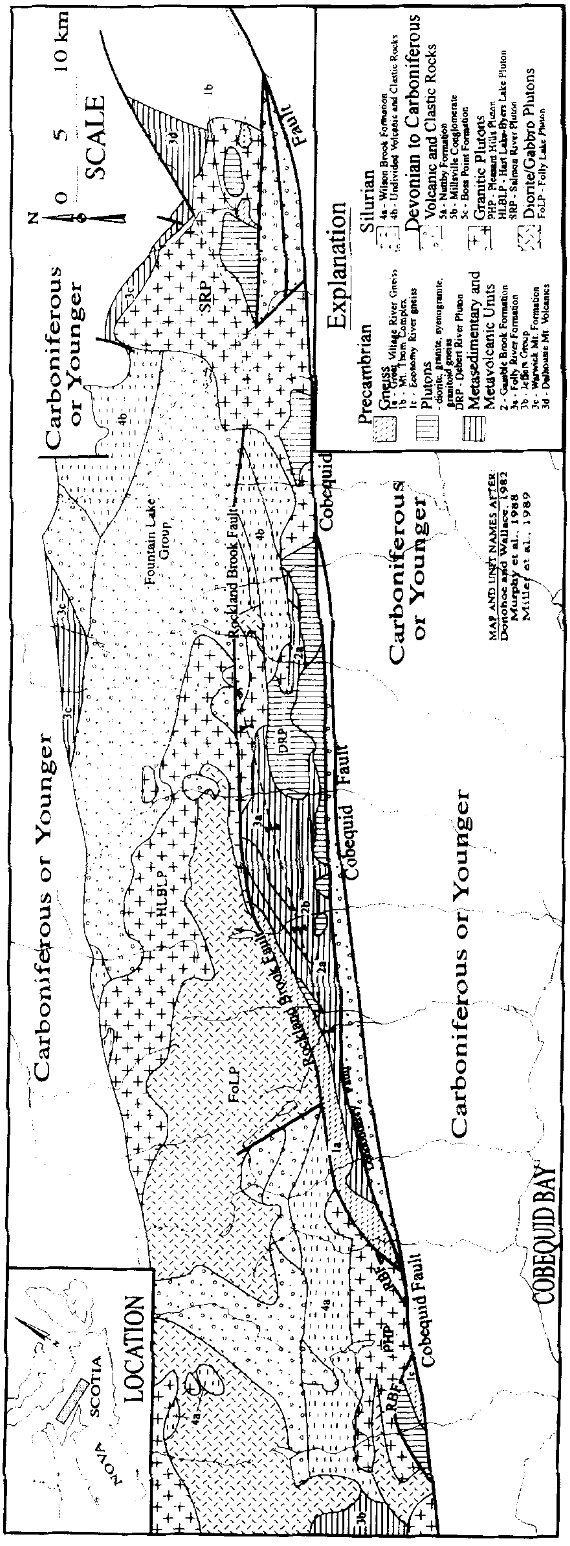


Fig. 2. Generalized geologic map of the eastern Cobequid Highlands (after Donohoe and Wallace, 1982; Murphy *et al.*, 1988; Miller *et al.*, 1989).

and ages for the Gamble Brook and Folly River formations are set by the 612 ± 4 Ma (Ub–Pb on zircon, Doig *et al.*, 1989) crystallization age of the Debert River Pluton which post-tectonically intrudes the latter unit. The Economy River gneiss (Fig. 2) is a mafic orthogneiss lithologically similar to the Great Village River Gneiss and has yielded a U–Pb zircon age of 734 ± 2 Ma (Doig *et al.*, 1993).

In the easternmost Cobequid Highlands, the Mt. Thom Complex comprises mafic orthogneisses correlated with the Great Village Gneiss (Donohoe and Cullen, 1983) and the Warwick Mountain Formation and Dalhousie Mountain Volcanics (Fig. 2) are interlayered felsic and mafic volcanic and turbiditic successions (Fig. 2). The Warwick Mountain Formation contains a flat-lying cleavage like that of the Folly Lake Formation and Jeffers Group, and the Dalhousie Mountain Volcanics lacks this cleavage and more closely resembles the *ca* 615 Ma Keppoch Formation of the Antigonish Highlands (Murphy *et al.*, 1991).

Throughout the Cobequid Highlands, a voluminous bimodal plutonic suite intrudes Silurian to Carboniferous volcaniclastic and sedimentary units. Large granite bodies adjacent to the RBF include the Pleasant Hills, Hart Lake–Byers Lake and the Salmon River Plutons (Fig. 2). These felsic bodies comprise distinctive, red to pink high-level megacrystic and porphyritic granite plutons. U/Pb–zircon ages of 363 ± 3 Ma and 361 ± 2 Ma (Doig *et al.*, 1990) have been reported from the Pleasant Hills Pluton and Hart Lake–Byers Lake plutons respectively. The Folly Lake Pluton (Fig. 2) is the largest Devonian to Carboniferous mafic body in the Cobequid Highlands. It comprises coarse grained gabbros intruded by porphyritic diorite, granodiorite and late fine-grained mafic dikes and sills (Murphy *et al.*, 1988). The age of the Folly Lake Pluton is constrained by its intrusion into the Devono-Carboniferous Fountain Lake Group, and by the age of the Hart Lake–Byers Lake Pluton which intrudes it.

Devonian and Carboniferous sedimentary units include bimodal volcanic rocks and minor clastic rocks of the Fountain Lake Group, gray quartzite, minor polymictic conglomerate, and dark gray siltsones and shales of the Nuttby Formation, and conglomerate, wackes, and siltstones of the Millsville Conglomerate and Boss Point Formation.

For more detailed descriptions of the units in the eastern Cobequid Highlands refer to: Donohoe and Wallace (1980, 1982, 1985), Cullen (1984), Murphy *et al.* (1988), Nance and Murphy (1988, 1990), Pe-Piper and Murphy (1989), Turner *et al.* (1988), Pe-Piper *et al.* (1989, 1991).

THE ROCKLAND BROOK FAULT

The RBF is an approx. 80 km-long shear zone in the central Cobequid Highlands (Fig. 1). Along much of its length it separates the Bass River Complex and other units to the south from the bulk of the Carboniferous bimodal plutonic suite to the north (Fig. 2). The western portion of the RBF forms the southern boundary of the Carboniferous Pleasant Hills Pluton (Fig. 2) where the fault forms a relatively narrow (50–100 m), but locally intensely deformed zone in porphyritic phases of the pluton (Cullen, 1984; Miller *et al.* 1989). Further west, it merges with the Cobequid Fault and re-emerges to enclose the Precambrian Economy River gneiss. In the central segment of the RBF, within the Hart Lake–Byers Lake Pluton (Fig. 2), the fault forms a kilometer-wide shear zone. To the east, the RBF was previously interpreted to represent at least two splays. The northern splay, as defined by Murphy *et al.* (1988), separates lithologically similar Late Precambrian volcano-sedimentary rocks (Murphy *et al.*, 1992) with differing deformational histories (the Warwick Mountain Formation and Dalhousie Mountain Volcanics), and parallels the northeast trending Hollow Fault (Fig. 1). The southern splay links the RBF to the Cobequid Fault, and separates Carboniferous sedimentary rocks from Carboniferous and Precambrian crystalline rocks. However, neither splay is ductile shear zone like that of the central portion of the RBF, but instead, each is defined largely by brittle faults.

KINEMATIC INDICATORS

Regional structures

Units in the fault-bounded block south of the RBF form a regional syncline with an axial surface oblique to the trends of the major faults in this area and with a gently northeast plunging fold axis (Fig. 2). The lack of regional folding of Westphalian stratified units outside of this block and the folding of units of the same age within the block suggests that the formation of this structure is related to Carboniferous movement on the boundary faults. The obliquity of the syncline in the southern block relative to the east–west boundary faults is consistent with large-scale folding during dextral movement of the faults. In general, the depositional, intrusive, and protolith ages of units exposed on either side of the RBF are progressively younger, and the age difference between them broadly decreases, from west to east. This suggests differential uplift of the western end of the block, in a manner typical of wrench faulting. Together, these large-scale relationships indicate a dextral transpressive regime and provide a framework for a more detailed examination of deformation within individual units.

Evidence for dextral strike-slip movement

The effects of RBF-related deformation are most easily recognised in the Carboniferous plutons. These plutons are largely undeformed, except by the RBF, and therefore contain no pre-existing deformational fabrics (in contrast to many of the units in the Bass River Complex). Furthermore, the plutons occur

Fig. 3. Polished hand sample of mylonitic granite from the Hart Lake–Byers Lake Pluton. Note well-defined foliation and numerous feldspar porphyroclasts (cut perpendicular to foliation and parallel to lineation).

along much of the length of the fault, and thus preserve a record of along-strike kinematic variations attributable to shearing on the RBF. An important part of this record is exposed within the Hart Lake–Byers Lake and Folly Lake plutons through which the RBF trends east-west, is relatively straight, and (structurally) least complex.

Within the Hart Lake–Byers Lake Pluton, mylonitic foliation planes are defined by alternating quartz–feldspar rich and chlorite–epidote rich compositional bands (Fig. 3) and contain a distinct mineral lineation defined by quartz ribbons and the preferred orientation of feldspar grains. Deformed diorite of the Folly Lake Pluton typically contains fine-grained mafic and felsic compositional bands on a centimeter to millimeter scale, and a mineral lineation defined in mafic bands by hornblende, biotite, and chlorite and in felsic bands by feldspar and recrystallized quartz. In both plutons, the mylonitic foliation dips steeply south or southeast and mineral lineations on these planes are sub-horizontal to gently east-plunging (Figs. 4a, b). Deformed granites of the Hart Lake–Byers Lake Pluton exhibit excellent examples of kinematic indicators and feldspar porphyroclasts are common within the mylonitic foliation planes (Fig. 3). Relationships between asymmetric porphyroclasts and the mylonitic foliation are well preserved in deformed porphyritic portions of the pluton. In these areas 1–5

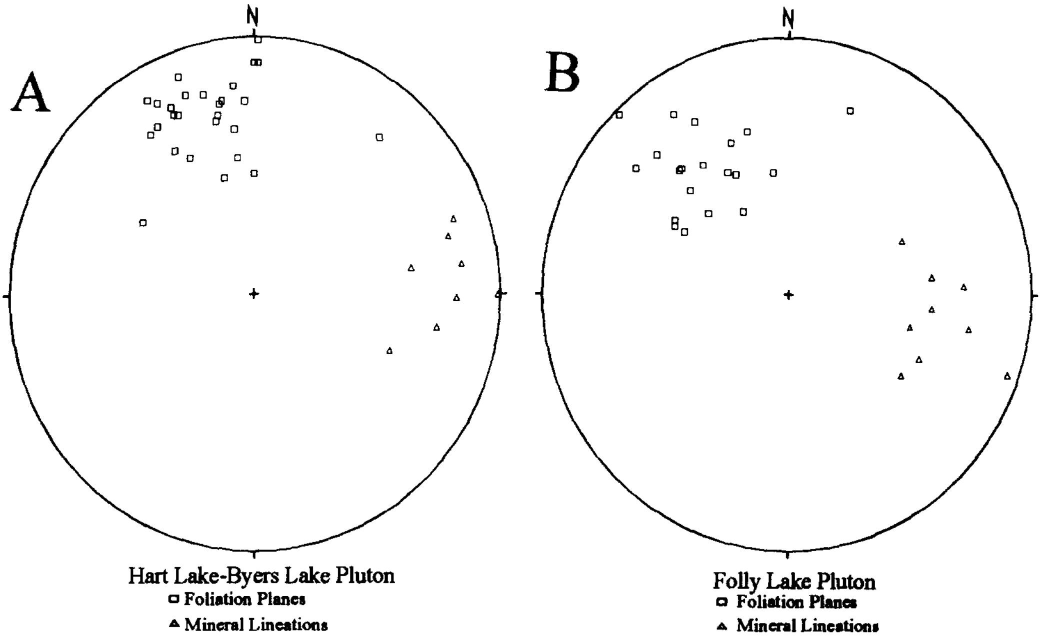


Fig. 4. Equal-area stereoplots of structural elements in the Hart Lake–Byers Lake (A) Folly Lake (B) plutons.

mm dia. feldspar porphyroclasts were rotated in the plane of the foliation or developed asymmetric pressure tails (sigma and delta structures, respectively of Passchier and Simpson, 1986). The asymmetry of the foliation and/or pressure tails around rotated porphyroclasts indicates clockwise rotation of the feldspar grain (Fig. 5a) and the shape of the pressure tails around non-rotated porphyroclasts indicates enlarged low-strain zones at the top right and bottom left of the feldspar grain (Fig. 5b). Feldspar porphyroclasts broken during shear show sinistral and dextral offsets along individual fractures in antithetic and synthetic orientations as a result of dextral shear (Fig. 5c). Sheared porphyritic portions of the Folly Lake Pluton contain similar, but fewer and less well-developed kinematic indicators. Nearly all asymmetric porphyroclasts from these two plutons are consistent with deformation resulting from dextral shear as determined by the geometric relationships between matrix and porphyroclast (Passchier and Simpson, 1986). Where folded, the mylonitic foliation defines predominantly Z-folds (Fig. 5d). These types of folds are interpreted to form as a result of competence differences in the mylonitic compositional layers and their vergence indicates dextral shear (Ramsay and Huber, 1987). Rare sinistral kinematic indicators occur in the deformed portions of these plutons, but likely reflect antithetic shearing, local folding, interference from other porphyroclasts, or complex ductile deformation within an overall dextral regime.

Units of the Bass River Complex, in particular the Great Village River Gneiss, Gamble Brook Formation, and Folly River Formation, typically contain a pre-

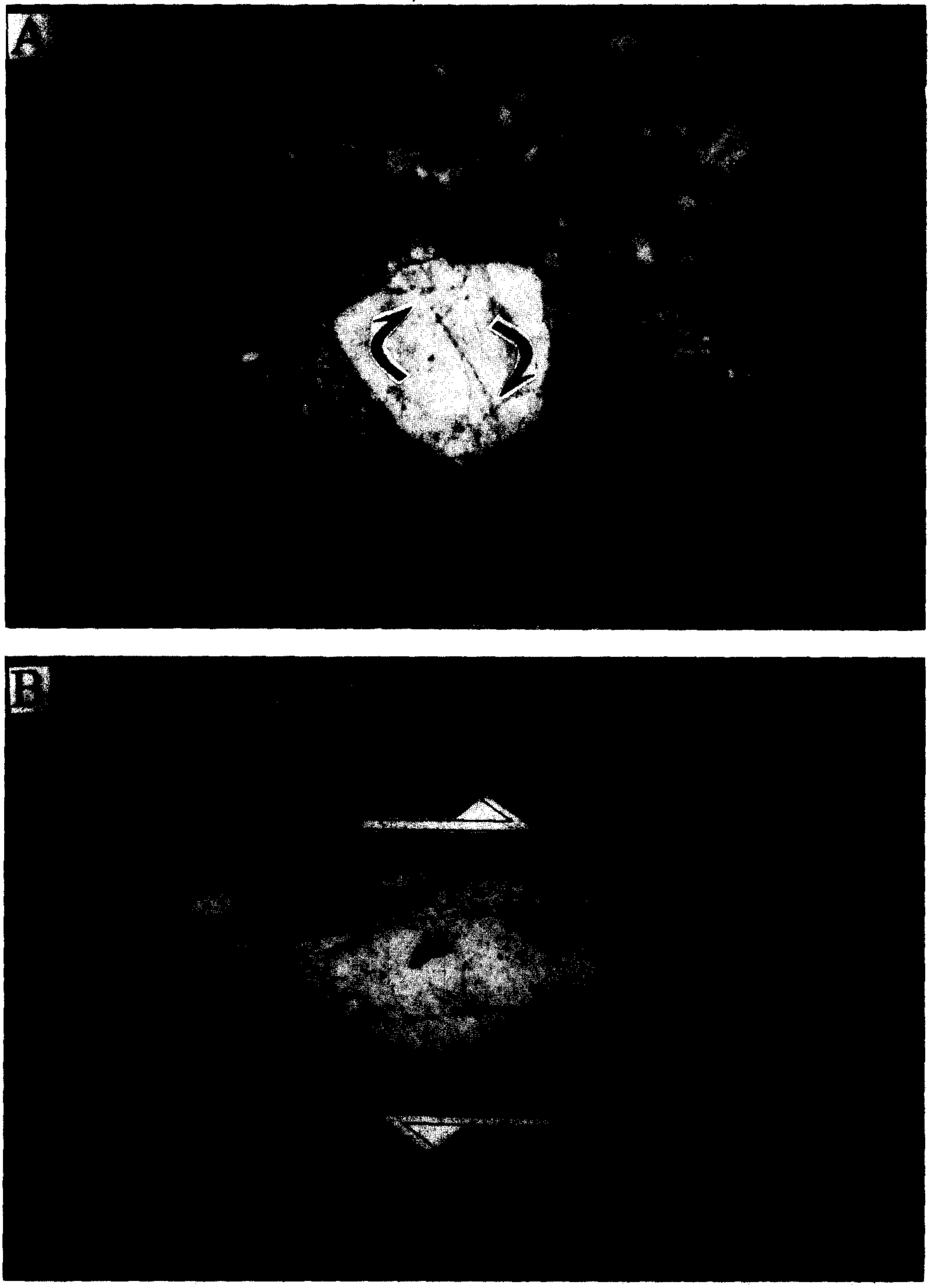


Fig. 5A and B. Kinematic indicators in deformed Carboniferous plutons. Porphyroclast systems (σ- and δ-structures of Passchier and Simpson, 1986) from the Hart Lake–Byers Lake Pluton include; (A) rotated porphyroclast (δ-structure, width = 1.8cm), (B) non-rotated porphyroclast (σ-structure; width = 2.7mm). All examples indicate dextral shear and are oriented perpendicular to the foliation and parallel to the lineation.

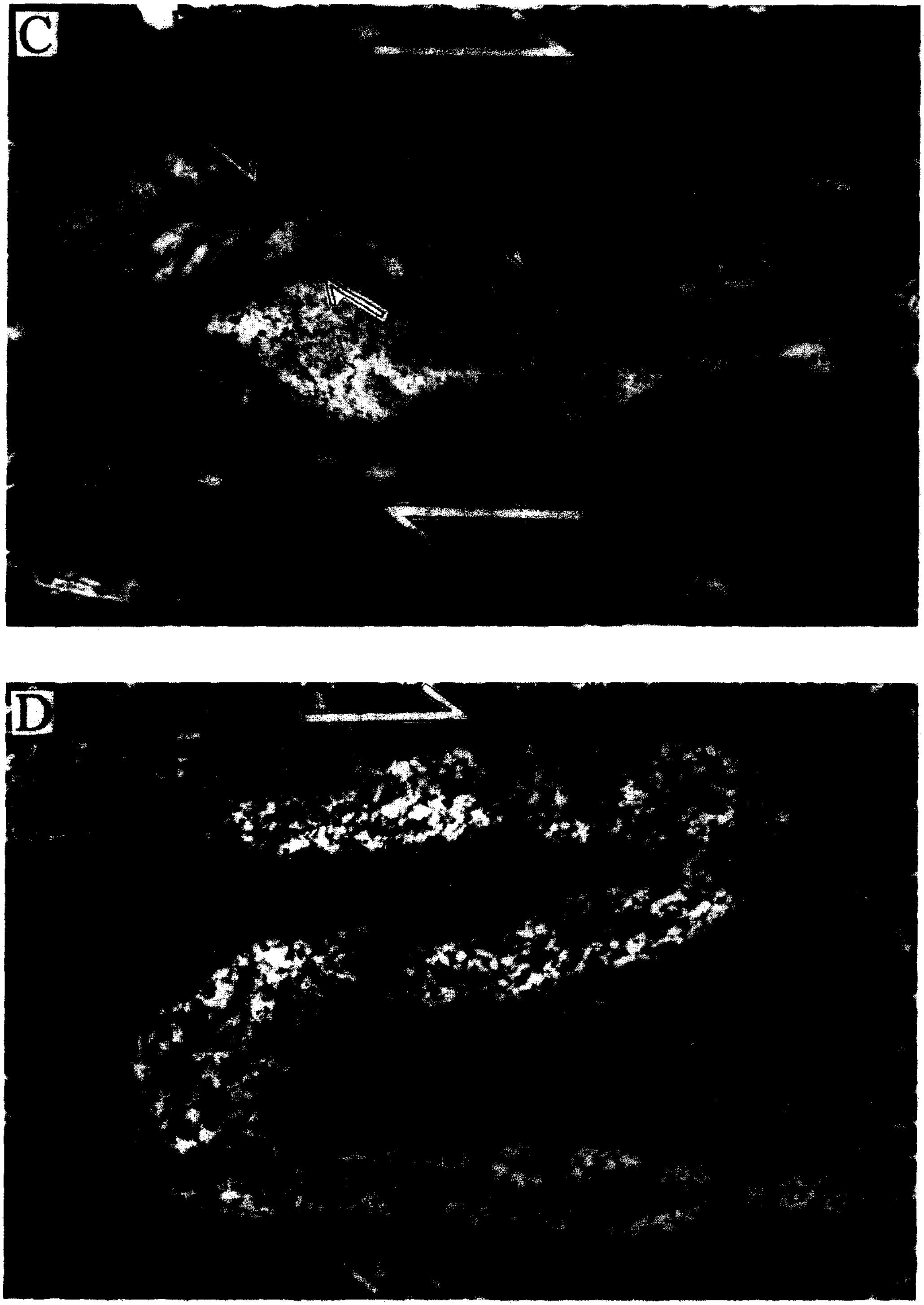


Fig. 5C and D. (C) displaced fractured feldspar grain (width = 5.4 mm), (D) Z-fold (width = 2.7 mm). All examples indicate dextral shear and are oriented perpendicular to the foliation and parallel to the lineation.

Paleozoic foliation not related to movement on the RBF (Nance and Murphy, 1988, 1990; Pe-Piper and Murphy, 1989). The nature of RBF-related deformation in these units is, therefore, difficult to establish except where the rocks are intensely deformed along the strike of the fault. RBF-related deformation resulted in tightening of folds, increase in fold amplitude, and transposition of these and other fabric elements (Cullen, 1984; Nance and Murphy, 1988, 1990). Pre-existing foliation planes outside of the RBF deformation zone are oblique to the fault, but proximal to the fault are rotated in a clockwise manner to parallel the RBF (Fig. 6). Near the RBF, mineral lineations on the foliation planes are subparallel to minor fold axes and both plunge gently east (Fig. 6).

In these three units, the clockwise rotation of the pre-existing foliation and the sub-horizontal mineral lineations are consistent with dextral strike-slip motion on the east–west trending segment of the RBF adjacent to the Bass River Complex. Other macro- and microstructural kinematic indicators are also consistent with this interpretation. In the Gample Brook Formation, the preferential recrystallization orientation of quartz grains (Fig. 7) is oblique to the macroscopic foliation in a manner consistent with dextral shear (Brunel, 1980; Schmid *et al.*, 1981). In the Folly River Formation, asymetrically boudinaged jasper lenses are exposed in an outcrop face perpendicular to the foliation and parallel to the sub-horizontal mineral lineation. One boudin (Fig. 8) preserves a thin brown jasper layer that is offset by fractures in both synthetic and antithetic orientations relative to the overall dextral shear direction indicated by the shape of the boudin. Shear bands developed in the foliated matrix also indicate dextral shear (Fig. 8).

Evidence for localized transpression

Although th RBF is largely a strike-slip fault, localized transpression occurs at restraining bends and has resulted in local thrusts. At its western extremity, the RBF changes from an east–west to west–southwest trend before merging with the Cobequid Fault (Fig. 2). Near the center of the RBF deformation zone in the Pleasant Hills Pluton, mylonitic foliation planes are gently dipping, north–south trending, and contain a shallow east-plunging mineral lineation. Further to the north, the foliation dips south at increasingly higher angles, whereas to the south the foliation dips at increasingly higher angles to the north (Fig. 9a). Because of the complex geometry of the RBF in this area, kinematic indicators are commonly ambiguous. However, most well-developed porphyroclast systems indicate dextral shear in the steeply dipping portions of the deformation zone, and top-to-the-northwest thrusting along the flanks of the structure.

In the Great Village River Gneiss south of the easternmost lobe of the Pleasant Hills Pluton (Fig. 2) the restraining bend in the RBF has resulted in rotation of east–west trending, steeply dipping gneissic foliations into northeast–southwest trending, moderately dipping orientations (Fig. 6). Mineral lineations on the foliation planes are also rotated from moderately easterly plunging to

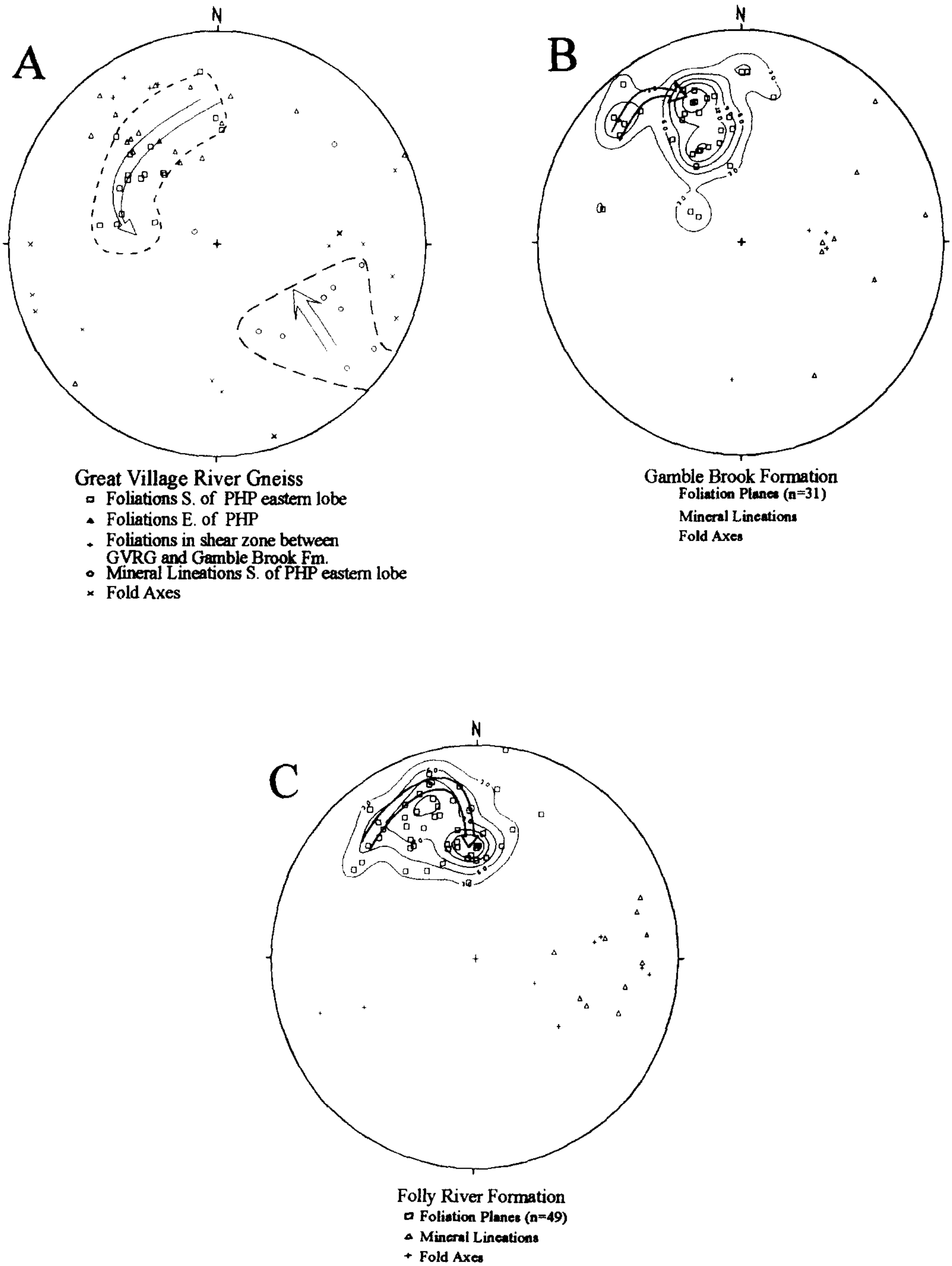
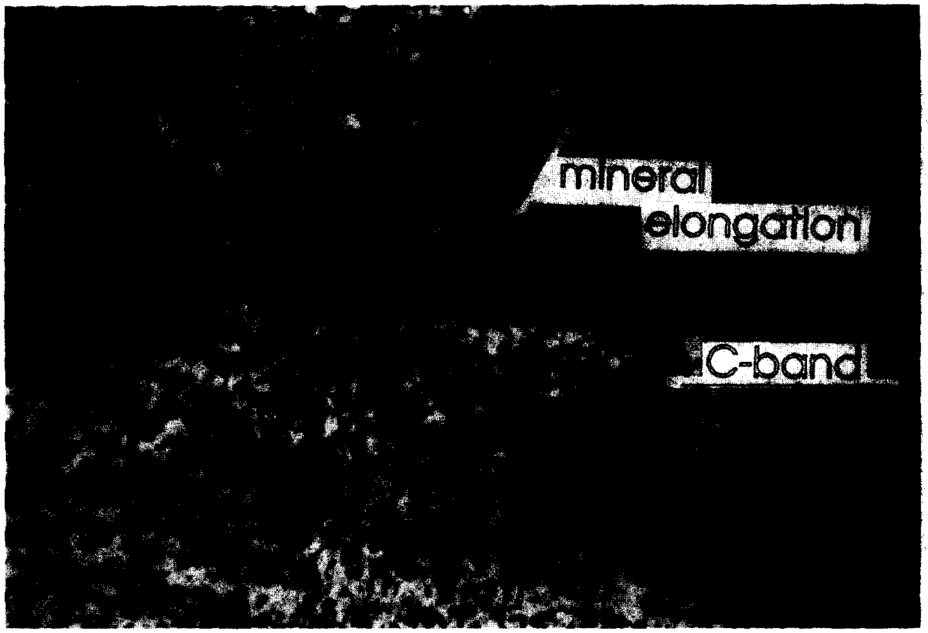


Fig. 6. Equal-area steroplots of structural elements in poly-deformed Precambrian units adjacent to the Rockland Brook Fault. (A) PHP = Pleasant Hills Pluton, GVRG = Great Village River Gneiss (arrow in dashed foliation field indicates rotation of foliation south of the Pleasant Hills Pluton where the RBF is a thrust fault; arrow in mineral lineation field indicates the direction of thrusting in this area), (B) contoured foliation data, mineral lineations, and fold axes in Gamble Brook Formation, (C) Contoured foliation data, mineral lineations, and fold axes in Folly River Formation.



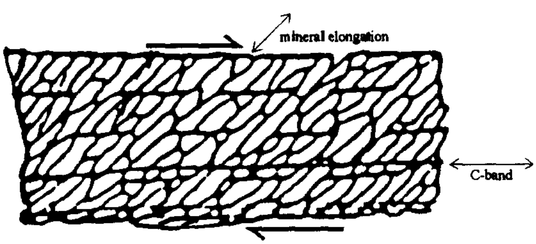


Fig. 7. Recrystallized quartzite of Gamble Brook Formation indicating dextral shear (width = 2.7mm). Sketch from Ramsay and Huber (1987, p. 633).

gently southeasterly plunging orientations (Fig. 6a), consistent with northwest-directed thrusting.

Evidence for localized extension

Within the Salmon River Pluton, Murphy *et al.* (1988) linked the RBF to a previously unnamed northeast-trending fault which separates the Warwick Mountain Formation from the Dalhousie Mountain Volcanics (Fig. 2). This fault comprises a system of brittle fractures along which individual offsets are small, in contrast to the ductile nature of the east–west trending western and central segments of the RBF. Fracture orientations in this area cluster into four groups (Fig. 9b). Group A fractures dip steeply southeast parallel to the fault. Bedding offsets along these fractures indicate predominantly normal dip-slip movement. Groups B–B′ and C–C′ are oblique conjugate joint sets. Fractures of group D–D′ are parallel to numerous steeply dipping, north–south trending faults that

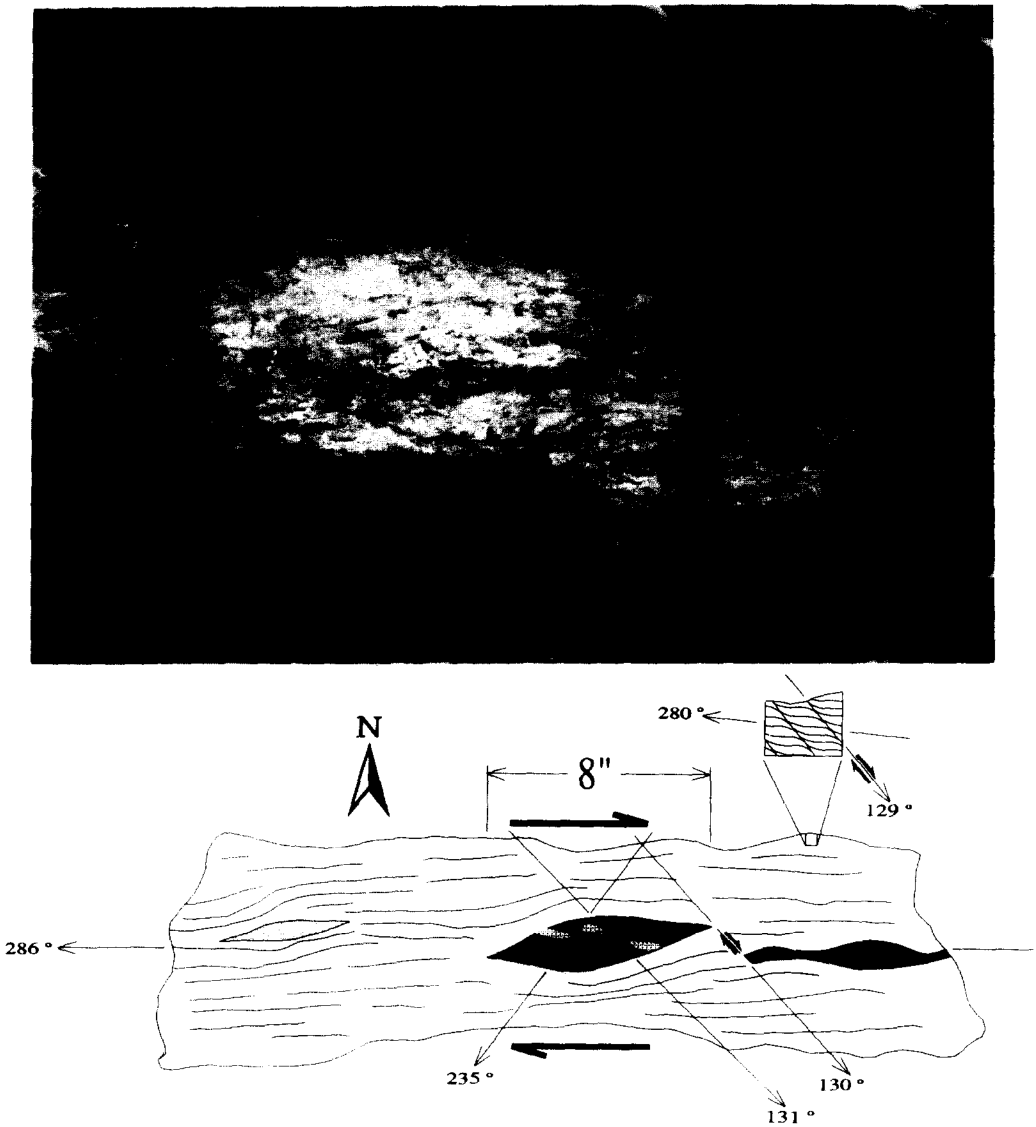


Fig. 8. Boudinaged jasper lens and interpretative sketch from the Folly River Formation, showing dextral asymmetry of boudins and shear bands (pen for scale).

cut all structures in the Cobequid Highlands and are thought to be related to the Triassic rifting of the Fundy Basin (Donohoe and Wallace, 1982).

Due to limited exposure, the effect of the RBF on the Salmon River Pluton is uncertain. Where exposure exists within the pluton, only minor late-stage, south-dipping normal faults have been recognized. The throw on these faults is likely to be small as a large portion of the Salmon River Pluton extends across the trace of the RBF. At the southeastern margin of the pluton these normal faults have undergone more movement and juxtapose the pluton with Carboniferous sedimentary rocks (Fig. 2).

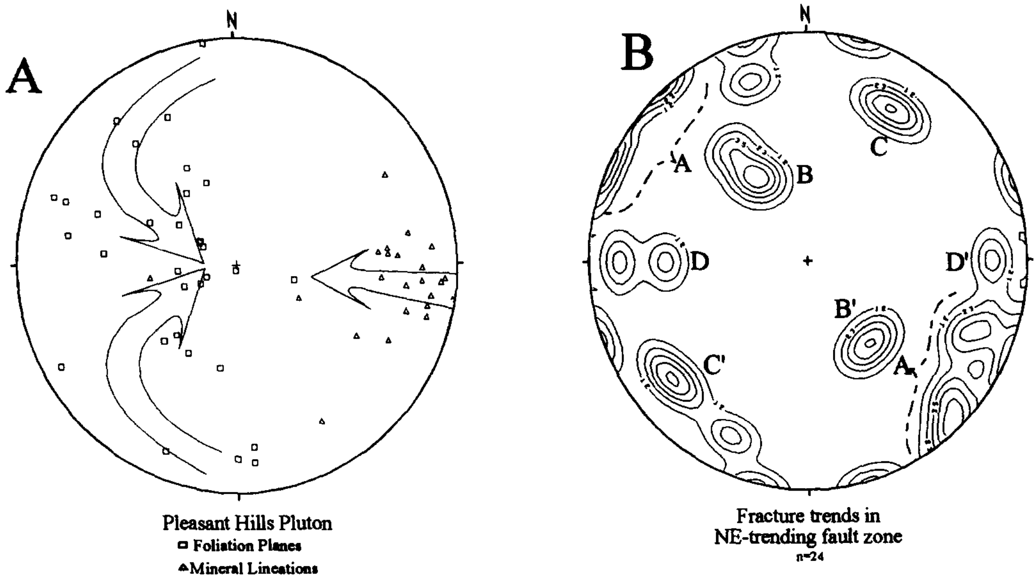


Fig. 9. Equal-area stereoplots of structural elements in: (A) the Pleasant Hills Pluton (curved arrows show sense of rotation of foliation nearer to the center of the RBF deformation zone). Straight arrow indicates direction of thrusting; (B) contoured data of poles to fractures in the area of the proposed northeast-trending extension of the RBF.

THE NATURE AND TIMING OF ROCKLAND BROOK FAULT MOVEMENT

Where mylonitic foliation planes are well-developed and features such as the degree of grain-size reduction and deformation-induced compositional differentiation infer high degrees of shear, the foliation is interpreted to record the local plane of movement. Likewise, a well-developed mineral lineation on the foliation is taken to indicate the vector of movement. Along the east–west trending segment of the RBF, kinematic analysis indicates primarily strike-slip, with a small component of reverse dip-slip, movement. Kinematic indicators along this section of the fault demonstrate predominantly dextral strike-slip movement. Where the trace of the fault curves into restraining bends, transpression between adjacent blocks occurs and the resultant kinematic indicators infer localized thrusting. At the eastern end of the RBF, only high-level brittle faulting is recognized.

From west to east, progressively younger portions of the stratigraphy of both the northern and southern fault blocks are exposed adjacent to the RBF, and the age difference between the juxtaposed units also generally decreases (Fig. 2). Additionally, in this direction progressively larger portions of the Carboniferous plutons are preserved south of the fault. These relationships reflect the relative degree of dip-slip movement along the length of the RBF, and infer more uplift (hence exposure at a deeper stratigraphic level) at the western end of the fault, in a manner consistent with a component of wrench faulting.

In summary, the detailed structural observations described above provide a basis for understanding the tectonic regime under which RBF-related deformation occurred. Based on these data, an overall strike-slip regime is proposed in which local transpression and wrench faulting occurs and the southern fault block is uplifted and thrust northwest at the western, transpressive end of the RBF. In the east–west trending central segment, the RBF represents a predominantly strike-slip shear zone with a small component of reverse dip-slip movement. At the eastern end of the RBF, the southern fault block is not significantly uplifted relative to the northern block and normal brittle faults have resulted in the development of small strike-slip rhomb grabens which were infilled by Carboninferous clastic rocks.

Although the data are limited in the area of the proposed northeast-trending splay of the RBF, they do not support the interpretation of this fault as a Precambrian southwest-dipping thrust plane as proposed by Miller *et al.* (1989). Furthermore, there is no evidence that significant strike-slip movement has occurred on this fault. Therefore, previous interpretations of this segment as a splay of (Murphy *et al.*, 1988), or an Avalonian "ancestor" to (Miller *et al.*, 1989) the RBF could not be further substantiated.

This re-interpretation is important in that a protracted, Precambrian to Carboniferous movement history can no longer be inferred for the RBF. Although pre-Carboniferous movement cannot be ruled out, there is no conclusive evidence for RBF-related deformation prior to intrusion of the *ca* 360 Ma granitic plutons. Because RBF-related deformation of crystalline rocks older than *ca* 360 Ma is intense and Westphalian sedimentary rocks show only minor brittle deformation near the RBF, the majority of strike-slip movement on the RBF is interpreted to have ceased by the Westphalian.

THE ROCKLAND BROOK FAULT—AN INDICATOR OF TERRANE INTERACTION

The Avalon–Meguma terrane boundary represented by the Cobequid Fault is poorly exposed in the eastern Cobequid Highlands. However, details of Late Paleozoic terrane interactions are preserved along adjacent faults, such as the RBF which transects the highlands.

In the western Cobequid Highlands, Waldron *et al.* (1989) proposed that the development of a pervasive flat-lying mylonitic fabric in the Early Carboniferous Cape Chignecto Pluton (Fig. 1) reflects its thrust emplacement over the Fountain Lake Group either because of its position within a restraining bend in the Cobequid Fault, or as a result of oblique collision during the initial stages of accretion of the Avalon Composite Terrane. Continued strike-slip movement tectonically isolated this pluton, preserving the thrust related structures. Between the Cobequid and Antigonish Highlands, the Stellarton gap (Fig. 1) is a fault-bounded basin containing Carboniferous conglomerate and coarse clastic rocks that are lithologically similar to, and may represent a similar depositional environment as, those near the western termination of the RBF (Donohoe and

Wallace, 1985). Yeo (1985) and Yeo and Ruixing (1986) proposed a dextral strike-slip pull-apart graben model for the development of the Stellarton gap, which includes the brittle faults at the eastern end of the RBF. They considered the timing of fault movement to coincide with the waning stages of strike-slip movement between the Meguma and Avalon terranes.

The kinematic history of the RBF as described above is essentially identical in style and timing to that inferred for the Cobequid–Chedabucto fault system and includes dextral strike-slip motion with a westward-increasing component of dip-slip. During the time interval represented by movement on the RBF, Avalon–Meguma terrane interaction was dominated by dextral, strike-slip (with some component of wrench-related), tectonics. As recorded in the units adjacent to the fault, the movement history of the RBF is consistent with these regional considerations, and provides new insights into Meguma–Avalon terrane interactions in the eastern Cobequid Highlands as a result of its exposure at deeper structural levels.

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